2025

SPRING UNDERGRADUATE RESEARCH CONFERENCE

APRIL 8-11

SCHEDULE OF EVENTS

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APRIL 10, 2025 | STEW 214 & 218

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APRIL 10, 2025 | STEW 206

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Virtual presentations

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Poster Presentation Abstract Number: 1000

Presentation Time: Session 1: 9:00-10:00am

VIP - AI for Education

STEM

Authors(s):

Colby Ben Acton† (Engineering); Gaetano Antonio Iannotta† (Engineering); Apostolos Adam Cavounis† (Engineering); Sun Hong H Park† (Polytechnic); Kaya Tacer† (Science); Alexander Peter Siladie‡ (Science); Ryan James Hirsch‡ (Science); Vaibhav Charan‡ (Science); Shrish Mahesh‡ (Science); Samuel Enoch Jebaraj‡ (Science); Saimaurya Kanagala‡ (Science); Shrey Agarwal‡ (Science|Graduate); Sarath Rajesh‡ (Science); Ruhaan Batta‡ (Engineering); Rohini Pillai‡ (Science); Yu-Kuang Chen‡ (Engineering); Sai Maanasa Gogula‡ (Engineering); Zhenghao Xu‡ (Engineering); Jake Alan Patterson‡ (DSB); Amey Bhandari‡ (Science); Keshav V Sreekantham‡ (Science); SuHan Cheng‡ (Engineering); Ziang Wang‡ (Science); Tri Quang Vo‡ (Science)

Abstract:

The increasing prevalence of large language models (LLMs) in educational settings has created new opportunities for providing students with personalized, real-time support. While LLMs can effectively handle general questions, they often lack the specialized knowledge required for domain-specific inquiries, particularly in advanced courses. To address this, our project develops a Retrieval-Augmented Generation (RAG) system tailored for an engineering course, ECE 20875, delivered through an integrated application with a connected front end and back end. This architecture facilitates seamless user interactions, ensuring efficient retrieval and display of contextually relevant information. The system retrieves information from a curated dataset that incorporates content from the syllabus, homework assignments, and Piazza discussions while utilizing metadata to enhance the context and relevance of the answers produced. We further improve the relevancy and accuracy of the answers generated by our RAG system by dynamically adjusting word embeddings and utilizing advanced document ranking techniques. Additionally, as traditional natural language processing metrics often fail to capture complex semantic relations between technical questions and their appropriate answers, we propose a novel LLM-based evaluation method. By using an LLM to assess both the accuracy and relevance of the answers with respect to the questions, we ensure that the system provides high-quality assistance aligned with course content. This comprehensive approach not only aids in answering student queries but

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

also enhances the overall learning experience in the course through an interactive and user-friendly application.

Keywords:
RAG; AI; ML; Education; Application

Mentor(s):
Qiang Qiu (Purdue University); Wei Zakharov (Purdue University); Zichen Miao (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1001

Presentation Time: Session 1: 9:00-10:00am

Heart Rate Measurement Abstract

STEM

Authors(s):

Fessehaye Adal† (Polytechnic)

Abstract:

Despite the widespread use of heart rate monitoring in exercise routines, there is limited insight into how various heart rate metrics differ across age groups and genders, particularly among older gym members. This study examines heart rate measurements among gym members aged 39 and older by analyzing the Gym Members Exercise Dataset from Kaggle. The dataset was refined to focus on key heart rate metrics: average, resting, and maximum BPM. Comparative analyses showed that heart rate values were consistent across age groups, including when compared with members under 39. A pivot chart analysis further indicated that while men's BPM remained relatively stable with age, females—particularly at age 57—exhibited higher average BPM values with more variability. Additionally, a histogram correlating calories burned with average BPM demonstrated that maximum heart rate tends to spike between 1 and 1.75 hours into a workout before declining to baseline levels. These discoveries improve our understanding of cardiovascular responses during exercise and offer practical insights for optimizing workout strategies to improve physical performance and overall health.

Keywords:

[no keywords provided]

Mentor(s):

Tiantian Qin (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1002

Presentation Time: Session 1: 9:00-10:00am

Interactive Skyboxes: Integrating Depth and 3D Object Reconstruction in VR

STEM

Authors(s):

Maz Agrawal† (Science)

Abstract:

In virtual reality (VR), a skybox is a background technique which displays 360-degree panoramic images and videos on an infinite plane, thus creating an illusion which can transport a user to anywhere in the world. However, current skyboxes lack interactive capabilities, limiting the level of immersion. The current project focuses on introducing depth to panoramic videos in VR skyboxes to give the environment a more dynamic and tangible feel. Using a neural network for instance segmentation, objects within the skybox are first isolated as masks over transparent backgrounds, and then layered as 2D images known as sprites over a new, static panoramic image generated by averaging background pixels over the entire set of video frames. Each of these masks are dynamically positioned along the x- and z-axes during runtime to reflect the true position of the extracted object at each frame by converting pixel coordinates to spherical angles and computing direction rays. We aim to accurately simulate depth while strengthening the immersive experience by transitioning from 2D sprites to 3D models. By utilizing the sets of overlapping images of each object, we will be able to estimate the dense representation of the 3D model via a Structure-from-Motion and Multi-View Stereo pipeline. This representation will then be inputted into a secondary neural network model that enables high-fidelity 3D surface reconstruction. A 3D model will not only enhance skybox realism, but open up new possibilities for rigging and animation, allowing for customized re-rendering of panoramic videos in VR.

Keywords:

Computer Graphics; Mixed/Augmented Reality; Interactive Environments; Neural Networks

Mentor(s):

Voicu S Popescu (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1003

Presentation Time: Session 1: 9:00-10:00am

Analysis of Longevity of Vegetable Oil as Metallurgical Quenchants Under Accelerated Aging

STEM

Authors(s):

Junyeong Ahn† (Engineering); Rachel Alexis Koeiman‡ (Engineering)

Abstract:

Due to the low sustainability of the current petroleum-based quenchants, past studies proposed natural oils as candidates for new heat treatment fluid replacements. Natural oils are susceptible to degradation at high temperature environment, undergoing a significant change in physicochemical properties and consequently impacting the result of metallurgical thermal processing. This study aims to characterize the change in chemical properties of four oils: high-oleic soybean oil, hydrogenated soybean oil, Bio Quench 600 and Martemp 2565 to compare the longevity of the natural oils and commercial quenchants under high temperature environment for a long period of time. Acid number (AN) measurement with respect to the duration of accelerated aging (50~330 hours at 200 ?C oven) using acid-base colorimetric titration and Fourier-transform infrared spectroscopy were applied for functional group characterization. Additionally, to study the effect of increase in AN on the metal parts, immersion corrosion testing was performed by immersing steel specimen in the oils at high temperature for a long period of time, and the specimen surface corrosion was analyzed by optical microscopy. Martemp 2565 and hydrogenated soybean oil experienced the least increase in AN over time, due to the presence of antioxidants, and the reduced number of double bonds in the polymeric structure through hydrogenation, respectively. Corrosion testing resulted in an insignificant change in mass, however surface corrosion has been observed through OM analysis. Future studies must be conducted regarding antioxidant and degradation resistant additives and structured analysis on change in quench behavior of the fluids in response to thermal degradation.

Keywords:

Sustainable Materials Processing; Heat Treatment Fluids; Thermal Degradation

Mentor(s):

Jeffrey P Youngblood (Purdue University); Michael Titus (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Ching-Chien Chen (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1004

Presentation Time: Session 1: 9:00-10:00am

Examining Bias in DNA Extraction of Surface Attached Soil Bacterial Communities

STEM

Authors(s):

Kaitlyn Marie Annunziata† (Agriculture)

Abstract:

Soils harbor a diverse community of microorganisms that colonize surfaces of soil particles by using adhesive properties to access resources and evade predation. However, this adhesion to soil particles represents a potential source of bias during soil DNA extraction, a critical step in sequencing-based analyses of the soil microbiome. Preliminary evidence suggests that surface-adhering microbes tend to yield higher quantities of DNA during extraction as compared to non-adherent, vagile types. This study tested whether surface adhesion influenced DNA extraction efficiency by comparing different mutant strains of adherent and non-adherent Agrobacterium tumefaciens and Caulobacter vibrioides. It is hypothesized that adherent cells will be more efficiently lysed during extraction due to increased contact during physical beating, yielding more DNA. Recognizing potential biases introduced from the preferential lysis of adherent cells, or variations in DNA extraction efficiency, is critical because DNA extraction is fundamental in the characterization of microbiomes, especially in agricultural soils.

Keywords:

Soil; Microbiome; Adhesion; Bacteria; DNA Extraction

Mentor(s):

Roland Conrad Wilhelm (Purdue University); Alex Batista Trentin (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1005

Presentation Time: Session 1: 9:00-10:00am

Elastically Recoverable Dynamically Vulcanized Polymer Blend Nanocomposites

STEM

Authors(s):

James Gavin Anzaldi† (Engineering)

Abstract:

Thermal interface materials (TIMs) require optimization in mechanical and thermal performances for effective operation and reliability of electronics. TIMs transfer heat away from the heat source to heat sinks while resisting high mechanical stress and critically maintaining complete contact with both surfaces. The purpose of this study is to characterize the mechanical behaviors of dynamically vulcanized TIMs of blends of polystyrene (PS) and polyisoprene (PI) constituting 2D boron nitride (BN) nanoparticles. This study focused on compressive recovery behavior of PS/PI/BN nanocomposites and compared the elastic modulus while under tension and compression. The formulated sample compositions ranged from 0 to 40% by volume. It was found that as the concentration of BN is increased, elastic modulus measured under both tension and compression increased. However, overall elastic modulus was less than 10 MPa for all compositions. Under compression, materials with higher BN concentration required higher stress to compress by 30% and recovered from the compression effectively similar to those of lower BN concentration samples. The fabricated materials at all compositions were therefore soft, flexible, and elastically recoverable. To summarize, we found that dynamically vulcanized thermoplastic elastomers with nanoparticles can be ideal materials to provide elasticity and mechanical strength, making them suitable materials for TIMs applications.

Keywords:

Thermal Interface Materials; Elastomers; Mechanical Characterization; Semiconductors; Material Science

Mentor(s):

John Howarter (Purdue University); Geeta Pokhrel (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1006

Presentation Time: Session 1: 9:00-10:00am

AC2 Inhibitor Synthesis for Assessment of Physiological Roles in Blood-Brain Barrier Disorders

STEM

Authors(s):

Isabella Vollmer Arauz† (Science|JMHC)

Abstract:

Adenylyl Cyclases (ACs) are critical enzymes responsible for catalyzing the conversion of ATP into cAMP, thus increasing intracellular cAMP molecules crucial for downstream signal transduction, specifically regarding prevalent diseases. In particular, AC2 is a potential therapeutic target for disorders of the blood-brain barrier (BBB). However, there is a large knowledge gap regarding AC2 and its specific contributions to disease due to a lack of both genetic knock-out studies and small molecule chemical probes available. Thus, there is a significant need for AC2 inhibitors to serve as molecular probes to deepen our understanding of the role of AC2 in BBB disorders. Recently, a 3,000-compound screen was performed in which (R/S)-SKF-83566, a strong AC2 inhibitor, was discovered. However, the molecule has reported dopamine receptor agonist activity. Thus, our goal is to build structure-activity relationships for (R/S)-SKF-83566 with respect to both AC2 potency and dopamine receptor (D1) activity. AC2 inhibitors are synthesized, purified through column chromatography, characterized with TLC, MS, and 1H NMR/13C NMR, assessed for purity with HPLC, and tested with cAMP inhibition assays to determine potency. Available data for one AC2 inhibitor indicates an HPLC purity of 100%, and more promising purity data is expected soon for another synthesized AC2 inhibitor. Furthermore, high potency results from cAMP inhibition assays are expected to be received for these inhibitors soon. Overall, generating AC2 inhibitors with strong inhibition and promising in vivo properties allows for furthered understanding of the physiological roles of AC2 in disease in animal models.

Keywords:

AC2 Inhibitors; (R/S)-SKF-83566; Blood-Brain Barrier; Molecular Probes; Physiological Roles

Mentor(s):

Daniel P Flaherty (Purdue University)

Other Acknowledgement(s):
Shrinidhi Annadka (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1007

Presentation Time: Session 1: 9:00-10:00am

Emergency Response Drone for Narcan Delivery

STEM

Authors(s):

Nathan James Arnold† (Engineering); Parth Kailash Dubal† (Engineering); Victor Ionut Ene‡ (Engineering); Natasha Rajendrara Gundapaneni‡ (Engineering); Shelby Grace Britton‡ (Engineering); Ty Dean Frederick‡ (Engineering); Harshavi P Birla‡ (Engineering); Bhaskar S Patke‡ (Engineering); Hailey Danae Manuel‡ (Polytechnic|JMHC); Nikolai Lyubomir Tesla Auclair‡ (Polytechnic); Yash Agnihotri‡ (Engineering)

Abstract:

Since early 2020, when the COVID-19 pandemic began, opioid overdose deaths in the United States have increased significantly, spiking at nearly 108,000 deaths in 2022. And against what experts believed, after lives began to return to normal this number remained high. While Narcan is an effective, easily administered opioid inhibitor, timely intervention is essential, as brain damage from oxygen deprivation can occur within six minutes–far shorter than the average emergency medical service (EMS) response time of 17 minutes in some rural Indiana counties. Even the national average sits at 7 minutes; still too slow to help save a life. This project focuses on developing an Unmanned Aerial Vehicle (UAV) system that autonomously delivers Narcan and instructs bystanders to administer the treatment significantly improving survival outcomes ahead of EMS arrival.

With a critical mission window of just six minutes, every second is vital. Accounting for dispatch time and a drone flight time of five minutes—achieved by designing a UAV capable of reaching speeds of 60 mph and a path planning algorithm for an optimal flight path—only 30 seconds remain for instructing a bystander on administering Narcan. However, prior human-UAV interaction trials revealed that medically untrained individuals in high-stress situations sometimes required more than 30 seconds. To address this, our research explores design improvements that enhance instructional clarity and response efficiency. By optimizing the way Narcan administration is communicated, we aim to reduce cognitive load and improve usability, ultimately increasing the number of lives saved in opioid overdose emergencies.

Keywords:

Drones; Opioid Overdose; Narcan; Emergency Response

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
James Michael Goppert (Purdue University); Nicole Adams (Purdue University); Nan Kong (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1008

Presentation Time: Session 1: 9:00-10:00am

Platinum-Containing Compounds have Potential Roles as Cyanide Antidotes

STEM

Authors(s):

Ari Samuel Samuel Arzumanian† (Pharmacy); Allison Catherine Bennett† (Pharmacy)

Abstract:

Cyanide, a deadly toxin that inhibits cellular oxygen use, poses a high risk in events like fires and terror attacks. Current IV-administered antidotes are impractical for mass casualties, necessitating the development of rapidly deployable alternatives. The efforts of our Purdue Team are developing novel cyanide countermeasures. Two of the promising compounds are bis-(L-S-methylcysteine amide)-(S,N)-platinum(II) ((SMeCysNH2)2Pt) and bis-(methionine-carboxamide(S,N))-platinum(II) ([Met(NH2)]2Pt), both of which demonstrate rapid cyanide binding and effective mitigation of cyanide toxicity in animal models. During the development of these complexes, our group focused on optimizing safety and efficacy. Throughout the study, there was an emphasis on mitigating the potential nephrotoxicity associated with platinum-based compounds, like cisplatin. Our studies in Sprague Dawley rats indicated a lower risk of acute kidney injury (AKI) with carboxamide-containing complexes. Recently, we have characterized these complexes using high-performance liquid chromatography (HPLC). Our recent experiments focused on identifying the retention times of these compounds, confirming their rapid reactivity with cyanide, assessing their stability over extended time periods, and evaluating their reactivity in the presence of competitors such as cysteine and glyoxylate. The data presented further support the rationale for continued investigation of these platinum(II) complexes to enhance their stability, reduce nephrotoxicity, and improve their feasibility as intramuscular cyanide antidotes.

Keywords:

Cyanide; Antidotes; Platinum; Nephrotoxicity; HPLC

Mentor(s):

Vincent Jo Davisson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1009

Presentation Time: Session 1: 9:00-10:00am

An Automated Blender-Python-MATLAB Pipeline for Testing Visual Navigation Algorithms

STEM

Authors(s):

Adam Daniel Aufderheide† (Engineering)

Abstract:

Errors in the data association process of visual navigation frameworks are often difficult to characterize within a filter due to their nonlinear and non-Gaussian nature. Therefore, robust testing of visual navigation algorithms requires test images of the expected terrain, which are often produced via rendering software. Rendering a scene is time consuming and requires significant input from a human user. These drawbacks often lead developers to render only a single set of images, which does not yield sufficient results. The ideal test includes multiple sets of images over many Monte Carlo trials to show performance over a range of potential trajectories. To enable robust testing of visual navigation algorithms, this poster proposes a pipeline between MATLAB, Python, and Blender to render Blender scenes efficiently, provide the resulting images to Python's powerful library of feature-matching algorithms, and finally return the set of associated points to a MATLAB-based navigation algorithm. The proposed approach efficiently communicates between these programs, providing a simple yet efficient interface for users to incorporate into existing visual navigation programs.

Keywords:

Visual Navigation; Blender; Monte Carlo

Mentor(s):

Keith Allen LeGrand (Purdue University)

Other Acknowledgement(s):

Timothy L Goulet (Engineering)

Poster Presentation Abstract Number: 1010

Presentation Time: Session 1: 9:00-10:00am

Investigating identity-based social capital for nonbinary STEM graduate students

Social Science

Authors(s):

Sofia Adelaide Jane Bahr† (Engineering)

Abstract:

Nonbinary and transgender individuals are shown to have lower retention rates in STEM fields, which is linked to the social-technical divide in STEM identity. As a growing number of students in academia openly identify as nonbinary, the educational community must be knowledgeable in how to support the success of nonbinary individuals alongside cisgender colleagues. This study examines how nonbinary STEM graduate students access identity-based and non-identity-based supports from cisgender and transgender faculty. This investigation is part of a larger study that explores the supports accessed by nonbinary graduate and undergraduate students in STEM. Of the 40 participants interviewed for the larger study, 14 were graduate students. Six of these interviews were examined in prior work, and the remaining eight were analyzed in this study using Saldaña's first and second cycle coding. Based on our conceptual framework, the data were sorted into thematic categories for identity-specific (kinship, insider knowledge, affirmation, advocacy, anti-witnessing, and anti-mirroring) and non-identity-specific (instrumental and expressive) supports. The findings of this study highlight the significant impact of identity-based support from faculty on the persistence and well-being of nonbinary STEM graduate students. Meanwhile, anti-witnessing of the participant's nonbinary identity reduced the positive impact of non-identity-based supports. Based on our findings, we recommend that faculty provide more identity-based supports such as sharing information regarding campus LGBTQ+ resources and fostering nuanced discussions on gender identity in scientific research. These actions will contribute to a more knowledgeable, respectful, and inclusive environment that will help nonbinary STEM graduate students succeed.

Keywords:

Nonbinary; STEM; Graduate; Social Capital

Mentor(s):

Coleman Blaine Thompson (Engineering); Adrian Gentry (Engineering); Kerrie Douglas (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1011

Presentation Time: Session 1: 9:00-10:00am

Effect of Nox2 Morpholino on Zebrafish Nervous System Development

STEM

Authors(s):

Mingi Bang† (Science); Aislinn Kaelind Davis‡ (Science)

Abstract:

Using CRISPR-Cas9-mediated gene knock-out, we have previously shown that the NADPH oxidase Nox2/cybb is required for proper nervous system development in zebrafish larvae, including the formation of retinotectal connections. To validate these results, we used a Nox2/cybb-specific splice-blocking Morpholino oligonucleotide that is expected to result in a truncated protein. Injection of 0.236 mM Nox2/cybb Morpholino into AB wild-type zebrafish embryos at the one-cell stage resulted in reduced eye size, increased body curvature, and pericardial edema similarly to what we previously observed in the nox2/cybb-/- larvae. Next, we will perform immunostaining using Zn-8 antibodies to estimate overall retinal development and using acetylated tubulin antibody to assess overall axonal connectivity in zebrafish. If Nox2/cybb is involved in the formation of retinotectal connections, we expect that Nox2/cybb Morpholino-injected larvae will exhibit alterations in retinal morphology and mis-targeting of axons in the optic tectum when compared to control-injected larvae similarly to what we found in the nox2/cybb-/- larvae. These findings suggest that Nox2/cybb-mediated ROS production plays a critical role in neural development, specifically in axon guidance and retinotectal connectivity.

Keywords:

Nox2/cybb; Morpholino; Reactive Oxygen Species; Knockdown; Zebrafish

Mentor(s):

Daniel Suter (Purdue University); Paola Nicole Vega Rodriguez (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1012

Presentation Time: Session 1: 9:00-10:00am

Gamification of Pediatric Rehabilitation Exercise for Brachial Plexus Injuries

STEM

Authors(s):

Twinkal Barai† (Engineering); Aidan Hirsch† (Engineering); Ian Kwan Yin Lam† (Science); Kelly Hsieh Lin† (Engineering); Hamsikasree Vedavinayagam† (Engineering); Shreya Krishnan† (Engineering); Parth Kapila‡ (Polytechnic); Cailyn Elizabeth Bowerman* (Engineering); Elena Anne Lehner* (Engineering|JMHC)

Abstract:

Physical therapy (PT) treatments can often be tedious and repetitive, leading to low adherence in pediatric patients and often causing prolonged injury recovery. Past studies have shown that pediatric adherence to PT drops to 63% nine months after beginning treatment. It is thus desirable to increase patient engagement in pediatric PT regimens.This project aims to increase PT adherence in pediatric patients aged 6 to 14 suffering from brachial plexus injuries via a muscle movement-controlled video game. To achieve this goal, EMG sensors connected to a Raspberry Pi were utilized to detect muscle activation during PT exercises. These signals were then used as input to control a virtual game. EMG data collected during the exercise duration were sent to a Firebase Cloud Firestore and later stored as a CSV file. In clinical applications, this data can be shared with the patient's physical therapist and healthcare provider. These metrics, including number of repetitions, duration of exercise hold, total practice time, prove essential for health practitioners to evaluate, recommend, and modify PT treatment. Future considerations to improve this design include further testing to reduce noise present in our data collection, as well as decreasing the latency between stimulus and response by the video game. Overall, this device can provide a new avenue for improving efficiency and effectiveness of pediatric PT regimens for brachial plexus injuries, potentially decreasing duration of treatment and increasing quality of patient care.

Keywords:

Electromyography (EMG) Sensors; Pediatric Physical Therapy; Brachial Plexus Injury; Wearable Sensors

Mentor(s):

Juan Camilo Mesa Agudelo (Engineering); Kevin Alessandro Bautista (Purdue University)

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Other Acknowledgement(s):
Sage Michael Turner (Engineering); Jean Pertuit (Engineering)

Poster Presentation Abstract Number: 1013

Presentation Time: Session 1: 9:00-10:00am

The Shot That Saves Lives

Humanities

Authors(s):

Calla Grace Bauman† (HHS)

Abstract:

Vaccine hesitancy has emerged as a “top ten threat to global health” according to World Health Organization. Despite safe and effective vaccinations, this issue has dramatically increased due to the COVID-19 pandemic (Ittefaq et al., 2024). Understanding the factors that play a role in hesitancy is important so that successful intervention measures and customized forms of communication can be implemented to prevent the spread of disease and protect public health. This exploratory research aims to explore specificities of the factors that cause vaccine hesitancy, such as misinformation, forms of communication, and fears. It also aims to explore strategies that may help in addressing the concern, such as, effective communication strategies, transparency about vaccine development, and healthcare campaigns. To further investigate this issue, I share insights and collected data drawn from my preliminary literature review. This research aims to inform the public and the government on vaccinations and what can be done to increase uptake. It also highlights the importance of vaccinations to better public health which would help to achieve herd immunity and prevent the spread of infectious diseases.

Keywords:

Vaccine Hesitancy; Public Health; Misinformation; Healthcare Interventions; Public Trust

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1014

Presentation Time: Session 1: 9:00-10:00am

Sounds of sustainability: Can unsupervised clustering recognize regenerative agriculture using insect acoustic data?

STEM

Authors(s):

Thomas Allen Belcher† (Science|JMHC); Zhixin Cai* (Science|JMHC); Ryan M Feller* (Science|JMHC); Hiya Samanta* (Science|JMHC)

Abstract:

Anthropogenic ecosystem change is a prevalent threat to animal habitats and insect biodiversity. Agricultural practices can range greatly, from sustainable to conventional, and have varying impacts on the environment. Insects are vital to agroecosystems, pollinating crops, controlling pests, and serving as a resource for other species. They are also valuable bioindicators of local environmental health. However, their small size and cryptic markings make direct species identification challenging. Passive Acoustic Monitoring (PAM) has seen success in other systems where direct identification is impractical. When combined with acoustic indicators or species identification algorithms, PAM can detect ecosystemic changes with minimal human intervention. While these techniques have been extensively applied to bird calls, the sonic qualities of insect calls are less well-known, especially within agricultural settings.

To fill this knowledge gap, we will analyze of 10 agricultural sites in the Midwest, particularly ones with very strong and very weak ecosystem-positive factors, using several models (Random Forest, non-metric multidimenstional, and k-means clustering). We expect higher scores on the acoustic indices in locations with environments more friendly to biodiversity. The clustering analysis is also expected to provide more varied, more clear species clusters when biodiversity is high.

Keywords:

[no keywords provided]

Mentor(s):

Kristen Marie Bellisario (Purdue University); Christine Harrison Elliott (Agriculture)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1015

Presentation Time: Session 1: 9:00-10:00am

Wettability and Condensation Dynamics on Ultrawhite Radiative Cooling Paints

STEM

Authors(s):

Sandra Edilia Bern† (Engineering)

Abstract:

Water scarcity affects approximately two-thirds of the global population. Consequently, alternative forms of water collection, such as atmospheric water harvesting via dewing, have been developed to address the growing issue. Integrating radiative cooling with dewing enables water collection without the need for an external energy input. The three characteristics that impact the water harvesting potential of a surface are the wettability/hydrophobicity of the radiative cooling paints, the inclination angle of the paint sample, and the subcooling dew temperature. This project aims to develop a real surface that effectively uses radiative cooling paint for dew harvesting by optimizing these three characteristics. Wettability and subcooling temperature influence the effectiveness of water dewing on the surface, while the inclination angle changes the view factor for reflectivity, reducing the sample's radiative cooling potential. Three radiative cooling paints (BaSO_4,hBN,and CaCO_3) were tested at four dew temperatures (1.5°C, 2°C, 5°C, and 10°C) and 2 sample angles (30° and 60°), resulting in 8 tests per sample. Each test recorded the time it took to harvest 3 grams of water. The 24 data sets will then be analyzed to determine the optimal chemical composition of the paint and angle of collection. These tests examined the competing characteristics of the sample inclination angle, radiative cooling potential, and surface wettability on the effectiveness of dew water harvesting. Therefore, identifying the optimal balance between these factors is crucial to developing a real surface that maximizes water harvesting potential.

Keywords:

[no keywords provided]

Mentor(s):

Xiulin Ruan (Purdue University); Orlando Gabriel Rivera Gonzalez (Engineering)

Other Acknowledgement(s):

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Aljwirah (Engineering); Dudong Feng (Purdue University); David Warsinger (Purdue University); Justin Weibel (Purdue University)

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Poster Presentation Abstract Number: 1016

Presentation Time: Session 1: 9:00-10:00am

Toxicity of Menthol- and Tobacco-Flavored Electronic Cigarette Constituents Cause Inflammation, Epithelial Barrier Dysfunction and Modulate Nicotinic Acetylcholine Receptors in the Absence of Nicotine

STEM

Authors(s):

Arni Prakash Bhatnagar† (HHS); Kirby Beck‡ (HHS); Vidhi Pandya‡; Nicholas James Georgiades* (Agriculture)

Abstract:

Menthol and Tobacco flavored nicotine delivery systems (ENDS) are widely used as safer alternatives to combustible cigarettes. These flavored products include constituents such as PG/VG, benzoic acid, acetoin, L-menthone, 98% menthone, WS-23, vanillin, and carvone. However, little is known about the potential adverse effects of the constituents in these flavored products. We hypothesized that exposure to these constituents can elicit an inflammatory response and cause lung epithelial barrier dysfunction via alpha nicotinic acetylcholine receptors (?-nAChR). Bronchial epithelial cells were treated with 100 mM of tobacco and menthol ENDS constituents on trans well inserts. Transepithelial barrier resistance and millivolts were measured over a 24-hour time course by EVOM. To assess the elicited inflammatory response, cytokines IL8 and IL6 were quantified in the conditioned media. Cytotoxicity was evaluated by AO/PI staining of the cells. Cell lysates were used for the ?1, ?4, ?5, and ?7 nAChR protein abundance assessment by immunoblotting. Epithelial integrity was decreased over time with a significant decrease in mV by all tested constituents. Significant increase in IL6 in conditioned media was observed in PG/VG, carvone, and WS-23 treated cells. Carvone-treated cells significantly elevated IL8. Further, significantly elevated ?5 and ?7 nAChR were seen in cells treated with PG/VG, Acetoin, 98% Menthone, Carvone, and WS-23. These findings suggest that common constituents in menthol- and tobacco-flavored ENDS induce lung inflammation, epithelial barrier dysfunction, and lung injury. Further, our data implicate potential lung disease pathogenesis via nAChR modulation-mediated inflammation even in the absence of nicotine. This study was funded by R00ES033835.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Inflammation; Tobacco; Inhalation Toxicology; Flavoring Chemicals; Electronic Cigarettes

Mentor(s):
Thivanka M Muthumalage (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1017

Presentation Time: Session 1: 9:00-10:00am

Acute Exposure to Nicotine-containing Electronic Cigarette Aerosols Augment Early Molecular Changes Related to Chronic Lung Diseases in Mice.

STEM

Authors(s):

Anvi Bhatnagar† (HHS); Nicholas James Georgiades† (Agriculture); Arni Prakash Bhatnagar‡ (HHS); Thomas John Cowden‡ (HHS)

Abstract:

Background: With the rising use of electronic cigarettes as a safer alternative to combustible cigarettes, there's a current gap in knowledge of the acute toxicity of flavored aerosol exposure. We hypothesized that acute exposure to nicotine-containing e-liquids augments pro-inflammatory and fibrotic responses in lung tissue, increasing the expression of genes linked to pulmonary toxicity and chronic disease progression. Methods: Eight-week-old C57BL/6J male and female mice were exposed for two hours (2x51mL puff/min) to PG/VG 0 mg/mL nicotine, PG/VG 6 mg/mL nicotine, tobacco-flavored 0 mg/mL nicotine, and tobacco-flavored 6 mg/mL nicotine aerosols. Total RNA was isolated from whole lung tissue, and the most altered gene expression ratios relative to the unexposed (air) counterparts were calculated in lung disease development pathways. Results: In the PG/VG exposed mice, minimal gene expression changes were observed, suggesting low inflammatory potential. PG/VG 6 mg nicotine vapor induced significant upregulation of S100a8, S100a9, and Cxcl15, indicating an acute inflammatory response with neutrophil recruitment and oxidative stress. Tobacco 0 mg nicotine aerosol exposure, with downregulation of Foxp3 and upregulation of Rorc, suggested a shift toward pro-inflammatory signaling and loss of immune regulatory function. Tobacco 6 mg nicotine aerosols caused the most significant effects, including Tgfbr1 upregulation and Sigirr downregulation. Conclusions: Our findings suggest that nicotine plays a critical role in enhancing inflammation, immune dysregulation, and fibrotic signaling in lung tissue. Additionally, a single hit of acute nicotine exposure with tobacco flavoring chemicals could predispose lung tissue to chronic disease states. This study was funded by R00ES033835.

Keywords:

Tobacco; Inflammation; Pulmonary Fibrosis; Nicotine; Vape

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Thivanka M Muthumalage (Purdue University)

Other Acknowledgement(s):
Benjamin Kieth Dierolf (HHS); Md Ehsanul Kabir (HHS)

Poster Presentation Abstract Number: 1018

Presentation Time: Session 1: 9:00-10:00am

Glutamatergic-Driven Behavioral Alterations in Lead-Exposed Larval Zebrafish

STEM

Authors(s):

Saraf Jalil Bhuiya† (HHS|JMHC)

Abstract:

Lead (Pb) is a known neurotoxicant associated with cognitive dysfunction even at low concentrations, making it a relevant model for studying neurodevelopmental and neurodegenerative diseases. This study utilizes larval zebrafish (Danio rerio) to investigate the impact of lead exposure on behavioral patterns, particularly anxiety-response and habituation learning. Zebrafish larvae were exposed to 0, 1, 10, or 100 parts per billion (ppb) of lead acetate from 1 hour post-fertilization (hpf) to 72 hpf and assessed at 168 hpf using the Acoustic Startle Response (ASR) test. This test evaluates habituation by analyzing the frequency and magnitude of C-bends, a characteristic startle response, as well as total distance moved post-stimuli. Given the critical role of the glutamatergic system in learning and memory, glutamate and glutamine levels were measured to examine potential correlations between neurotransmitter alterations and behavioral adaptations. Disruptions in glutamate-glutamine homeostasis may contribute to impaired habituation and heightened anxiety responses, which could serve as indicators of cognitive deficits. By characterizing these behavioral and neurochemical changes, this study aims to provide insight into the mechanisms of lead-induced neurotoxicity and its potential implications for neurodegenerative disease models. The habituation of startle-response behaviors of lead-exposed groups demonstrated altered patterns, suggesting potential neurotoxic effects on learning and memory processes related to the cycling of glutamine and glutamate, where measured levels of glutamate correlated most with these changes.

Keywords:

Glutamate; Glutamine; Habituation; Lead

Mentor(s):

Jennifer Freeman (Purdue University)

Other Acknowledgement(s):

Wagner Antonio Tamagno (HHS)

Poster Presentation Abstract Number: 1019

Presentation Time: Session 1: 9:00-10:00am

Development of a 5000 lbf Rocket Turbopump

STEM

Authors(s):

Andrew Alberto Fontanetta† (Engineering); Cole Alan Halupnik† (Engineering|JMHC); Kamon Van Blong‡ (Engineering); Nicolas Michael Makovnik‡ (Engineering); Timothy Joseph Mareachen‡ (Engineering|JMHC)

Abstract:

Design of a kerosene-oxygen rocket engine turbopump utilizing a conventional open-cycle system architecture sized to power a 5,000-lbf thrust chamber is described. As an undergraduate program, a number of decisions were made to reduce programmatic risk: A strict and comprehensive technical onboarding program is applied to kickstart personnel development, and a conservative design doctrine which prioritizes reduced technical risk, ease of integration, low cost, and fast development time, potentially at the expense of performance, is adopted. The conventional, single-shaft oxygen-kerosene-turbine arrangement is chosen, allowing substantial use of prior art, and operating speed is maintained well below the first critical speed. Commercial tools such as CFturbo and Dyrobes are leveraged for pump and rotordynamic design to further derisk and accelerate development. Both additive and subtractive manufacturing processes are utilized, and requisite design for manufacture is discussed. Plans and procedures for manufacturing and quality assurance, as well as buildup of test and auxiliary infrastructure, are additionally outlined.

Keywords:

Rocket; Propulsion; Turbomachinery

Mentor(s):

Dong won Lim (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1020

Presentation Time: Session 1: 9:00-10:00am

ARES: A Comprehensive RF Testing Platform for Power Amplifiers and Antennas

STEM

Authors(s):

Jose Abraham Bolanos Vargas† (Engineering)

Abstract:

With next-generation communication systems demanding precise RF testing, traditional methods remain manual, slow, and costly. The Automated Radio Evaluation Suite (ARES) streamlines power amplifier and antenna characterization through an open-source MATLAB-based platform, integrating seamlessly with standard lab equipment for accessible, automated, and efficient RF measurements.

ARES measures the DC and RF power of amplifiers and calculates gain, drain efficiency, power-added efficiency, output power, and linearity. For antennas, it measures return loss, realized gain, and radiation patterns using a reference or two identical antennas. Recently, ARES has been enhanced with multi-supply PA measurement and de-embedding capabilities to calibrate the measurement by removing the losses of setup and including an active driver measurement to remove the effects of the driver response.

The flexibility of ARES enables efficient data collection and rapid visualization, significantly reducing the time required for comprehensive RF component analysis. Initial evaluations by researchers in PA and antenna testing showed that ARES produces detailed datasets within minutes, compared to traditional methods requiring tens of hours of manual measurements.

By delivering a cost-effective, open-source alternative to commercial software, ARES fosters collaboration and innovation within the research community. Future development will enhance multi-tone and modulated signal interference testing and provide comprehensive documentation.

Keywords:

Power Amplifier Characterization; Antenna Testing; RF Measurement Automation; Two-Tone and Modulated Signal Analysis; Open-Source RF Testing

Mentor(s):
Dimitrios Peroulis (Purdue University); Alex David Santiago Vargas (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1021

Presentation Time: Session 1: 9:00-10:00am

Visualizing the Enemy: Artificial Intelligence Image Generators and the Reproduction of Counter-Insurgent Logics in the Western Imagination

Social Science

Authors(s):

Reuben Lewis Bowie† (Liberal Arts)

Abstract:

Scholars have noted that AI image generators often produce racist and sexist results. Indeed, AI systems have been shown to not simply reproduce common racial stereotypes but at times amplify biases found in the real world. Across the board, images produced by AI systems include biased and stereotypical traits related to gender, skin color, occupations, nationalities and more. But, scholars have yet to contextualize AI imaging technologies and the stereotypes on which they rely in relation to its militaristic origins. From its birth in the US Pentagon's Cold War crusade against Communism, Artificial Intelligence technologies have always been yoked to America's quest to master the dark military art of counter-insurgency. This article will explore this enduring function of AI through a demonstration of how these technologies produce images that reify the tenets of Western strategic thinking associated with the pre-eminent doctrine of modern irregular warfare: counter-insurgency. With two sample sets, we will show that AI image generators amplify tropes associated with Black male militant stereotypes in the US and secondly how AI generators rely on Orientalist stereotypes that assume the benevolence and superiority of Western society (particularly the US) which add to a narrative of gender inequality and protecting or liberating Black/Brown women from their 'barbaric' male counterparts. More than anything, this project aims to bridge the gap between research on bias in AI and counterinsurgency scholarship.

Keywords:

Counter-Insurgency; Social Dominance Theory; Bias; Artificial Intelligence; Prejudice

Mentor(s):

Miron Javionne Clay-Gilmore (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1022

Presentation Time: Session 1: 9:00-10:00am

Measuring the Immune Response in Mouse Tumor Models Treated with Attenuated Salmonella Anticancer Bacteria Strains

STEM

Authors(s):

Lindsay Rebecca Brncick† (HHS|JMHC); Julia Lynn Flowers‡ (HHS)

Abstract:

Bacteria-based cancer therapy has recently been on the rise to discover effective and safe ways to treat cancer in humans, specifically by using genetic engineering modifications. In this study, we aim to address one of the current issues with cancer immunotherapy: poor immune responses of cold solid tumors. The objective is to elicit innate and adaptive immune responses for tumor tissue destruction. We used an attenuated strain of Salmonella Typhimurium, named VNP20009, as a control to study how the tumor responds following injection with this bacterium. Further, we engineered the attenuated VNP20009 strain to express two anticancer proteins: tumor necrosis factor alpha (TNF-alpha) and metnioninase, and tissue oxygen biomarker myoglobin. Previously, we have shown that the Salmonella Typhimurium VNP20009 strain expressing metnioninase (METase), TNF-alpha, and myoglobin caused tumor destruction of cold Lewis Lung Carcinoma (LLC) grown on immunocompetent C57BL/6 mice. In this study, several mechanisms of this anti-cancer bacteria were studied including the innate and adaptive immune system responses and cancer cell apoptosis. In continuation of this previous study, we are examining the biomarker specificity and quantification using imaging software to ensure accuracy and compare tumor responses to different engineered bacteria strains. We are also studying the effects of the control VNP 20009 Salmonella bacteria strain on U87 glioma tumors grown in immune compromised nude or SCID mice. We will also use the VNP20009 strain with anticancer proteins to compare immune responses in several immune competent mouse models to the control.

Keywords:

Anti-Cancer; Bacteria; Immunotherapy; Tumors; Cancer Therapy

Mentor(s):

Qiuhong He (Purdue University)

Other Acknowledgement(s):
MacKenzie J McIntosh (Purdue University); Boxi Gong (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1023

Presentation Time: Session 1: 9:00-10:00am

Mental health effects of high-rise living

Humanities

Authors(s):

Aiden Abhimanu Bunnell† (HHS)

Abstract:

In the past 20 years, the number of skyscrapers has risen dramatically. For decades urban planners have pondered the age-old question of whether high-rises and skyscrapers impact the mental health of city dwellers and inhabitants. This exploratory study seeks to investigate the data on the mental health effects of tall buildings. I have conducted a preliminary literacy review of the findings of more recent papers.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1024

Presentation Time: Session 1: 9:00-10:00am

A Next-Generation Probiotic Strain Promotes Epithelial Wound Healing (Repair) after Physical Damage In Vitro

STEM

Authors(s):

Alvin Cai† (Agriculture|Engineering); Luke Wilson Heymann† (HHS)

Abstract:

Background: Probiotic bacteria are known for their beneficial effects on the host, such as promoting anti-inflammatory response and alleviating dysbiosis. Probiotic therapy to aid in wound healing has been touted as an emerging area in clinical research. However, probiotic action is inconsistent due to their variable adhesion and colonization. Therefore, our laboratory has engineered a probiotic strain to express the housekeeping enzyme acetaldehyde dehydrogenase (AdhE), also known as Listeria adhesion protein (LAP), from a nonpathogenic Listeria to promote receptor (Hsp60)-specific attachment.

Methods: Here, we examined the effects of this next-generation bioengineered probiotic (NGP) in its ability to repair tissue damage. We created longitudinal ~1 mm-wide scratches (wounds) on intestinal epithelial Caco-2 cell monolayers. Wounded monolayers were treated with NGP and wild-type (WT) probiotics for 24 hrs; then, wound repair was monitored by measuring the width of the wound. Additionally, monolayers were assayed for lactate dehydrogenase (LDH) release and cytokine production.

Results: Data show that NGP-mediated total wound closure was significantly ($P<0.05$) higher than the wild-probiotics, with the rate of wound closure also increasing over 24 hours. LDH release was significantly ($P<0.05$) reduced in damaged Caco-2 monolayers treated with NGP compared to those treated with WT. NGP demonstrated increased adhesion to damaged cells due to increased expression of Hsp60 (receptor) from wounded cells and reduced inflammatory cytokine (Interleukin-6) concentrations

Significance and Impact: The study shows the potential application of our receptor-targeted NGP for enhanced repair and healing of intestinal linings that may be damaged following infection or inflammatory diseases.

Keywords:
Next-Generation Bioengineered Probiotic (NGP); Caco-2; Wound Healing; Heat Shock Protein 60 (Hsp60); Acetaldehyde dehydrogenase (AdhE)

Mentor(s):
Arun K Bhunia (Purdue University)

Other Acknowledgement(s):
Weicang Wang (Purdue University); Jathya Chathurika Karunathilaka Senarath Pathiranage (Agriculture); Nicholas Leo Frank Gallina (Agriculture); Nicole Irizarry Tardi (Agriculture)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1025

Presentation Time: Session 1: 9:00-10:00am

Effects of Proximal Phosphorylation Sites on pThr181-Tau Antibody Affinity

STEM

Authors(s):

Gwendolyn Mae Enoy Carreon† (Science|JMHC)

Abstract:

Alzheimer's disease (AD) is a progressive neurodegenerative disorder and the leading cause of dementia, characterized by amyloid plaques and neurofibrillary tangles (NFTs) with hyperphosphorylated tau. Clinical symptoms, including memory loss and cognitive decline, often appear decades after disease onset, making early detection difficult. Therefore, identifying reliable biomarkers is crucial for AD's early diagnosis.

Phosphorylated tau at threonine 181 (pThr181-tau) has shown promise as an AD biomarker in cerebrospinal fluid (CSF) and blood, correlating with NFT burden. In recent studies, its detection relies on pThr181-tau antibodies, however, phosphorylation at nearby residues has been shown to alter antibody binding affinity. Thus, it's expected that proximal phosphorylated serine/threonine sites may modulate antibody affinity.

To investigate this, we employed bio-layer interferometry (BLI) to analyze the binding kinetics of the commercial pThr181-tau antibody (ADx252) to tau peptides phosphorylated at Thr181 and various combinations of neighboring sites such as pT175/pT181, pT181/pS184, and pT181/pS185. The BLI assay enables real-time monitoring of binding kinetics and provides direct measurements of association and dissociation rates. For each interaction, the equilibrium disassociation constant (Kd) was determined.

We expect that phosphorylation events at residues proximal to Thr181 will modulate the binding affinity of the ADx252 antibody, with closer phosphorylation sites leading to weaker binding affinity. Understanding how phosphorylation impacts antibody binding can inform the development of more effective therapeutic antibodies targeting specific tau conformations or phosphorylation states. Additionally, phosphorylation-state-specific antibodies may serve as diagnostic tools to detect and quantify pathological tau species, improving early AD diagnosis.

Keywords:
[no keywords provided]

Mentor(s):
Jean-christophe Rochet (Purdue University)

Other Acknowledgement(s):
Wenzhu Qi (Pharmacy)

Poster Presentation Abstract Number: 1026

Presentation Time: Session 1: 9:00-10:00am

Left Ventricular Strain During Chronic Hypertension in Murine Pregnancy Using 4D-Ultrasound Analysis

STEM

Authors(s):

Jake Anthony Castro† (Engineering); Sarah Elizabeth Grev‡ (Engineering); Samantha Stebbings‡ (Engineering|JMHC)

Abstract:

Chronic hypertension occurs in 3 - 5% of pregnancies and can lead to adverse outcomes for both mother and fetus including preeclampsia and placental insufficiency [1]. Effects of hypertensive cardiac pressure overload have been investigated, but a gap exists in how volume overload from a 45% blood volume increase during pregnancy also effects cardiac remodeling [2]. To understand the dual effect of pressure and volume overload on cardiac functioning in chronic hypertensive pregnancies, we assessed left ventricular strain in mice with chronic hypertension (HT control; n=5) and mice with chronic hypertension+pregnancy throughout gestation (HT+Preg; n=5). 4D ultrasound (3D+time) images of the left ventricle were collected at baseline, throughout pregnancy, and postpartum day-1. Using a graphical user interface to examine these 4D images, we calculated circumferential, longitudinal, radial, and surface area strain throughout a cardiac cycle [2]. Comparing start and end timepoints, radial strain showed the largest difference between groups (6.4% increase for HT+Preg vs. 3.5% decrease for HT control) in our preliminary analysis. For circumferential strain, HT+Preg decreased 4.15% and HT control 2.7%. With longitudinal strain, HT+Preg decreased 3.3% and HT control 0.3%. Examining surface area strain, HT+Preg decreased 7.4% and HT control 3.8%. Future studies will compare these initial results to murine left ventricular strain in cohorts of normotensive pregnancy and pregnancy+induced hypertension. Overall, these data may inspire further maternal cardiac health studies.

[1] E. W. Seely, et al., Circulation, 2014.

[2] P. Soma-Pillay, et al., Cardiovascular. 2016.

[3] F. W. Damen et al., Tomography. 2017.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Strain Quantification; Chronic Hypertension; Pregnancy; Cardiac Remodeling; 4D Ultrasound

Mentor(s):
Elnaz Ghajar-Rahimi (Engineering); Craig Goergen (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1027

Presentation Time: Session 1: 9:00-10:00am

Purdue Aerial Robotics Team - Competition Airframe

STEM

Authors(s):

Ethan Joseph Chace† (Engineering); Tanya Rathi† (Engineering); Kailey Christina Dvorak† (Engineering); Marvel Jiaxiang Zheng† (Engineering); Ryan Charles Harrison Schaeffer† (Engineering|JMHC); Yuet Ching Jolie Lai† (Engineering)

Abstract:

In the Spring semester, the Purdue Aerial Robotics Competition Airframe Sub-team was tasked to manufacture and assemble a plane to compete in the Student Unmanned Aerial Systems (SUAS) competition. Compared to the fall semester, there is more hands-on work as the ideal plane design has been devised.

When molds from previous seasons are used, they tend to have a more gummy and sticky texture than newly manufactured molds. To maintain quality, the textured layer is removed using sandpaper, which is believed to be wax residues from previous carbon fiber applications.

After the molds are prepared, two layers of carbon fiber weave are laid onto the molds and impregnated with resin. On top of the carbon fiber layers, a layer of peel ply is applied to reduce unwanted bonding between the carbon fiber and the vacuum bag. A layer of breather is then applied to facilitate the vacuum sealing process. Then a vacuum bag is set up around the molds using special tape to protect against air leakage. The molds are held at a vacuum for 12 hours to apply consistent pressure to the molds as the resin cures. After the demolding, we dremel excess carbon fiber from the parts. Once the parts are cut to an approximate size, they are assembled with the 3D printed supports using 5-minute epoxy. Once the epoxy has cured, the parts must be hand-sanded to remove the remaining errant carbon fiber. This will get the parts to their exact proper size.

Keywords:

UAV Development; Composite Materials; Aerodynamics; Airframe Design

Mentor(s):

Niall Patrick Moloney (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1029

Presentation Time: Session 1: 9:00-10:00am

Paper-Based Duplex Assay for Early Cervical Cancer Screening

STEM

Authors(s):

Akansha Chauhan† (Engineering|JMHC)

Abstract:

Cervical cancer is one of the most common forms of cancer among women globally and occurs disproportionately in low- and middle-income countries due to limited access to the HPV vaccines known to prevent 90% of this cancer. Screening tools for cervical cancer are often invasive, expensive, or time-intensive. This project aims to develop a rapid, protein-based lateral flow immunoassay (LFIA), similar to a COVID-19 test, for early-stage cervical cancer screening at the point-of-care. More specifically, an LFIA with multiplexed detection of both precancerous and HPV-specific biomarkers will reduce the need for secondary screening. The duplex design features a shared sample pad while using two separate conjugate pads, absorbent pads, and nitrocellulose membranes with test and control lines. Both branches are initially designed for the detection of the MCM2 biomarker to validate the duplexed design. The assay uses detector antibodies conjugated to gold nanoparticles to produce a colorimetric readout. Methods for conjugation include passive adsorption and NHS-activation of gold nanoparticles. We compared conjugate pads prepared using each method at multiple optical densities. The results were validated by using image processing software (Fiji) to quantify the color intensity at the test line. NHS-activated conjugates at an optical density of 5 yielded the best limit of detection for MCM2 at a concentration of 10 ug/mL. After further optimization, one branch will use anti-HPV16 L1 antibodies to detect a second biomarker at a clinically relevant concentration. Ultimately, this assay will be interpreted by eye, allowing for rapid and low-cost screening of early-stage cervical cancer.

Keywords:

Lateral Flow Assay; Point-Of-Care; Antibody-Antigen; Cervical Cancer

Mentor(s):

Jacqueline Linnes (Purdue University); Lucy Teberh Tecle (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1030

Presentation Time: Session 1: 9:00-10:00am

Hydrolytically Degradable Hyaluronic Acid Hydrogels for Biomedical Applications

STEM

Authors(s):

Zhiyuan Chen† (Agriculture|Engineering)

Abstract:

Biodegradability is an important parameter in biomaterials design, with implications for drug delivery and tissue engineering. While various degradable polymers have been developed, precisely tuning the rate of degradation to range from days to months has been challenging. Here, we develop hyaluronic acid (HA)-based polymeric hydrogels that are chemically modified to confer hydrolytic degradability. Specifically, we hypothesized that varied amounts of dialdehyde groups on the HA backbone, in combination with covalent crosslinking via norbornene groups with enhanced susceptibility to hydrolysis, would achieve tunable degradation profiles. We used esterification and oxidation reactions to chemically modify HA to introduce norbornene (via carbic anhydride) and dialdehyde (via sodium periodate) groups, respectively. Nuclear magnetic resonance was used to verify chemical modifications. Gelation properties were determined using oscillatory shear rheology with dynamic light exposure and mechanical properties were characterized using uniaxial compression testing. The polymers were used to make microgels using a flow-focusing microfluidic device. Microgel mass swelling ratio, morphology, and degradation via release of a fluorescent label were characterized over time. Hydrogels crosslinked instantaneously on light exposure, and mechanical properties could be tuned by varying crosslinker density. The degree of oxidation and modes of degradation (through crosslinker hydrolysis or via backbone degradation) is consistent with the degradation rate of each hydrogel group. Furthermore, through initial mechanical moduli matching, it's evident degradation rate can be decoupled from initial mechanical properties. These promising findings warrant further investigation of how different degrees of oxidation, in conjunction with different bioactive molecules, achieves controlled delivery and influences cell proliferation.

Keywords:

Biodegradable; Hydrogel; Tissue Engineering; Biomaterials; Controlled

Mentor(s):

Taimoor Hasan Qazi (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1031

Presentation Time: Session 1: 9:00-10:00am

Ultra-processed food: industrial food processing and palatability effects on appetite and gastrointestinal transit time

STEM

Authors(s):

Yixin Chen† (HHS|JMHC)

Abstract:

Obesity is one of the most critical health issues in the United States and globally. Many attribute the high incidence and prevalence to poor dietary choices. The NOVA food classification system links certain foods termed, “ultra-processed food (UPF)” with obesity risk. This is supported by epidemiological data, but only very limited evidence exists from controlled trials. There are no data documenting a mechanism. However, two popular purported mechanisms entail the consumption of hyper-palatable food and rapid gastric emptying. This research study will investigate the role of industrial food processing and palatability on both behavioral and physiological responses to foods classified as minimally and ultra-processed. In this study, a 4-arm cross-over trial was conducted to assess the effects of ultra-processed food (UPF) versus non-ultra-processed foods (NUPF) food varying in palatability on appetitive sensations and gastrointestinal transit time (GTT). Participants consumed four test meals (hyperpalatable and unpalatable, both as UPF and NUPF), and outcomes included appetite ratings, GTT via lactulose hydrogen breath test and hedonic ratings. The hypothesis was that palatability and food processing influence appetite and GTT. The results are expected to clarify the uncertain validity of two mechanisms by which UPF may promote overeating and weight gain. This research aims to contribute to understanding the potential role of food processing in obesity risk and to improve the evidence base for dietary recommendations. Analyses of results are underway.

Keywords:

Ultra-Processed Foods (UPF); Palatability; Appetite; Gastrointestinal Transit Time (GTT)

Mentor(s):

Richard D Mattes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1032

Presentation Time: Session 1: 9:00-10:00am

Predicting the Future of Electric Vehicles: Adoption Trends, Reliability, and Market Growth in Washington State

Business Case Study

Authors(s):

Maoxiong Chen† (DSB); Abhinav Bondlela† (DSB); Dane Alexander Kniola† (DSB); Theodore Dean Schmidt† (DSB)

Abstract:

The growing adoption of electric vehicles (EVs) represents a transformative shift within the automotive industry, significantly impacting market dynamics, infrastructure needs, and environmental policy considerations. This study examines the trends influencing EV adoption in Washington State, addressing critical research questions: What are the current patterns and rates of EV adoption? Utilizing comprehensive electric vehicle population data, we uncover patterns in the sector. Subsequently, analytical approaches are employed, including time series analysis, to understand historical adoption trends. This research provides actionable insights for stakeholders across various domains. Automakers benefit through enhanced strategies for targeted marketing, informed product development, and better forecasting of geographic demand. Policymakers gain critical data to support infrastructure decisions, including strategic placement and expansion of EV charging stations. By clearly defining and addressing the research problem, accurately interpreting complex data, and thoroughly documenting sources and methodologies, this project sets a strong foundation for future research and industry innovation.

Keywords:

Electric Vehicle Adoption; Predictive Analytics; Market Growth; Machine Learning; Geospacial Analysis

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1033

Presentation Time: Session 1: 9:00-10:00am

Heat Across Generations: Thermal Transgenerational Plasticity in a frog-biting mosquito

STEM

Authors(s):

Yu-Wei Cheng† (Agriculture)

Abstract:

Climate change is increasing thermal variability and extreme weather events forcing organisms to adapt for survival and reproduction. Thermal transgenerational plasticity (TGP) can facilitate responses to novel conditions by enhancing offspring thermal performance through inherited temperature-induced traits. Understanding TGP is crucial for predicting ecological responses to climate change. Freshwater temperature increases directly influence species with aquatic larvae, including mosquitoes. This study examines TGP in a frog-biting mosquito, Uranotaenia lowii, to determine how elevated water temperatures during development influence larval survival, developmental rates, and adaptive responses across generations. We hypothesize that thermal stress in the parent generation causes phenotypic changes in life history traits in both the F1 and F2 generations, suggesting transgenerational plasticity. We predict that the progeny from mosquitoes surviving at high temperatures will have higher survival rates and faster developmental rates but with trade-offs such as reduced adult body size. To investigate TGP, mosquito larvae were reared at 24?C, 28?C, and 32?C. F1 adults were subsequently reared in different thermal regimes to produce and raise F2 generations under the same thermal conditions. Phenotypic traits of both F1 and F2 offspring were then evaluated under different temperatures to assess thermal responses across generations. The observed changes across generations suggest that frog-biting mosquitoes exhibit thermal transgenerational plasticity, which may facilitate their ability to confront fluctuating environmental conditions. This study provides new insights into the potential evolutionary and ecological consequences of thermal stress on insect populations focusing on a mechanism that has received limited attention.

Keywords:

Climate Change; Thermal Responses; Adaptation; Freshwater Temperature; Uranotaenia lowii

Mentor(s):

Ximena Bernal (Purdue University); Richa Singh (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1034

Presentation Time: Session 1: 9:00-10:00am

AREG signaling decreases sensitivity to therapeutic PP2A activation in pancreatic cancer

STEM

Authors(s):

Ella Rose Deanne Chianis† (Science)

Abstract:

Pancreatic ductal adenocarcinoma (PDAC) has the lowest five-year survival rate of all major cancers at only 13%. Mutations in the small GTPase KRAS cause activation of the epidermal growth factor receptor (EGFR) pathway which drives PDAC development. Current treatments target EGFR and KRAS, but many patients develop resistance. Our lab investigates alternative therapeutic strategies through the activation of protein phosphatase 2A (PP2A). PP2A turns off many of the cancerous signals in the EGFR-KRAS pathway but is often suppressed in PDAC. We use a small molecule called DT-061 to study PP2A activation, but little is known about resistance mechanisms to this therapeutic route. Preliminary data in our lab demonstrate that PDAC cells treated with DT-061 increase production of the EGFR ligand, amphiregulin (AREG). AREG is associated with many cellular survival programs including the integrated stress response, activation of the EGFR pathway, and epithelial to mesenchymal transition (EMT) which is a common resistance mechanism to therapeutics including KRAS inhibitors. I hypothesize that PDAC cells increase production of AREG in response to PP2A activation to evade cell death. To investigate this potential resistance mechanism, I altered human PDAC cell lines to stably overexpress AREG. In this project, I investigate the signaling pathways that may be giving cells that overexpress AREG a survival advantage against PP2A activation. Uncovering this relationship between AREG expression and resistance mechanisms would provide critical data for the therapeutic efficacy of PP2A activation in patients.

Keywords:

PDAC; EGFR; AREG; PP2A

Mentor(s):

Brittany Lee Allen-Petersen (Purdue University); Claire M Pfeffer (Science)

Other Acknowledgement(s):

Sydney Joann Clifford (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1035

Presentation Time: Session 1: 9:00-10:00am

Pulse Shaping With Integrated Chirped Photonic Bragg Gratings

STEM

Authors(s):

Ethan Chieng Chiao† (Engineering)

Abstract:

Bragg gratings are a type of periodic waveguide structure commonly used in optical signal processing applications because they can be easily designed to attain a desired frequency response. A Bragg grating consists of a periodic modulation in the refractive index of the waveguide. This modulation can be observed in the width or thickness of the waveguide. Chirped Bragg gratings (CBG) take this a step further, by modulating the period of the grating itself. The goal of this work is to explore pulse shaping with CBGs suitable for integration with existing infrastructure. Simulations were first performed using a custom python-based transfer matrix method solver, which generates the frequency response for arbitrary CBG geometries. Efforts then transitioned and are currently focused on physical modeling with Ansys Lumerical simulation tools like finite difference time domain (FDTD) and eigenmode expansion (EME) methods. These methods simulate the device geometry following Maxwell's equations. In order to validate the CBG performance, results should align closely between both physical modeling and script simulation. Designs will need to be optimized for weak reflection over broad bandwidth with low optical loss. The performance will be evaluated through circuit-level simulations using the models created in the FDTD and EME simulations.

Keywords:

Silicon Photonics; Bragg Gratings

Mentor(s):

Jason Dwight McKinney (Purdue University); Vivek vasantrao Wankhade (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1036

Presentation Time: Session 1: 9:00-10:00am

Self-Handicapping in Purdue Undergraduate Honors Students

Social Science

Authors(s):

Amanda Rose Colip† (Science|JMHC); Colin Thomas O'Donnell† (HHS|JMHC); Triniti M Jenkins‡ (Agriculture|JMHC)

Abstract:

This research explores self-handicapping behaviors among Purdue Honors College Students. The study aims to identify common self-handicapping techniques and better understand the unique academic challenges faced by honors students, a group often overlooked in terms of academic setbacks.

A mixed-method approach was used during a workshop to investigate these behaviors. Data was collected anonymously through a 2-item Qualtrics survey and participant notes from small group discussions. The initial survey assessed students' familiarity with self-handicapping. After presenting examples of self-handicapping, participants completed a second survey to pinpoint specific behaviors they engaged in. An open-ended writing activity collected through sticky notes allowed students to reflect on personal experiences regarding self-handicapping.

Among the 11 participants, 54.54% reported unfamiliarity with the term "self-handicapping," 36.36% reported awareness of and engagement in self-handicapping, and 9.09% reported awareness without engagement. Common self-handicapping behaviors included procrastination and avoiding help, which were shared by all participants. Some students reported that they subconsciously self-handicapped despite a desire to preserve “a specific ‘image’” and to “be viewed well by others.” Other behaviors, such as neglecting self-care and substance use, were the least reported at 63.64%.

While existing research on self-handicapping predominantly focuses on all undergraduate students, there is limited attention on Honors students specifically, who could be more prone to self-handicapping behaviors. This study addresses the gap in research on self-handicapping among Honors students and underscores the need for targeted interventions to support this group in overcoming their academic challenges.

Keywords:

College; Honors; Motivation; Learning; Setbacks

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Temitope Folasade Adeoye Olenloa (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1037

Presentation Time: Session 1: 9:00-10:00am

Big Tech's Authority and Governance

Social Science

Authors(s):

Margaret Elizabeth Collins† (Liberal Arts); Kathryn Laura Yang-Can Nevers* (HHS); Raymond Tan* (DSB); Fayrouz Mourad* (Liberal Arts)

Abstract:

As tech bureaucrats play an increasingly influential role in American democracy, it is crucial to analyze how Big Tech companies employ language to construct, legitimize, and maintain their authority within a democratic society. How do Big Tech corporations gain and keep authority? This poster uses an original database, constructed by the International Politics and Responsible Tech (iPART) lab at Purdue, consisting of 752 human rights-related voluntary disclosures and corporate transparency reports. The preliminary analysis draws from Microsoft, Meta (Facebook, Instagram), and Apple in the text corpus. Conducting qualitative content analysis of these documents reveals that corporations utilize self-governance and human rights language to uphold their authority. This sometimes entails an us-vs-them rhetoric, framing the company as a protector of users against external threats from governmental actors or other corporations. These strategies have the power to shape public perceptions of corporate responsibility and to reinforce Big Tech corporations' positions as regulators and standard-setters. Examining how corporations position themselves through their voluntary disclosures reveals much about their values and ambitions as powerful entities.

Keywords:

Big Tech; Responsible Tech; International Relations; Authority; Human Rights

Mentor(s):

Swati Srivastava (Purdue University); Alexander Thomas Wilhelm (Liberal Arts)

Other Acknowledgement(s):

Madeleine Yang (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1038

Presentation Time: Session 1: 9:00-10:00am

Twitchy Whiskers, Busy Brains

STEM

Authors(s):

Alyssa Yates Collins† (Science|JMHC)

Abstract:

How movements contribute to the development of the sensorimotor system is not well understood. In many ways, rodent barrel cortex is an ideal system to study this relationship. The barrel cortex processes sensory input from whiskers, which are essential for rodent exploration, and is unique because each individual “barrel” represents, and receives projections from, a specific whisker. We hypothesize that whisker movements, especially myoclonic twitches during REM sleep, drive activity-dependent plasticity in the barrel cortex, shaping this specificity. These involuntary, rapid whisker movements may aid in the refinement of sensorimotor processing by driving neural activity during early development.

This study longitudinally examines whisker twitches during REM sleep in infant rats at postnatal days (P) 5 and P12. Using a customized recording apparatus, high-speed video, DeepLabCut for motion analysis, and Spike2 for extracting displacement data, we track C-row whisker movements over time to explore whisker-specific developmental changes. We hypothesize that whisker twitches during REM sleep at both P5 and P12 will be largely uncorrelated across individual whiskers, supporting the theory that uncoordinated whisker movements drive the activity-dependent plasticity necessary for the development of distinct barrels in the barrel cortex.

By investigating early-stage whisker movements, we aim to elucidate how myoclonic twitches may contribute to barrel and general motor cortex maturation. Understanding these mechanisms may offer broader implications for how early sensory experiences shape neural circuits in the developing brain.

Keywords:

Barrel Cortex; Whisker Movements; Myoclonic Twitches; Sensory Processing; Cortical Plasticity

Mentor(s):

Jimmy Dooley (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1039

Presentation Time: Session 1: 9:00-10:00am

Rotenone-induced acute miRNA alterations in extracellular vesicles produce Parkinson's Disease relevant mitochondrial dysfunction and neurotoxicity.

STEM

Authors(s):

Matthew Thomas Corson† (HHS|JMHC); Sofia Schumann* (HHS)

Abstract:

Rotenone is a naturally occurring neurotoxin previously used as a pesticide, insecticide, and piscicide. Treating rodents with rotenone produces mitochondrial stress and neurotoxicity like that of Parkinson's Disease (PD) through the loss of dopaminergic neurons in regions of the brain critical for fine motor function. To study PD pathogenesis, we focused on extracellular vesicles (EVs) which are essential for interneuronal communication and can cross physiological barriers. The specific role of EVs and how they contribute to PD pathogenesis is not fully understood; however, the microRNA (miRNA) sequences found within these EVs are known to be important for post-transcriptional regulation of protein levels in some pathogenic processes. Our study aims to show how acute rotenone treatment in rodents produces differential miRNAs in cerebrospinal fluid (CSF) and serum extracellular vesicles, resulting in Parkinson's Disease-like functional modifications in neuronal cells. Prior work has shown that acute rotenone treatment produces distinct serum miRNA alterations in EVs, and two miRNA sequences that have been connected to these functional changes are miR-30a-5p and miR-484. The dysregulation of these miRNA sequences may be connected to early PD pathogenesis. Moreover, when primary midbrain neurons are exposed to serum EVs with altered miRNA profiles, there is evidence of oxidative stress, mitochondrial toxicity, and cell death. The differential miRNA expression in EVs of the serum and CSF of rodents may be an early diagnostic marker for PD and understanding how these miRNAs influence cellular functions is critical to developing a more accurate understanding of PD pathogenesis.

Keywords:

Parkinson's Disease; miRNA; Rotenone; Extracellular Vesicles; Neurotoxicity

Mentor(s):

Fatema Mustafa Currim (Purdue University); Jason R Cannon (Purdue University); Josephine Maria Brown (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Reeya Tanwar (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1040

Presentation Time: Session 1: 9:00-10:00am

Image-based Analysis of Silicone-Encapsulated Particle Attenuation

STEM

Authors(s):

Grace Margaret Costello† (Engineering)

Abstract:

Granular materials possess unique dynamic properties, making them of interest to many fields, including civil engineering. These properties are influenced by many factors, including the characteristics of the individual grains, which affect interparticle interactions. This study investigates how grain surface modifications can be used to tune the dynamic response of granular materials, specifically their attenuation properties. Surface modifications are introduced via encapsulation of rigid particles in a soft silicone shell. The modulus contrast between the two materials spans several orders of magnitude. Three types of particles are tested: unmodified glass beads and glass beads with either two or four silicone applications, corresponding to different thickness of the shell. The dissipative behavior is quantified through the coefficient of restitution (COR). The COR is measured through tests in which a high-speed camera records individual particles as they free fall from a controlled height and collide with a steel block. The particle's position in each frame is used to calculate the COR in two ways: by comparing the maximum rebound height with the initial drop height and by comparing the velocity before and after impact. Preliminary results show that the application of the soft silicone shell leads to significantly higher energy dissipation compared to the original rigid particles. The differences in damping between the two types of silicone-encapsulated particles are not as evident. COR values from repeat tests on the same particle exhibit variability, suggesting irregularity in shell thickness. Overall, these results indicate a possibility to engineer particles to control their attenuation properties.

Keywords:

Attenuation; Coefficient of Restitution; Grain Surface Modifications

Mentor(s):

Luis Enrique Garzon Sabogal (Engineering); Maria Caterina Santagata (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1041

Presentation Time: Session 1: 9:00-10:00am

Retesting Elderly Drivers

Social Science

Authors(s):

Sofia Pilar Cox† (HHS)

Abstract:

The purpose of this research project is to determine whether or not elders should be required to be retested at a certain age to be able to have their driver's license renewed. Research will be gathered by acquiring data on the number of accidents due to elders driving, determining the effects of aging on elders, and finding alternative solutions that balance safety and avoid discrimination. Primary research will also be completed through a survey of Purdue students on whether or not elders should be required to retest. The findings will be used to determine the efficacy of retesting elders on the number of car crashes caused by elders, and suggestions will be made on alternative options for transportation for elders instead of driving themselves.

Keywords:

Elderly; Car Accidents; Aging; Safety

Mentor(s):

Catherine Jean Shukle (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1042

Presentation Time: Session 1: 9:00-10:00am

Impact of Arthrobacter Phage Genome Frameshift on Function and Protein Structure Prediction

STEM

Authors(s):

Therese Richelle Cunanan† (Agriculture|Engineering); Kyle Kai-Yuan Han† (Agriculture|Engineering); Sabrina Michelle Hardy† (Science|JMHC)

Abstract:

Bacteriophages are viral particles that infect specific bacteria, particularly, Arthro-bacteriophages target a genus of the phylum known as Arthobacter, frequently found in soil. This study aims to annotate the genome of Arthobacter phage Halloweekend to investigate its alterations due to frameshift and corresponding functional benefits. Halloweekend was sequenced in Pittsburgh Bacteriophage Institute with a genome length of 41876 bp. Computational tools were utilized, such as DNAMaster, Phamerator, AlphaFold 3, and PhagesDB, to study the region between called genes 11 and 16. By comparing Halloweekend to Gusanita and Nandita, two FF cluster phages, gene annotation revealed a frameshift in gene 17 and confirmed functions for genes 18 to 21. The frameshift mutation was functionally identified as tail assembly chaperones. In comparison to similar phages, a slipper sequence was identified as overlapping genes adjacent to the frameshift across phages. The frameshift is an insertion, adding a nucleic acid into the DNA, potentially changing genome transcription and its use as a template for protein formation. Protein prediction models, such as AlphaFold 3, can be implemented to demonstrate theoretical protein structures. By viewing its confidence metrics, such as pLDDT, it is possible to investigate the effect of protein structure formation caused by genome frameshift and increase our understanding of the purpose and effect of the advantageous mutation of the bacteriophage.

Keywords:

Bacteriophage; Arthrobacter Phage; Gene Annotation

Mentor(s):

Kari L Clase (Purdue University); Opeyemi Samuel Oduniyi (Agriculture)

Other Acknowledgement(s):

Julia Ann Simler (Agriculture); Marcelo Inaki I Guerrero Montalvan (Agriculture)

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Poster Presentation Abstract Number: 1043

Presentation Time: Session 1: 9:00-10:00am

Supervisor for Embedded Systems

STEM

Authors(s):

William Rowan Cunningham† (Engineering); Kathy Niu† (Engineering|JMHC)

Abstract:

Modern computers execute multiple processes at different privilege levels, introducing the need to keep processes isolated from each other. Memory virtualization provides protection and isolation of different processes, ensuring that they cannot interfere with each other or compromise the underlying system. The operating system (or supervisor) is responsible for managing these processes and providing a proper environment for their execution utilizing virtualized memory. The AFTx08 RISC-V embedded platform currently supports Machine mode (M-mode) and User mode (U-mode). The implementation of the RISC-V privileged specification's Supervisor mode (S-mode) introduces a secure middle layer between M-mode firmware, which interfaces between firmware and user-mode processes using virtual memory. The full S-mode specification is implemented in hardware, along with a supporting translation lookaside buffer (TLB) and page walker that performs two-level address translation. The S-mode software (OS) will be built on top of OpenSBI, an open-source implementation of the RISC-V Supervisor Binary Interface (SBI) specification that permits portability of OS's over a unified M-mode firmware layer. The project will produce a multitasking OS that will run on future iterations of the AFT processor with full S-mode implementation, including memory virtualization and execution-context switching for U-mode processes. We will run supervisor benchmarks in terms of memory overhead, counting TLB hits and misses, and other performance metrics to determine the effects of implementation on the overall performance of the AFTx08 platform.

Keywords:

Computer Architecture; Embedded Systems; Virtual Memory; Operating System; RISC-V

Mentor(s):

Cole Aaron Nelson (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

William Milne (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1044

Presentation Time: Session 1: 9:00-10:00am

Artificial Intelligence: Marine Maneuvering

STEM

Authors(s):

Sameeksha Sekhar Desai† (Science); Pranav Sanghi† (Science|Graduate); Liam M Mccormack† (Polytechnic); Steven James Van Hulle† (Science); Margulan Mukhametkarim† (Engineering); Ridge McCain Blankenship† (Engineering); Joseph Dominic D'Alessandro† (Engineering); Nicholas Keir Wade† (Science); Benjamin Harris Ciliberto† (Engineering); Jamie Youngjin Cho‡ (Science); Alexander T Valdes* (Engineering); Andrew Joseph Shelley* (Polytechnic); Alexander Kmetko* (Engineering); Atharva Shailendra Patil* (Polytechnic); Audrey L Williamson* (Polytechnic); Chun Yi Pham* (Polytechnic); Emily Marie Thomas* (Polytechnic); Jason Zheng* (Polytechnic)

Abstract:

Autonomous vehicles allow for multiple systems and operations to operate independently from human intervention. Applications for such autonomous vehicles include cars, trucks, and boats that serve purposes in a variety of different industries such as transportation, agriculture, and in the case of this project, defense. This study focuses on the design and development of an innovative autonomous boat focused on implementing advanced computer vision systems and autonomous navigation strategies. Through a synergy of emerging technologies and ingenious design, the Purdue University West Lafyette team aims to excel in the competition, addressing unique challenges in marine engineering and robotics. The development of this vessel is broken down into various subsystems that are all integrated together into a singular process. The team prioritized autonomous navigation and integration of computer vision for path planning. The system utilizes a Nvidia Jetson mini-PC for high-speed onboard data processing, enabling efficient, responsive decision-making. The YOLO-based object detection model, run on Jetson, is currently being trained on a diverse dataset of simulated and real-world maritime scenarios, encompassing conditions from calm coastal waters to open-sea environments. The long-range LiDAR sensor creates a SLAM (Simultaneous Localization and Mapping) based map and works in tandem with the Oak and Zed cameras to identify, detect, and avoid obstacles. The primary application of this research is for defense and homeland security, protecting the United States' coasts from potential threats like drug trafficking and maritime terrorism. An alternate application for this research could potentially be

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

innovations in public and private transportation as well as maritime transportation of goods.

Keywords:
Artificial Intelligence; Unmanned Vehicles; Autonomous; Computer Vision; Machine Learning

Mentor(s):
Brittany A Newell (Purdue University); Samuel Labi (Purdue University); Richard M Voyles (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1045

Presentation Time: Session 1: 9:00-10:00am

Lipidomic Analysis of Crocosphaera subtropica ATCC 51142 Under Diurnal Light-Dark Cycle and Nitrogen Conditions

STEM

Authors(s):

Aryaman Dewan† (Science); Priyanshu Datta Roy† (Agriculture|Engineering|JMHC); Malyka Ram‡ (Agriculture|Engineering); Rishabh Kottakota* (Science)

Abstract:

Crocosphaera subtropica ATCC 51142, a unicellular nitrogen-fixing cyanobacterium, adapts to diverse environments, making it a promising candidate for bioenergy production. Despite its lipid-rich cell wall's role in energy storage, membrane integrity, and stress response, its lipidome remains uncharacterized. This study uses untargeted lipidomics to examine how nutrient availability and diurnal light-dark cycles influence lipid metabolism.

C. subtropica cultures were grown under nitrogen-fixing and non-fixing conditions with a 12h light-dark cycle for two weeks. Cells were harvested 6h into both phases, and lipids were extracted using the Bligh and Dyer method. Untargeted liquid chromatography-tandem mass spectrometry (LC-MS/MS) identified lipid classes, including fatty acids, galactosyldiacylglycerols, sulfoquinovosyl diacylglycerol (SQDG), and phospholipids like phosphatidylglycerol (PG), on which we performed statistical analysis to understand the differences in lipid regulation under these conditions.

Galactosyldiacylglycerols such as monogalactosyldiacylglycerols (MGDG) and digalactosyldiacylglycerols (DGDG), along with SQDGs, are key components of photosystem I (PSI) and photosystem II (PSII). In plants, galactolipids are upregulated during nutrient starvation, such as phosphate deprivation. Our data suggests SQDGs are upregulated under nitrate-deficient conditions, whereas PGs are more abundant in nitrate-rich media.

We further aim to integrate lipidomic and proteomic data to uncover lipid regulatory mechanisms in C. subtropica. This knowledge will be instrumental in optimizing lipid production for biofuel applications, emphasizing lipid metabolism's role in renewable energy research.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Crocosphaera subtropica ATCC 51142; Bligh and Dyer; MGDG; DGDG; SQDG

Mentor(s):
Uma K Aryal (Purdue University); Punyatoya Panda (Vet Med)

Other Acknowledgement(s):
Rodrigo Mohallem Ferreira (Vet Med)

Poster Presentation Abstract Number: 1047

Presentation Time: Session 1: 9:00-10:00am

Optimization and Testing of Process Parameters for Void Reduction in Additive Manufacturing

STEM

Authors(s):

Rishipreet Singh Dhir† (Engineering); Rohan Jeyasothy† (Engineering); Sruthi Anil‡ (Engineering)

Abstract:

In large scale additive manufacturing applications, the formation of intra-bead voids is common within extrusion printing. These voids weaken the structural integrity of manufactured parts and decrease material strength properties of the material utilized to print. The underlying mechanisms driving void formation remain unclear, prompting this research to experimentally investigate its causes. The formation of intra-bead void formation was analyzed using a Composites Additive Manufacturing Research Instrument (CAMRI) and by experimentally varying four key process parameters: inlet pressure (400, 550, 700 psi), temperature profile (low, medium, high), flow rate profile (low, medium, high), and vacuum application (on/off). The experimental setup includes assessing void content in pellet form prior to extrusion, measuring density, mass, and volume of extruded parts, and employing microscopy and thermal imaging to quantify void content. Mechanical testing helps evaluate the effects of void formation. Throughout this experimental setup, correlations between process parameters and void formation were identified with the goal of providing insights to optimize manufacturing conditions with the goal of enhancing the structural characteristics of printing materials.

Keywords:

Void Content; Additive Manufacturing; Intra-Bead Voids; Vacuum Degassing; Mechanical Testing

Mentor(s):

Eduardo Barocio Vaca (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1048

Presentation Time: Session 1: 9:00-10:00am

CRISPR Nanocarriers: Developing a Novel Method of Genome Engineering Using DNA Nanocage-Based Delivery of EnAsCas12f and CRISPR Associated Components

STEM

Authors(s):

Michael Stuart Dickinson† (Science); Eric Tate Vasser† (Agriculture|Engineering)

Abstract:

Traditional mammalian genome editing methods present significant challenges, relying on complex and time-consuming transfection methods such as electroporation and chemical pre-treatment. DNA nanotechnology presents a potential solution to this problem. DNA nanocages—synthetic cube-like vessels composed of DNA strands—have been shown to act as channels for smaller, less complex biomolecules across the mammalian cell membrane. However, this technology has been primarily used to transport small compounds rather than large molecules like proteins or nucleic acids. In this study, we investigated the effectiveness of DNA nanocages in transporting modified, size-optimized proteins across the cell membrane while retaining their enzymatic function. To characterize whether modified proteins can be transported, we used 3G assembly to design and introduce DNA nanocages compatible with CRISPR-associated proteins into cell membranes. EnAsCas12f, a size-modified 422 amino acid protein being roughly one-third the length of SpCas9, was chosen for its compatibility with DNA nanocages. We will then introduce the enAsCas12f protein into the mammalian cell environment and measure for genome-editing activity. Successfully edited cells should exhibit a significantly lower target protein concentration than wild-type cells. These findings will support the efficacy of DNA nanocages as an effective alternative method of genome editing. With applications in biomedical health, synthetic biology, and the agricultural and food industries, the DNA nanocage-based CRISPR delivery system presents a versatile genome editing solution and a promising avenue for future research.

Keywords:

DNA Nanotechnology; Synthetic Biology; CRISPR; Genome Editing; Bioengineering

Mentor(s):

Leopold Noel Green (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Sang hoon Um (Engineering); Derrick Dankwa (Engineering)

Poster Presentation Abstract Number: 1049

Presentation Time: Session 1: 9:00-10:00am

Evaluating the Effectiveness of Transient Prioritization Algorithms for Follow-Up Observations in Modern All Sky Surveys

STEM

Authors(s):

Benjamin David Duttlinger† (Science); Elijah Scott Forbes† (Science); Michael Vic Paulson† (Science); Adina Ioana Margineantu† (Science)

Abstract:

The upcoming Vera C. Rubin Observatory is set to revolutionize time domain astronomy by discovering hundreds of thousands of supernovae per year, an order of magnitude increase over current surveys. However, Rubin's 3-day cadence across 6 filters will lead to sparce light curves that are insufficient for the robust characterization of the millions of transients it will discover. Due to our limited follow up resources, the vast majority of transients will not receive additional observations. The Recommender Engine for Intelligent Transient Tracking (REFITT) is a prototype recommendation engine operating on alerts from the Zwicky Transient Facility (ZTF) that aims to address the challenges that Rubin presents. REFITT works by forecasting the future evolution of transients and prioritizes them based on the given user's scientific objective. To improve REFITT, we developed a framework to evaluate how well REFITT prioritizes transients for a given scientific objective. To do this, we simulated a sample of Type Ia supernovae and developed a metric to prioritize transients near peak brightness as a toy recommendation objective. We applied our metric to the simulated supernovae and compared the prioritization to the true times of peak to measure its effectiveness. This work provides a framework for the development of future metrics and the evaluation of their effectiveness.

Keywords:

Supernova; Transients; Physics; Observatory; Astronomy

Mentor(s):

Braden Lee Garretson (Science); Danny Milisavljevic (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1050

Presentation Time: Session 1: 9:00-10:00am

Coniferyl alcohol rescues aberrant root development phenotypes of Arabidopsis lignin mutants

STEM

Authors(s):

Maren Michele Eaton† (Agriculture|JMHC); Claire Elizabeth Nowak‡ (Agriculture); Eleanore Margaret Malinowski‡ (Agriculture)

Abstract:

Lignin, an abundant structural polymer found in plant cell walls, plays a significant role in maintaining plant structural integrity at both macroscopic and microscopic levels, but presents challenges in industrial utilization of lignocellulosic materials. In Arabidopsis thaliana, mutation and overexpression of CINNAMYL ALCOHOL DEHYDROGENASE (CAD) and FERULATE 5-HYDROXYLASE (F5H), respectively, have been used to increase lignin degradability in crop plants. Although both strategies alone improve lignin characteristics, in combination they result in abnormal growth phenotypes. Interestingly, coniferyl alcohol and its dimeric coupling product, pinoresinol, rescue the aberrant root growth phenotypes in cadc cadd fah1-2 Arabidopsis in which F5H is overexpressed under the control of the CINNAMATE 4-HYDROXYLASE promoter. To study these phenotypes in greater detail, we have generated corresponding mutants carrying a dexamethasone-(DEX) inducible F5H transgene. In these lines, F5H induction resulted in multiple root growth abnormalities, including a change in main root length, lateral root density, and root hair shape. Coniferyl alcohol treatment partially rescued these phenotypes. To establish the optimal time to perform an RNAseq experiment aimed at identifying genes proximally responsible for these phenotypes, we performed a time-course experiment with DEX-treated seedlings. F5H induction led to predictable changes in soluble phenylpropanoid metabolism within a few hours, suggesting the biochemical changes that lead to growth abnormalities in these plants occur rapidly. These results support the hypothesis that coniferyl alcohol plays an important, but not yet fully understood, role in Arabidopsis thaliana root development, and provide the necessary information for the planning of future RNAseq experiments.

Keywords:

Lignin; Coniferyl Alcohol; Growth; Lateral Roots

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Clint C S Chapple (Purdue University)

Other Acknowledgement(s):
Lizhi Cheng (Agriculture); Zhiwei Luo (Agriculture); Chase Taylor Hearn (Interdisciplinary & Special Programs); Fabiola Muro-Villanueva (Purdue University)

Poster Presentation Abstract Number: 1051

Presentation Time: Session 1: 9:00-10:00am

Service Dogs for Military Veterans with PTSD: Research Design and Initial Data Collection for a Randomized Clinical Trial

STEM

Authors(s):

Shawna Lynn Edmiston† (Agriculture|JMHC)

Abstract:

According to the US Department of Veterans Affairs, at least 7 out of 100 veterans develop post-traumatic stress disorder (PTSD). While preliminary scientific evidence suggests benefits for veterans' PTSD symptoms when accompanied by a service dog, stronger evidence from more rigorous methodology is needed to fully substantiate these findings. The purpose of this randomized trial is to compare symptomology and well-being among veterans with PTSD who receive a service dog (treatment group) or continue usual care while on the waitlist for a service dog (control group). The research design includes assessments performed in two-week intervals at 0, 3, 6, 9, 12, and 15 months through a series of data collection methods, including blinded clinician assessments of PTSD, standardized surveys, ecological momentary assessments (EMA), biological sample collection to monitor stress levels from both humans and service dogs, activity and sleep monitoring through a wearable wristband, and canine behavioral assessments. Data collection for this clinical trial began in October 2023 and is projected to continue until March 2027. To date, we have enrolled 109 veterans out of our target goal of 150, with 4 veterans having completed the entire 15-month study protocol. Findings from this research aim to further understand the clinical impacts of human-animal partnerships for veterans with PTSD and may increase support through funding for veterans seeking service dogs as part of their PTSD treatment, potentially improving both their lives and the lives of their families.

Keywords:

[no keywords provided]

Mentor(s):

Clare Jensen (University of Arizona); Maggie O'Haire (University of Arizona)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1052

Presentation Time: Session 1: 9:00-10:00am

Bracket Bias: Predicting NCAA March Madness Outcomes and the Influence of Fan Loyalty

Business Case Study

Authors(s):

Kyle Steven Emgenbroich† (DSB); Kaitlin Rose Otto† (DSB); Ishita Tripathy† (DSB); Vaibhavi Chamiraju† (DSB)

Abstract:

Every March, millions of basketball fans attempt to predict the NCAA Division I Men's Basketball Championship winners by filling out tournament brackets. This study aims to develop predictive models for the final two rounds of the 2024 tournament while analyzing how school loyalty influences fan selections, potentially leading to biased predictions. By applying statistical and machine learning techniques, we expect to quantify the extent of fan bias in bracket selections and provide insights into how personal affiliations impact predictive accuracy.

This research utilizes three key datasets: (1) First, one that contains historical user-submitted brackets and features related to selection patterns; (2) Second, a test set requiring final-round predictions based on prior selections; and (3) Third, a dataset which provides school identifiers to analyze affinity relationships. Predictive models are trained to evaluate how historical seeding, win-loss records, and geographic proximity influence bracket choices, identifying patterns in fan behavior and selection bias.

Preliminary findings suggest that fans consistently overpredict their teams' success, leading to deviations from optimal bracket strategies. Understanding these biases has practical implications for NCAA engagement strategies, sportsbook modeling, and sports marketing efforts. By identifying how cognitive biases shape sports predictions, this research provides valuable insights for refining bracket challenge scoring systems, improving fan engagement, and informing media coverage strategies. Ultimately, this study bridges data analytics, behavioral psychology, and sports fandom, offering a deeper understanding of how personal loyalty influences decision-making in competitive contexts.

Keywords:

Predictive Analytics; Machine Learning; Sports Analytics; Cognitive Bias; Decision-Making

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1053

Presentation Time: Session 1: 9:00-10:00am

Mid-Air Autonomous Battery Exchange System

STEM

Authors(s):

Victor Ionut Ene† (Engineering); Clifford Walter Gamble‡ (Engineering); Abhishek Kini‡ (Engineering); Jamie Chanadol Henson‡ (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Drone; Battery-Swap; Autonomy; Controls; Electronics

Mentor(s):

Ran Dai (Purdue University); Yooseung Choi (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1054

Presentation Time: Session 1: 9:00-10:00am

Examining Inflammatory Outcomes in Macrophage Cells Exposed to Specialized Pro-Resolving Mediators Bound to Carbon Black Nanoparticles

STEM

Authors(s):

Jacob Randy Eyster† (HHS|JMHC)

Abstract:

Throughout the human body, inflammation occurs in response to various injurious stimuli, including physical trauma, infection, and toxicant exposure. During this process, cellular signals released from the site of injury recruit the body's innate immune system to address the affected change in tissue; this constitutes the inflammatory response. Once the area has been appropriately repaired, the body leverages additional signaling pathways--including those involving Specialized Pro-Resolving Mediators (SPMs), typically produced by the body's own cells--that end the inflammatory response at the site. This study examines whether a similar reduction in inflammation can be achieved upon introducing additional SPMs into a cellular site. In this investigation, a macrophage cell line was exposed to one of two common SPMs, Maresin 1 or Resolvin D1, delivered via carbon black nanoparticles (CBNPs). CBNPs, an engineered nanomaterial commonly found in printer ink and rubber, offer an intriguing potential for delivery due to their small size, uniform characteristics and low levels of cellular toxicity at low concentrations; during this project, SPMs were bound to CBNPs, and these nanoparticles were delivered to macrophage cells. Cells were subsequently evaluated for dose- and time-dependent changes in toxicity (cell survival) and the expression of Interleukin-10, a common cellular signal for inflammatory resolution typically produced by SPMs. Preliminary data indicates that CBNPs offer an effective delivery method; studies involving IL-10 expression are underway. If IL-10 levels increase, this pilot study could establish the foundation for a potential therapeutic intervention to address sustained, localized inflammation.

Keywords:

Nanoparticle; Inflammation; Nanotoxicology; Immunology; Interleukin

Mentor(s):

Jonathan Shannahan (Purdue University); Arjun Pitchai (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1056

Presentation Time: Session 1: 9:00-10:00am

How can a Python-based application with a user-friendly interface and remote computation capabilities enhance the efficiency, accessibility, and scalability of calculating acoustic indices for ecologi

STEM

Authors(s):

Ryan M Feller† (Science|JMHC)

Abstract:

Sound analysis is a vital tool for ecologists seeking to assess biodiversity and environmental health. A meta analysis found a moderately positive correlation between acoustic indices and the overall biological diversity of an environment. Traditional approaches to compute and analyze acoustic indices may rely on inefficient practices that involve coding knowledge, and adjustments to differing audio parameters (ie., R, configuration files). Recent technology has improved the interface options for ecologists with the development of Kaleidoscope Pro, ecoSound-web, and others, but these tools often have either a broad focus, can lack an open-source model, have expensive licensing terms, or are very technical. To help undergraduate students, conservation managers, and concerned stakeholders, this work seeks to identify the utility of an open-source, single use-case Python app to aid researchers in optimizing the workflow for calculating acoustic indices. Here, we show how a GUI based settings interface, a tool to create custom graphs, and the option to offload computation onto a user-provided server can increase efficiency, accessibility, and scalability for ecological work.

Keywords:

Ecology; Computing

Mentor(s):

Kristen Marie Bellisario (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1057

Presentation Time: Session 1: 9:00-10:00am

Evaluating the Effect of the Location of Type III Secretion System Genes on Agrobacterium-Mediated Transformation Efficiency

STEM

Authors(s):

Elizaveta Filippova† (Agriculture|Engineering)

Abstract:

Agrobacterium tumefaciens naturally transfers DNA to plants and is commonly used to create transgenic plants. However, many crop species are difficult to transform by Agrobacterium because of poor plant regeneration after infection and strong plant defenses against the bacterium. To tackle this, a Pseudomonas type III secretion system (T3SS) can be introduced into Agrobacterium to deliver proteins into the plant to improve plant susceptibility. An Agrobacterium strain carrying the T3SS genes on a plasmid can be used to improve transformation efficiency of Arabidopsis by Agrobacterium. However, the use of this plasmid relies on antibiotic selection, which complicates using this strain. An Agrobacterium strain carrying T3SS genes on the chromosome might be a more practical alternative as it does not require antibiotic selection for the T3SS plasmid, although its low copy number might negatively affect transformation. Thus, the transformation efficiencies of the chromosome-based and the plasmid-based T3SS Agrobacterium strains were compared to identify the strain best suited for transformation. In this study, Agrobacterium-mediated transformation experiments were conducted on Arabidopsis using these two strains to deliver an anti-defense protein AvrPto and a plant histone protein tHTA1, both of which were previously shown to improve transformation when present in the plant cell. Initial results confirm that the plasmid-based Agrobacterium strain improves transformation efficiency compared to various control strains that lack either the T3SS genes or the protein cDNA. In addition, the chromosome-based strain performs at a level comparable to the plasmid-based strain. Further experiments will be conducted to validate these findings.

Keywords:

Genetic Engineering; Agrobacterium; Transformation; Arabidopsis; Transgenic Plants

Mentor(s):

Stanton B Gelvin (Purdue University); Lan-Ying Lee (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1058

Presentation Time: Session 1: 9:00-10:00am

Pregnant and Waiting: The Alarming Delays in Indiana's Prenatal Care System

Social Science

Authors(s):

Alexandra Sophia Finlayson† (HHS)

Abstract:

Background: Prenatal care (PNC) is most effective when it is initiated early and is continued consistently, but in Indiana, 15.5% of births are to women receiving inadequate care, with an additional 5.3% receiving only intermediate care. This study will explore the experiences of pregnant Indiana residents locating a PNC provider in early pregnancy and their experiences with, and reflections on, care.

Methods: We conducted in-depth interviews with 26 Indiana women who were pregnant between 2018 and 2023 to learn about their experiences with the healthcare system. We discussed barriers and facilitators to accessing PNC and birth care. We audio-recorded the interviews, transcribed them, and we are in the process of carrying out content and thematic analysis.

Preliminary results: Most of our participants had desired pregnancies and identified their pregnancy early. They reported attempting to initiate PNC as soon as they confirmed their pregnancy with an at-home test but faced wait times of several weeks for an initial appointment. When participants experienced complications with their pregnancy, those who had not established PNC reported greater distress and confusion about what to do.

Discussion: This study highlights significant delays and barriers that pregnant people in Indiana face when seeking PNC. These delays reflect broader systematic issues, such as a shortage of PNC providers and difficulties in navigating healthcare systems which may disproportionately affect low-income, rural, or uninsured women. As we continue analysis, these findings will help us better understand barriers to seeking PNC.

Keywords:

Prenatal Care; Pregnancy; Health Outcomes; Barriers; Healthcare

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Kathryn Jean LaRoche (Purdue University)

Other Acknowledgement(s):
Scotty Secrist (Purdue University)

Poster Presentation Abstract Number: 1059

Presentation Time: Session 1: 9:00-10:00am

Sublethal Impacts of Bio-Ex ECOPOL A 3%, a Fluorine-Free Foam Alternative, on American Bullfrog Larvae (Lithobates catesbeianus) activity.

STEM

Authors(s):

Jonathan Lester Flinn† (Science|JMHC)

Abstract:

Aqueous film-forming foams (AFFF) are an effective tool in the suppression of liquid-based

fires but raise concerns due to most formulations containing per- and polyfluoroalkyl substances

(PFAS), a group of toxic chemicals impacting both wildlife and public health. This has led to the

development of fluorine-free foam (F3) alternatives to be used in place of their PFAS-containing counterparts. Previous studies have shown that F3 alternatives can be more acutely toxic to various aquatic species, but little is known on how these foams may alter behavior. To explore this, we exposed American Bullfrog larvae (Lithobates catesbeianus) to two sublethal concentrations of Bio-Ex ECOPOL A 3% F3 (ECOPOL) over a three-week period, with activity levels measured every two days throughout the study. Tadpole activity was assessed using a repeated measures ANOVA. While activity significantly changed over time ($P < 0.001$), neither of the ECOPOL concentrations significantly altered tadpole activity over the three-week period ($P = 0.451$). Interestingly, there was a trend of increased activity at the highest ECOPOL concentration. These findings suggest that while F3 alternatives can be more acutely toxic to aquatic life, at sublethal concentrations they do not alter activity levels. These results serve as an important starting point in understanding how F3 alternatives may alter the ecology and behavior of aquatic species. Given that the use of F3 alternatives will increase over time, it will be important for future research to continue examining their potential effects on the ecology of other aquatic species to inform ecological risk assessments.

Keywords:

Behavioral Toxicology; PFAS; AFFF; Fluorine-Free Foam; Tadpoles

Mentor(s):
Jason T Hoverman (Purdue University)

Other Acknowledgement(s):
Olivia Ann Biasetti (Agriculture); Hannah Casey McNeese (Purdue University)

Poster Presentation Abstract Number: 1060

Presentation Time: Session 1: 9:00-10:00am

Design and Implementation of a 2.4 GHz Local Oscillator for Energy-Efficient Wi-Fi RF Receivers in Low-Power Applications

STEM

Authors(s):

Manuel Ashraf Melad Gad† (Engineering); Kerollos Ehab Matta Yanny† (Engineering)

Abstract:

The work presented here focuses on the design and implementation of a high-performance single-band local oscillator operating at 2.4 GHz for an energy-efficient Wi-Fi RF receiver, targeting low-power applications such as mobile phones and IoT devices. The local oscillator is a critical component in the direct conversion architecture chosen for its simplicity and low power consumption. The design aims to achieve low phase noise, high frequency stability, and minimal power consumption, ensuring compatibility with the receiver's overall performance targets, including a gain of 54 dB and a noise figure between 2.1 and 4.4 dB. Key challenges include minimizing noise to reduce signal degradation, optimizing power efficiency, and ensuring stable and accurate frequency generation at 2.4 GHz. The design process involves simulations, performance analysis, and layout design to validate the LO's performance. By delivering a high-performance single-band local oscillator, we aim to further enhance the reliability and energy efficiency of wireless communication systems, seeking the state-of-the-art in RF technology for low-power devices operating in the 2.4 GHz band.

Keywords:

RF Receiver Design; Local Oscillator; Low-Power Applications; Wireless Communication

Mentor(s):

Archana Dharanipragada (Engineering); Seyedehmarzieh Rouhani (Engineering); Mark Johnson (Purdue University); Swapnil Bansal (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1061

Presentation Time: Session 1: 9:00-10:00am

Community health workers in supporting lung cancer screening in the United States: A systematic review

STEM

Authors(s):

Rebecca Gao† (HHS); Ruchi Rajesh Patel‡ (HHS); Tricia Isabel Sy‡ (HHS); Lourdes Olivia Bengero‡ (HHS|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Haocen Wang (Purdue University)

Other Acknowledgement(s):

Valentina Santoyo-Angulo (HHS); Andrea M Hayes (Purdue University)

Poster Presentation Abstract Number: 1062

Presentation Time: Session 1: 9:00-10:00am

Microscale 3D Printing using Volumetric and Holography Methods

STEM

Authors(s):

Anika Siya Garg† (Engineering|JMHC)

Abstract:

For context, through my research under Professor Liang Pan in the School of Mechanical Engineering, I am continuing to develop an advanced algorithm that replicates microscale lithography using volumetric and holographic methods. The general question of my research is how to create a fast, efficient, and inexpensive formation of three-dimensional holographic microstructures via lithography methods and programming softwares. My work combines concepts like the sigmoid function, convolution theory, and topology optimization to enhance the precision and efficiency of 3D printing via laser manipulation. By applying these mathematical theories, my aim of the project is to discover strategies to reduce energy consumption and overall error during the lithography process. So far, over the year 2024 to 2025 I have been utilizing python to support and process analytical methods like dose map approach to eventually study the effects and intensity distribution of a 3D Gaussian beam. Furthermore, the analytical methods I have analyzed include integrating convolution filtering, adjoint methods, and topology optimization to refine the system's characteristics. My research is still on-going so no concrete results have been found as of yet. Additionally, I hope to further advance general 3D printing techniques in order to improve potential applications like medical-related printing and rapid micro-prototyping.

Keywords:

3D Printing; Python Based; Microscale Technology; Holography Methods; Laser Manipulation

Mentor(s):

Liang Pan (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1063

Presentation Time: Session 1: 9:00-10:00am

Forecasting Nike's 2025 Earnings: A Data-Driven Approach

Business Case Study

Authors(s):

Aditya Ghorpade† (DSB); Shreem Bhavesh Amin† (DSB); Ronak Bhagia† (DSB); Gabriel E Calleja Sanchez† (DSB); Jayanth Madhava Kurup† (DSB)

Abstract:

This project investigates whether Nike's 2025 earnings will exceed or fall short of projections by at least 3%, using consumer spending trends, corporate governance indicators, and macroeconomic variables. The clearly defined research question underscores the significance of accurately forecasting Nike's financial performance, given its influential role in signaling broader market and consumer behavior trends. Accurate forecasts will enable Nike to optimize critical strategic decisions, such as marketing investments, pricing strategies, and potential market expansions.

The study integrates multiple comprehensive datasets, including Nike's historical financial statements, consumer spending metrics, corporate governance assessments, and key macroeconomic indicators such as GDP growth, inflation rates, unemployment figures, stock market trends, and competitor financial data. Rigorous data preparation processes were applied, encompassing thorough cleaning, data standardization, and extensive feature engineering, particularly targeting revenue trajectories, quarterly growth variations, and stock price dynamics.

Exploratory Data Analysis highlights Nike's post-pandemic revenue growth, earnings fluctuations due to macroeconomic shifts, and its strong digital sales presence. Stock analysis reveals periods of volatility influenced by economic cycles and company events. Challenges such as missing data, overfitting, and model complexity will be addressed using imputation techniques, cross-validation, and feature selection. The project aims to create a strong forecasting framework that supports Nike's financial strategy and enhances competitive positioning in the industry.

To ensure robust predictive performance, Multinomial Logistic Regression was selected for its proven efficacy in multi-outcome classification scenarios and its adeptness at handling feature interdependencies. Alternative modeling approaches, including Naïve

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Bayes and K-Nearest Neighbors (KNN), are identified as contingency methods to address potential issues with data sparsity or computational limitations. Model evaluation will be meticulously conducted using F1-score and log-loss metrics to guarantee precision and reliability. Ultimately, the project delivers a comprehensive, data-driven forecasting framework designed to inform Nike's strategic financial decisions and strengthen its competitive position within the dynamic sportswear industry.

Keywords:
Forecasting; Earnings; Modeling; Strategy; Macroeconomics

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1064

Presentation Time: Session 1: 9:00-10:00am

Simulated Annealing for CMS Primary Vertexing demonstrates promise of Quantum Annealing

STEM

Authors(s):

Ishan Goel† (Science)

Abstract:

Primary vertexing at the CERN CMS experiment is a crucial clustering task in which the locations of proton-proton collisions in each event are determined. The current standard, deterministic annealing, is robust at current complexities, but may struggle with scalability and convergence as LHC undergoes luminosity upgrades. We introduce a simulated annealing based algorithm that solves primary vertexing's clustering challenge embedded as a Quadratic Unconstrained Binary Optimization (QUBO) problem. A key element of our approach is the implementation of a clustering-specific neighbor function that guarantees constraint satisfaction and induces a convex energy landscape, allowing for zero-temperature annealing and rapid convergence to low energy solutions. Benchmarking our algorithm, which we call SA*, against the state-of-the-art deterministic annealing method shows that at realistic event sizes (65 vertices, each with 30 tracks), SA* achieves comparable performance as measured by the Adjusted Rand Index, and significant improvements as measured by the QUBO energy metric. Crucially, the QUBO formulation opens the door to implementation on quantum annealers, which are physical analogs of simulated annealers with annealing times never exceeding a millisecond. A rapid solution time for the primary vertexing task at CMS can result in significant compute budget gains for later analysis-relevant tasks in the LHC event processing pipeline - roughly a 10% saving. Our work thus not only opens a path to a classical algorithm that offers better convergence at future collider complexities but also demonstrates the promise of quantum annealing for the primary vertexing task.

Keywords:

Simulated Annealing; CMS; Primary Vertexing; Quantum Annealing; Particle Collider

Mentor(s):

Andrew James Wildridge (Science); Andy Jung (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1065

Presentation Time: Session 1: 9:00-10:00am

Predicting The Functions of Hypothetical Proteins Using Pymol and Alphafold

STEM

Authors(s):

Bhoomika Kumar Gowda† (Agriculture|Engineering); AJ DiAndreth† (Agriculture|Engineering|JMHC); Milena Campos Prada† (Agriculture|Engineering)

Abstract:

The functional roles of hypothetical proteins in bacteriophages remain largely uncharacterized despite their prevalence in phage genomes. Aligning hypothetical proteins with known proteins can predict their potential functions. Using bioinformatics tools to predict their functions can contribute to the growing knowledge of phage biology, particularly in areas such as host interactions and potential biotechnological applications. The structures of hypothetical proteins were compared to the genomic structure of the gene with the established protein function to determine whether they were similar. HHPred results of hypothetical proteins were analyzed to choose the established functions and the structures were created using Alphafold. The structures were then compared using PyMol. PyMol results with similar alignments suggested that hypothetical proteins had the same function as the established protein function structure due to their genomic similarities. The existing knowledge of phage genomes can be expanded upon by determining the functions of hypothetical proteins, and this information can be used to develop phage therapies for different infections and diseases. Deciphering protein functions unveils their roles within the organism, a crucial aspect in designing phage therapies and formulating phage cocktails.

Keywords:

[no keywords provided]

Mentor(s):

Kari L Clase (Purdue University); Opeyemi Samuel Oduniyi (Agriculture)

Other Acknowledgement(s):

Julia Ann Simler (Agriculture); Marcelo Inaki I Guerrero Montalvan (Agriculture)

Poster Presentation Abstract Number: 1066

Presentation Time: Session 1: 9:00-10:00am

"Enhancing Purdue Grand Prix Training Through Racing Simulation: A Virtual Approach to Karting Performance"

STEM

Authors(s):

Giancarlo Sean Guccione† (Polytechnic); Anthony Tan† (Science)

Abstract:

Purdue Grand Prix is a collegiate racing event in which drivers have traditionally relied on extensive on-track training. Professional motorsport training is increasingly incorporating simulation training with motion-based simulators, force feedback steering wheels, and advanced physics engines. The research in this study intends to create a virtual training alternative in which a digital model of the Purdue Grand Prix track will be implemented in a premier go-karting simulator, Kart Racing Pro. The research will investigate whether training on a virtual track actually improves lap time, consistency, as well as race readiness. This project will involve designing a highly accurate 3D model of the Purdue Grand Prix track in 3Ds Max. It will then be exported into Kart Racing Pro. The kart physics will be calibrated from technical data from a variety of grand-prix drivers and engineers, in order to achieve authentic handling. Interviews will also be conducted to gather information on training methods as well as drivers' histories with simulative tools. Lap time comparison (simulation versus reality) will be referenced to determine virtual training success. Drivers will be more consistent and familiar with tracks because they have utilized the simulator. On-track training can be reduced. Successful development can produce a scalable and reliable training technique that can be shared with future participants. The research also explores opportunities in terms of making available a licensed form that can be shared with multiple teams. The research is innovative in that it utilizes professional training methods at a collegiate level in kart racing.

Keywords:

[no keywords provided]

Mentor(s):

Michael Douglas Johnson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1067

Presentation Time: Session 1: 9:00-10:00am

Engineering Materials for Thermal Transport of Semiconductor Packaging

STEM

Authors(s):

Vikash Gunalan† (Engineering)

Abstract:

As artificial intelligence applications expand, the demand for efficient thermal management in data centers is growing. Traditional air-cooling methods struggle with heat dissipation, leading to increased energy consumption, sustainability concerns, and reduced equipment lifespan. Immersion cooling, where electronic components are submerged in dielectric fluids for direct heat transfer, has emerged as a promising alternative. However, its effects on the reliability of Thermal Interface Materials (TIMs), which facilitate heat transfer between components, remain underexplored.

This research focuses on designing a testing rig to evaluate the impact of immersion fluids on the reliability of TIMs. We utilized steady-state thermal analysis through ANSYS simulations to validate our proof-of-concept, ensuring consistency with theoretical calculations. Additionally, we employed SolidWorks to develop technical drawings and 3D models for prototyping. The testing rig would be used to assess the thermal degradation of TIMs across power cycling environments and would help in understanding their reliability. This research contributes to optimizing thermal management strategies, improving energy efficiency, and extending the lifespan of data center hardware.

Keywords:

Artificial Intelligence; Thermal Interface Materials (TIMs); Thermal Management; Data Centers; Energy Efficiency

Mentor(s):

Ritwik Vijaykumar Kulkarni (Engineering); Amy M Marconnet (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1068

Presentation Time: Session 1: 9:00-10:00am

Purdue Aerial Robotics Team - R&D Avionics

STEM

Authors(s):

Doha Bahaa Eldin Hafez† (Engineering); Arsanious Waseem Kamel Boushra† (Engineering); Vikram J Checka† (DSB); Stephen Michael Tushentsov† (Engineering); Madison Marie Statler† (Engineering); Soren Christophe Turner† (Engineering); Seungho Han‡ (Engineering); Alexander Sau Hang Ching‡ (Engineering)

Abstract:

The goal of this project is to better understand the unique avionics challenges that are faced when designing a VTOL (vertical take-off and landing) aircraft. As the Avionics sub-team in the R&D Division of Purdue Aerial Robotics Team (PART), the team intends to develop a viable VTOL system to be used on future aircrafts for the Competition division of PART.

Last year, the aircraft was not flying, so the team prioritized thrust when designing the V2 aircraft. However, this caused less endurance, leading the team to begin developing a component optimization model utilizing an optimizer developed by professor Scott D. Sudhoff called Genetic Optimization System Engineering Toolbox (GOSET). This optimizer was integrated with mathematical functions and component databases to return the optimal combination of avionic components.

AUGUST (Autonomous Unmanned Guided Uplift and Safe Transport) is a wireless-controlled winch and payload system designed for precise payload deployment from Unmanned Aerial Vehicles. It consists of a winch controller PCB, a payload mechanism PCB, and supporting electronics interfaced with a Pixhawk flight controller. The winch motor, controlled by the parent system, manages payload descent and retrieval, while the child system ensures stability and executes the drop. The use of PCBs minimizes the UAV's weight, enhancing performance and reducing operational constraints.

Through these developments, the team is helping the Competition Avionics team develop a more consistent VTOL system which will help them perform better in future competitions. Furthermore, through further testing, the team can determine the reliability of these developments to assess efficiency.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
VTOL Aircraft; PCB; UAV; Optimization

Mentor(s):
Niall Patrick Moloney (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1069

Presentation Time: Session 1: 9:00-10:00am

The Boilermaker Food Security Project: Multidimensional Analysis of Campus Food Experiences

Social Science

Authors(s):

Juniper Rodriguez† (Liberal Arts); Jarren Haggard‡ (Liberal Arts)

Abstract:

A 2021 report by Foster Success and the Indiana Commission for Higher Education highlighted the lack of "high-quality data on the prevalence of student food and housing insecurity" at universities across Indiana. Despite widespread food insecurity among U.S. college students, driven by high education costs, rising living expenses, and limited employment opportunities, comprehensive data remains scarce. At Purdue's West Lafayette campus, this study, in collaboration with ACE Food Pantry, draws on multimodal data to explore the economic and social barriers students face. We are sharing preliminary findings to guide interventions and inform policies aimed at improving student food security.

Keywords:

Food Security; Anthropology

Mentor(s):

Sarah Renkert (Purdue University)

Other Acknowledgement(s):

Yifeng Hu (Liberal Arts)

Poster Presentation Abstract Number: 1070

Presentation Time: Session 1: 9:00-10:00am

Elements of Art: pXRF Testing and Exhibition of Purdue

Humanities

Authors(s):

Jarren Haggard† (Liberal Arts)

Abstract:

In 2005, Betsy Scheuring donated what would become known as the Scheuring Icon Collection to Purdue Galleries' permanent collection. Beginning in spring 2023, a revitalized attempt at researching this rich collection was made. Through interdisciplinary efforts across Purdue's West Lafayette campus and beyond, a wealth of knowledge has been produced, deepening our understanding of cultural, material, and spatial aspects of the Scheuring Icon Collection.

This presentation centers around the portable x-ray fluorescence (pXRF) spectrometry analysis done on Purdue's icon collection, and how it fits into Purdue Galleries' latest display of these works. pXRF research provided results regarding the elemental composition of the icons' metal aspects, allowing conclusions to be drawn about the different alloys present.

Keywords:

Orthodox Iconography; Portable X-Ray Fluorescence Spectroscopy (Pxrf); Art History; Museum Studies

Mentor(s):

Harold Kory Cooper (Purdue University); Kirstin Marie Gotway (Purdue University); Lana J Newhart-Kellen (Purdue University)

Other Acknowledgement(s):

Mikayla Klemp (Purdue University); Amelia Markert (Purdue University)

Poster Presentation Abstract Number: 1071

Presentation Time: Session 1: 9:00-10:00am

The Sound of Blood Meal: Exploring the Acoustic Preferences of a Frog-Biting Mosquito

STEM

Authors(s):

Nina Rose Hall† (Science|JMHC)

Abstract:

Female mosquitoes use multiple sensory cues to localize their hosts and obtain blood meal for egg production. Depending on the species, they exhibit varying host preferences, feeding on humans, mammals, birds, reptiles, or amphibians. While the majority of mosquitoes feeding on endothermic hosts such as humans use various cues including smell, heat production, and visual cues, other mosquitoes use auditory cues to feed on ectothermic hosts like frogs. These frog-biting mosquitoes localize their hosts by detecting species-specific mating calls. In this study, we investigate the host-seeking behavior of Uranotaenia lowii, a mosquito species specialized in feeding on frogs. We hypothesized that attractive acoustic features of frog calls influence the acoustic preferences of mosquitoes. To test this hypothesis, we acoustically characterized the calls of six frog species that vary in their evolutionary history with these mosquitoes and investigated the relative attractiveness of their calls by performing experiments that study the movement of the mosquitoes in response to sound. This work broadens our understanding of how invasive species may change species interaction dynamics, therefore, paving the way for studying the fitness consequences of these blood meals on this mosquito species and contributing valuable insights into the host-seeking strategies and understanding of the sensory information that mosquitoes use to locate ectothermic hosts.

Keywords:

Bioacoustics; Ecology; Eavesdropping; Uranotaenia lowii; Frogs

Mentor(s):

Ximena Bernal (Purdue University); Richa Singh (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1072

Presentation Time: Session 1: 9:00-10:00am

Enhancing Brand Recognition and Market Positioning Case Study: The Studio at Miracles Fitness

Business Case Study

Authors(s):

Chloe Grace Hardesty† (DSB); Grace E Bedka† (DSB); Whitley Claire Judd† (DSB); Max Jatin Arnold† (DSB); William Charles Young† (DSB)

Abstract:

The Studio at Miracles Fitness, a reformer Pilates studio in West Lafayette, faces challenges in building publicity and attracting new clients due to limited brand recognition. This research seeks to identify the studio's target market, analyze local competition, and develop an effective marketing strategy to strengthen its presence within the community. The central research question guiding this study is: How can The Studio at Miracles Fitness effectively identify its target market and differentiate itself within the competitive local fitness industry?

To address this question, our study employs a mixed-method approach, including a demographic analysis to determine promising customer segments based on age, gender, income level, and fitness goals. Data will be gathered through primary and secondary sources, including surveys. Additionally, a competitive analysis will assess other fitness studios in the area that offer similar services, such as Pilates, yoga, and general fitness programs.

Expected outcomes include a clearer understanding of The Studio's market position, an actionable marketing strategy to increase brand awareness, and insights into differentiation opportunities within the local fitness landscape. These findings will offer strategic recommendations to enhance visibility and attract a broader clientele, ultimately fostering business growth.

Keywords:

Marketing Research; Consumer Behavior; Competitive Analysis

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1073

Presentation Time: Session 1: 9:00-10:00am

How Lifestyle Factors Impact Physical and Mental Symptoms

STEM

Authors(s):

Payton Victoria Harrington† (HHS); Renee Nicole Chua† (HHS|JMHC)

Abstract:

This study explores the relationships between various lifestyle factors including diet, physical activity, and the use of e-cigarettes and their effects on mental and physical symptoms. Information on dietary habits, physical activity, and e-cigarette use was collected using a Qualtrics questionnaire. Individuals who maintained a balanced diet consisting of vegetables, fruits, protein, healthy fats, and grains as well as consistent exercise exhibited fewer unhealthy coping mechanisms such as the use of e-cigarettes, sedentary lifestyles, and poorer food choices. This contributes to the management of symptoms such as fatigue, headaches, anxiety, depression, irritability, and several others. Unhealthy coping mechanisms, such as e-cigarette use, were associated with an increase in severity of certain mental and physical symptoms. With the increasing prevalence of a sedentary lifestyle and poor diets, it has become even more important to adopt healthy coping mechanisms and prioritize overall physical and mental well-being. Our research aims to highlight the importance of maintaining a healthy lifestyle and bring awareness to certain trends to prevent these symptoms and advocate for healthy coping strategies. Further research is needed to explore mental and physical symptoms; however, in general, a balanced diet, consistent moderate to vigorous exercise, and a reduction in stress correlates to enhancing overall health.

Keywords:

[no keywords provided]

Mentor(s):

Mark Wilson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1074

Presentation Time: Session 1: 9:00-10:00am

Cloning and Characterizing a GH43 Enzyme from Bacteriodes for Arabinoxylan Degradation

STEM

Authors(s):

Yara Zaidoun Hijaz† (Science|JMHC)

Abstract:

A major hemicellulose component of plant cell walls, known as arabinoxylan, is a key dietary fiber that influences gut microbiota composition and metabolism. A 7-day sequential fecal fermentation experiment was conducted to investigate microbial communities capable of fermenting sorghum arabinoxylan. This process led to an enriched microbial consortium. Metagenomic analysis showed a high abundance of Glycoside Hydrolase family 43 (GH43) genes. These findings suggest that GH43 enzymes play a significant role in arabinoxylan degradation. GH43 enzymes break down arabinoxylans by targeting their xylan backbone. They also target the arabinose side chains, cleaving arabinoxylan into oligosaccharides containing xylose and arabinose. To better understand GH43 enzyme function, we will first PCR-amplify the GH43 gene from pooled Bacteroides DNA. The amplified gene will then be inserted into a plasmid using Gibson Assembly. After cloning, then our construct will be transformed into Escherichia coli BL21(DE3) under an IPTG-inducible T7 promoter system. After expression, the expressed GH43 protein will be purified and tested for activity on arabinoxylan substrates. Enzymatic assays will help determine its substrate specificity and cleavage patterns. Understanding these enzymatic interactions can help us better understand dietary fiber metabolism and gut microbiota dynamics. Future applications include developing designer prebiotics to support gut health. This research may also aid individuals with IBS and IBD by utilizing GH43 enzymes to selectively cleave specific parts of arabinoxylan, breaking it down into more digestible fragments. Additionally, optimizing commercial enzymatic processes for carbohydrate degradation could have industrial applications.

Keywords:

Gene Cloning; Polysaccharides; Gut Microbes; GH43 Enzyme

Mentor(s):

Stephen R Lindemann (Purdue University); Anurag Rajendra Pujari (Agriculture)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1075

Presentation Time: Session 1: 9:00-10:00am

Novel Superabsorbent Polymers for Concrete 3D Printing

STEM

Authors(s):

Daniel Steele Hiller† (Engineering|JMHC)

Abstract:

This study investigates the potential benefits of novel superabsorbent polymers (SAPs) for use as an internal curing agent in concrete 3-D printing. The novel SAPs utilize 3-(trimethoxysilyl) propylmethacrylate (TPM) to integrate more effectively into the cement matrix while maintaining a swelling capacity sufficient to aid internal curing. Three variations of novel SAPs were synthesized and compared in testing to a commercially available reference SAP. Swelling kinetics of the SAPs were measured with gravimetric swelling tests. Mortar samples were prepared and tested for compression and tensile strength at 2, 7, and 28 days. Novel SAP samples exhibited increased compressive and tensile strength compared to the reference SAP. Autogenous shrinkage tests demonstrated the novel SAP's ability to mitigate autogenous shrinkage, though less than the reference SAP. Scanning electron microscopy was performed on 7-day samples showing better integration of the novel SAPs into the cement matrix.

Keywords:

Superabsorbent Polymers; Concrete; 3D Printing

Mentor(s):

Kendra A Erk (Purdue University); Akul Seshadri (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1076

Presentation Time: Session 1: 9:00-10:00am

The impact of different types of high-fat diet on energy consumption, weight gain, and hypothalamic inflammation in male and female rats

STEM

Authors(s):

Natalie Chyrystine Hoffman† (HHS); Linnaea Eileen Krupke* (HHS)

Abstract:

Obesity is a continuing health concern in the United States, which is attributable to myriad factors, including increased availability and consumption diets high in fat content. In a Western Diet, the offset ratio of long chain triglycerides (LCT) to medium chain triglycerides (MCT), may impact feeding behaviors along with hypothalamic inflammation, playing a role in the development and maintenance of obesity. Shifting the composition of a HFD from LCT's to MCT's has been shown to reduce energy intake and body weight gain. Most of the research in this area has done on male subjects to study the impact of HFD, limiting evaluation of HFD impact in females. To address this gap, 38 male and female rats were fed one of three different diets for 8 weeks: (1) an MCT-rich HFD, with added coconut oil, (2) an LCT-rich HFD with added palm oil, or (3) a control group fed laboratory chow. Overall, there was a significant difference between the control groups and the HFDs for both males and females in body weight change, energy intake, and body fat % change. We also observed differences in hypothalamic inflammation between groups, indicating that inflammation may impact feeding behaviors. Males in the HFD groups experienced more impactful changes in body weight, energy intake, and body fat than the female HFD groups. To conclude, high fat diets affect males more than females, but the type of fat may not play a role. We have analyzed brain tissue for microglia to observe how these diets influence neural inflammation.

Keywords:

Hypothalamic Inflammation; High Fat Diet; Sex Differences

Mentor(s):

Brent Benjamin Bachman (HHS); Kimberly Kinzig (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1077

Presentation Time: Session 1: 9:00-10:00am

High throughput testing for ductility and hydrogen embrittlement

STEM

Authors(s):

Gwendolyn E Hofman† (Engineering|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

David Bahr (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1078

Presentation Time: Session 1: 9:00-10:00am

How telemedicine platforms can be leveraged to improve mental health accessibility and outcomes for teens and young adults in rural areas

Social Science

Authors(s):

Reetika Ranjeet Hogade† (Engineering|JMHC)

Abstract:

The purpose of this research is to investigate how emerging technologies, such as GenAI-powered telemedicine platforms, can improve mental health care accessibility and outcomes for teens and young adults in rural areas. Access to mental health care in these areas has been a long time challenge due to provider shortages, stigma, and technological limitations. With the rise of telemedicine, digital mental health platforms have emerged as a potential solution. This study uses a mix of methods, incorporating an analysis of electronic and print sources, as well as interviews and surveys to assess the barriers and benefits of telemedicine. Preliminary findings suggest that online therapy platforms may help reduce stigma, as individuals are more likely to seek help when therapy is provided remotely, minimizing the fear of judgement with visiting a local clinic. However, concerns over the effectiveness of chatbots in delivering high quality care and limitations of broadband infrastructure in rural areas are challenges that still remain. While digital mental health platforms show promise, overcoming technological barriers is crucial. This research will explore strategies to improve internet accessibility, enhance the effectiveness of AI-driven mental health support, address privacy and security concerns, and increase trust and adoption among rural populations.

Keywords:

[no keywords provided]

Mentor(s):

Richard D Johnson (Purdue University); Thomas J Rickert (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1079

Presentation Time: Session 1: 9:00-10:00am

Development of Synodic Orbit Cycler Targeting the Trojan Asteroids of the Sun-Jupiter L4 Lagrange Point

STEM

Authors(s):

Jack William Hulbert† (Engineering); Shaun Nethan Artzi† (Engineering|JMHC); Matthew Robert Dillman† (Engineering|JMHC); Yanchen Liu† (Engineering); Adam David Rushdy‡ (Engineering|JMHC); Andrew Alberto Fontanetta‡ (Engineering); Truman Quincy Howerton‡ (Engineering); James Shim* (Engineering)

Abstract:

Mining Trojan asteroids offers a promising solution for accessing valuable resources such as metals that are essential for space exploration and industrial applications. However, establishing a stable and efficient transport route between Earth and a Trojan asteroid in the Lagrange points of the Sun-Jupiter dynamical system presents significant challenges in astrodynamics due to unfeasible delta V requirements and time of flight. A synodic cycler is proposed due to its ability to minimize delta V requirements by not utilizing a return maneuver, instead only requiring one initial interplanetary maneuver. The synodic cycler is developed utilizing a patched-conic approach to Lambert’s problem, which is a mathematical method to leverage Kepler's equation to generate a trajectory between two points given a time of flight. By evaluating all possible elliptical solutions, trajectories are selected to minimize delta V requirements while ensuring the orbit’s period is an integer multiple of one Earth solar year. This guarantees the spacecraft returns to Earth at the same position relative to the Sun, enabling a repeatable and predictable transfer architecture. Using this method to target L4, all possible transfer solutions were found to be highly elliptical. While this presents challenges, such as longer orbital periods or higher delta V requirements, these trajectories provide valuable opportunities for further optimization and offer key insights into the dynamics of synodic cycler solutions.

Keywords:

Astrodynamics; Orbital Mechanics; Aerospace Engineering; Control Engineering; Numerical Methods

Mentor(s):

Kenshiro Oguri (Purdue University); Paulo Ramirez (Engineering); Travis James Hastreiter (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1080

Presentation Time: Session 1: 9:00-10:00am

CVGM - Computer Vision and Generative Models

STEM

Authors(s):

Julianne Quin Iaccarino† (Engineering); Basil Khwaja† (Engineering); Ian Owen Ou† (Engineering); Ibrahim Issa Abdullah† (Engineering)

Abstract:

Text-to-image generative models, including diffusion models and Generative Adversarial Networks (GANs), have rapidly advanced in terms of technique, performance, and accuracy, with applications ranging from content creation to object detection in autonomous vehicles. However, with the abundance of existing models, identifying the most optimal one, especially in resource-constrained environments, remains challenging. To address this, we aim to develop the CVGM (Computer Vision and Generative Models) platform, a software-based benchmarking tool designed to evaluate the performance of various generative models on low-powered devices across key metrics. The platform will focus on evaluating the computational efficiency, scalability, and quality of generated outputs. Through the integration of tools like RT-DETR (Real-Time DEtection TRansformer) for assessing model accuracy in object detection, and visual transformers for evaluating artistic style classification, the system will comprehensively measure model performance, accuracy, and quality. In addition, we will implement another tool CMMD (CLIP Maximum Mean Discrepancy) to evaluate the quality of the images produced by the models with reference images. Finally, to evaluate performance, we will implement tracking of the overall execution time and resource usage. The platform calculates a weighted score for each model and provides detailed analysis, offering insights into model comparisons and actionable recommendations. We propose this platform as a means to evaluate the overall performance of generative models and provide insights into which models best suit user needs.

Keywords:

Computer Vision; Generative Models; Object Detection; CMMD; RT-DETR

Mentor(s):

Yung-Hsiang Lu (Purdue University); Monika Tomar (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1081

Presentation Time: Session 1: 9:00-10:00am

Developing a Collaborative Coding Framework for Onboarding Undergraduate Researchers

Social Science

Authors(s):

Naomi Elizabeth Islas† (Liberal Arts); Sarah Colleen Buwick† (Liberal Arts)

Abstract:

Interdisciplinary, collaborative research teams often work in distributed spaces using team communication platforms to meet, plan, and conduct research (Saldaña, 2016). Researchers working with Crow, the Corpus & Repository of Writing, have often analyzed data through collaborative and iterative coding methods (Smagorinsky, 2008).

In a previous study, we individually and collaboratively coded 68 threads from Basecamp, our team communication platform, to holistically examine how the Crow research team coordinates work (Buwick & Islas, 2024). This was the first phase of two investigating Constructive Distributed Work, our heuristic for sustainable collaboration. In the second phase, we coded an additional 163 threads to identify how interactions between researchers align with Crow's three core principles: fostering rhetorical confidence, developing a networked model of mentoring, and building a sustainable infrastructure (McMullin & Dilger, 2021).

Throughout both coding phases, we established a coding workflow to maximize the efficiency and quality of our codes. We are developing a written framework that documents this coding process so Crow can better onboard future researchers to coding, aligning with two of Crow's goals: (1) developing sustainable approaches to building interdisciplinary research teams; (2) cultivating writing research methods to share broadly (Banat et al, 2022). In this poster, we share the workflow and describe the next steps of its development, in the hopes our framework will be used by other academic research teams who analyze data through iterative coding methods.

Keywords:

Coding; Collaboration; Distributed Work; Onboarding; Research Teams

Mentor(s):

Bradley Dilger (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1082

Presentation Time: Session 1: 9:00-10:00am

Development and Exploration of Existing 5G and 6G Standards

STEM

Authors(s):

Rohan R Iyer† (Engineering); Andrew Owen Fewell† (Engineering); Aaron David Slamovich† (Engineering); Raghav Aggarwal† (Science); Justin Yunzhi Lin† (Polytechnic)

Abstract:

The 6G standard is in early development and more engineers are needed in assisting the transition away from 5G to 6G systems. The goal of our research is twofold, to look into fundamental concepts that help make up the already existing 5G standard and research new ideas to assist in the development of the 6G standard. The focuses we have chosen for this semester are as follows: Carrier Synchronization, Orthogonal Frequency-Division Multiplexing (OFDM), Integrated Sensing and Communication, and Universal Software Radio Peripheral (USRP). Our carrier synchronization team has designed and simulated how to synchronize the phase and timing of signals sent between the transmitter and receiver. The OFDM team has simulated and designed an OFDM algorithm to solve the problem of frequency selective fading and how OFDM uses cyclic prefix to prevent intersymbol interference. The ISAC research group researched the uses of position reference signals and sounding reference signals, and how it can be used to sense objects using the communication band. The USRP team researched using a software defined radio to use radar frequency bands for communication. Future work for our teams is to explore topics like error correcting codes, MIMO space time codes, and frame recovery.

Keywords:

OFDM; Carrier Synchronization; ISAC; USRP; 5G

Mentor(s):

Chih-Chun Wang (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1083

Presentation Time: Session 1: 9:00-10:00am

Strategies for Implementation of Microelectronics in Engineering Education

STEM

Authors(s):

Camille Leigh Johnson† (Polytechnic)

Abstract:

This study investigates the impact of student engagement using microelectronics within engineering education, specifically in the First-Year Engineering (FYE) curriculum. Using Social Cognitive Career Theory (SCCT), data was collected through 18 semi-structured interviews. These results were interpreted using codes with SCCT as the main guideline for each interview. Results indicate that students taking the course's interest and persistence regarding microelectronics either increased or remained consistent throughout the course. Prior experiences with microelectronics and programming influenced how students navigated the course. A team-based format of the course leads to increased and decreased engagement based on students' prior experiences and the general dynamic of their teams. However, students approached the course with varying levels of knowledge about microelectronics. This shaped the perception of their persistence and interest. This study highlights the potential microelectronic interventions have to create engaging learning opportunities and foster the future engineering workforce.

Keywords:

Microelectronics; Engineering Design; First-Year Engineering; Hands-On

Mentor(s):

Jason Wade Morphew (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1084

Presentation Time: Session 1: 9:00-10:00am

Evaluating AI's Ability to Detect Literary Symbolism

STEM

Authors(s):

Mert Karabulut† (Science)

Abstract:

Artificial intelligence has made significant progress in natural language processing, yet its ability to interpret abstract literary concepts remains uncertain. While AI can identify patterns and structures, research shows it struggles with figurative language, metaphorical reasoning, and implicit meaning. Studies suggest that AI relies on statistical associations rather than genuine comprehension, often misinterpreting non-literal expressions and failing to distinguish deeper meaning from memorization. These challenges raise questions about whether AI can analyze literature beyond surface-level recognition or if it merely replicates learned correlations.

This study examines whether AI can recognize symbolism in literature without relying on prior interpretations. It builds on existing research in computational linguistics and literary analysis to explore the limitations of AI in detecting abstract meaning. By evaluating how AI processes figurative language, this research provides insight into whether current models can infer symbolic meaning or if their analysis remains bound to statistical patterns. The findings will contribute to discussions on AI's role in literary studies, its potential as an analytical tool, and its constraints in replicating human interpretation.

Keywords:

Artificial Intelligence; Literary Symbolism; Literary Analysis; Natural Language Processing; Figurative Language

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1085

Presentation Time: Session 1: 9:00-10:00am

Methods of investigation into the xylem sap microbiome of Ralstonia solanacearum resistant and susceptible tomato species.

STEM

Authors(s):

Colin Francis Kelly† (Science|JMHC); Olivia Anne Walker‡ (Agriculture|JMHC)

Abstract:

The soil-borne bacterial pathogen Ralstonia solanacearum has been detrimental to over 250 plant species and is the causal agent in Bacteria Wilt Disease (BWD). In the United States, BWD has led to around one billion USD loss annually in agriculturally significant crops. One such crop, tomato, is especially vulnerable to this disease with the rise of global temperatures. The focus of this project is to address the knowledge gaps regarding the xylem microbiome of four tomato species: Hawaii7996 (H7996), CastleMart (CM), CRA66, and L390 which vary in their pathogenic response to Ralstonia colonization. This will be accomplished through a series of experiments on focal points of interest (i) the microbes present in the xylem sap of the tomatoes (ii) genotypic differences in species (iii) defense mechanisms for the resistant species and (iv) whether sap toxicity, a physical barrier, or the combination thereof result in the resistant species ability to be invaded and yet not become diseased. This project's end goal is to form a synthetic community (SynCom) of microbes that are capable of protecting the tomato system to overcome different abiotic and biotic stress. If this is completed, then SynCom usage for other agricultural crops in the face of climate changes' rising effects on host-pathogen interactions will be viable and successful for future developments.

Keywords:

Xylem Sap; Microbes; Ralstonia; Resistance; Agriculture

Mentor(s):

Sana Anum Mohammad (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1086

Presentation Time: Session 1: 9:00-10:00am

The Diversity of Saprotrophic Fungi Degrading Environmental and Anthropogenic Substrates

STEM

Authors(s):

Samantha Nicole Kessel† (Agriculture)

Abstract:

This study explores how saprotrophic fungi break down natural substrates, such as chitin, pollen, straw, and leaves, as well as various types of plastics. We hypothesize that different fungal species have distinct capabilities to degrade specific substrates, including a range of polymers associated with commercial plastics. To test our hypotheses, we will examine the diversity of fungal species present in association with these substrates in a controlled setting. Using culture-dependent methods, we will isolate fungi from buried substrates and identify them through barcoding at the Internal Transcribed Spacer Region. Additionally, we will create phylogenetic reconstructions to determine if there is a phylogenetic signal correlated with the ability to degrade various compounds. While our current focus is on identifying fungal diversity and their association with different plastics, we acknowledge that functional testing of the degradation capabilities is essential for understanding the enzymatic processes involved. By emphasizing the role of fungi in ecological recycling processes, our findings may provide important insights for bioremediation efforts targeting natural, industrial, and plastic waste. This research aims to advance knowledge of microbial community ecology and its potential applications in environmental sustainability.

Keywords:

Plastics; Straw; Chitin; Pollen

Mentor(s):

Daniel B Raudabaugh (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1087

Presentation Time: Session 1: 9:00-10:00am

The impact of colostrum versus milk replacer feeding on the morphological development and proliferation of cells in the small intestine of neonatal piglets

STEM

Authors(s):

Ellie Grace Ketcham† (Agriculture|JMHC); Yuchen Zhang‡ (DSB|JMHC)

Abstract:

As the first milk, colostrum is a rich source of nutrition and bioactive factors for piglets immediately after birth. Low consumption of colostrum links to lower growth efficiency and leaner body mass at maturity. The objective of this study was to determine if bioactive or nutritive factors of colostrum differentially impacted small intestinal development of female neonatal piglets. We hypothesized that piglets who consumed a high versus low level of colostrum (COL) or milk replacer (MR) would exhibit greater development of the villi and higher rates of cellular proliferation. Neonatal gilt piglets (n=57) received COL or MR at 20% or 10% of birth body weight (BBW) for 24 hours before euthanasia. Controls stayed on the sow for ad libitum intake of colostrum or were euthanized immediately. Jejunum was excised, fixed, paraffin embedded, cross sectioned, mounted, and stained with H&E or Ki67. Images were captured using light microscopy at 200x, and ImageJ deconvolution analysis measured percent area of proliferation in Ki67 slides. Villus length, width, stromal area, and epithelial area, and crypt depth of H&E stained tissue were measured using ImageJ. COL versus MR increased villus width, epithelial area, lamina propria proliferation, and deep lamina propria proliferation while decreasing crypt depth ($P<.05$). Dose of 20% BBW versus 10% BBW increased villus length, width, area, and proliferation of lamina propria and deep lamina propria. Levels of both nutritive and bioactive factors regulate development of the small intestine in the first 24 h postnatal.

Keywords:

Colostrum; Small Intestine; Morphology

Mentor(s):

Theresa M Anderson (Purdue University); Linda Marie Beckett (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1088

Presentation Time: Session 1: 9:00-10:00am

DDR4 DRAM Controller Design for Accelerated Matrix Processor

STEM

Authors(s):

Dhruv Roopchand Khatri† (Engineering); Tri Than† (Engineering)

Abstract:

Dynamic Random Access Memory (DRAM), more commonly referred to as main memory, is a type of memory commonly used in computers and other devices for storing data that needs to be accessed quickly and frequently. In contrast, file-based storage systems such as SSDs have significantly higher access latency (~1000x slower) than DRAM, making them less ideal for tasks that require rapid data access. Hence, this project focuses on the design and implementation of a DRAM controller for the DDR4 protocol, a widely used standard for memory systems. In the initial phase, we aim to develop a minimal controller that supports the fundamental operations of DDR4 memory, such as read, write, and refresh commands. The controller will be designed with an emphasis on correctness and reliability. In the subsequent phase, we will optimize the controller for integration with the Accelerated Matrix Processor, aiming to improve memory access performance for AI workloads. To validate the functionality of our design, we will compare it against a DDR4 simulation module to ensure adherence to standard DDR4 behavior and timing constraint. The project will lay the groundwork for optimizing memory systems in high-performance computing, particularly for AI applications.

Keywords:

Memory Controller; DDR4; DRAM

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering); Malcolm Lloyd Seib McClymont (Engineering); Timothy Francis Hein (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1089

Presentation Time: Session 1: 9:00-10:00am

Altering Affect and Emotional Reactivity Through Exercise and Mindfulness

Social Science

Authors(s):

Wojciech Jan Kielbus† (Science|JMHC)

Abstract:

PURPOSE: While previous research explored how aerobic exercise (AE) enhances positive emotional reactivity and how mindfulness (MF) reduces negative emotional reactivity, their combined effects remain unknown. This study introduces a novel mindful-aerobic exercise (MF-AE), comparing its effects on emotional reactivity and self-reported affect to traditional AE.

METHODS: Twenty-nine adults (22.1±2.2yr, 15 males) completed 30-minute sessions of MF-AE (moderate-intensity treadmill-walking [70% max heart rate] with mindful audio for guided attention), AE (moderate-intensity treadmill-walking with a health-related podcast), and RE (sitting with a health-related podcast) in counterbalanced order on three separate days. Affect was assessed via the Feeling Scale (FS) pre- and post-session. Following each session, participants completed the State Mindfulness Scale for Physical Activity (SMS-PA) and a passive picture-viewing task during electroencephalogram recording to measure late positive potential (LPP) elicited by pleasant, neutral, and unpleasant images.

RESULTS: SMS-PA body-domain scores following AE and MF-AE were higher than RE, with MF-AE scoring higher than AE ($ts>3.1$, $ps<0.013$, $ds>0.57$). MF-AE showed higher SMS-PA mind-domain scores ($t=2.2$, $p=0.002$, $d=0.72$) and posttest FS ($t=4.5$, $p<0.001$, $d=0.83$) than RE. While analysis on negative (unpleasant minus neutral LLP) and positive (pleasant minus neutral LPP) emotional reactivity showed no between-condition difference, negative emotional reactivity was greater than positive emotional reactivity following AE and RE ($ts>2.82$, $ps<0.009$, $ds>0.52$) but not MF-AE ($t=0.32$, $p=0.746$, $d=0.06$).

CONCLUSION: While AE and MF-AE induce body-domain mindfulness and similar enjoyment levels, integrating mindfulness into exercise via guided attentional instructions induces greater increases in mind and body mindfulness, positive feelings, and more stable emotional reactivity.

Keywords:
Aerobic Exercise; Guided Attention; Event-Related Potential; Feeling; Emotion

Mentor(s):
Shih-chun Kao (Purdue University); Salim Ibrahim Onbasi (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1090

Presentation Time: Session 1: 9:00-10:00am

Impact of a RAGE antagonist on tendon biomechanical properties in a mouse model of type 2 diabetes

STEM

Authors(s):

Joshua Dongjin Kim† (HHS)

Abstract:

Disruption of tendon extracellular matrix homeostasis and altered biomechanical properties result in substantial clinical challenges for millions of individuals with diabetes. Compounding the problem, improving blood glucose levels does not normalize tendon properties in those with diabetes. Advanced glycation end-products (AGEs) accumulate in the serum of individuals with diabetes via hyperglycemia, the intake of AGE-rich foods, and diminished kidney AGE clearance. We hypothesized that serum AGEs and activation of RAGE represent a mechanism underlying impaired tendon properties with diabetes.

Nineteen db/db mice, a mouse model of type 2 diabetes, with naturally elevated serum AGEs and impaired tendon function, were treated daily with a RAGE antagonist [Azeliragon (AZ), n=9] or vehicle (n=10) for three weeks. Structural and material properties were calculated from the ramp-to-failure. Stiffness and modulus were calculated from the linear portion of the load-displacement and stress-strain curves, respectively.

For the db/db experiments, vehicle and AZ treatment groups were compared using a Mann-Whitney test. Values were considered significant at an ? level of $p<0.05$. All data are expressed as mean ± SE and analyzed using Prism 9.5.1 (GraphPad). Patellar tendon stiffness and modulus were greater ($p<0.05$) in mice receiving AZ (stiffness: 9.6±1.2 N/mm, modulus: 78.2±8.2 MPa) compared to vehicle (5.8±0.9 N/mm, modulus: 49.0±8.3 MPa).

While additional work is needed to define the role of RAGE in regulating tendon properties, our preliminary results provide a premise for detailed mechanistic studies and the framework to evaluate therapeutic approaches to prevent tendon complications in people with diabetes with RAGE inhibition.

Keywords:

Tendon; Diabetes; Advanced Glycation End-Products (AGEs); RAGE

Mentor(s):
Chad C Carroll (Purdue University)

Other Acknowledgement(s):
Harrison Michael Cottingham (HHS); Dylan Cole Easley (Purdue University); Gordon Carl Smilanich (HHS); Eric Gutierrez (HHS)

Poster Presentation Abstract Number: 1091

Presentation Time: Session 1: 9:00-10:00am

A Scoping Review of Patient-Centered Communication in Healthcare: an International Comparison of Curriculum and Recommendations

Social Science

Authors(s):

Riley Ann Knudsen† (Engineering|JMHC)

Abstract:

Communication in healthcare is essential but often overlooked. Studies have shown that doctors' ability to communicate diagnoses and prognoses effectively plays a crucial role in patient care, influencing treatment outcomes and patient satisfaction. However, communication skills are not always explicitly taught in medical schools or routinely trained in hospitals. This paper aims to answer the question: How can international approaches to health communication and diplomacy incite the development of curriculum adjustments in U.S. healthcare that better prepare healthcare professionals to communicate effectively?

This research examines the integration of communication training into medical education in different countries. Through a comparative content analysis of medical curricula, training programs, and healthcare policies in more than seven countries, it explores how different educational approaches shape the way healthcare professionals communicate. The study also considers the role of information dissemination, digital health resources, and information literacy in strengthening doctor-patient interactions.

Findings suggest that incorporating structured communication training can improve patient comprehension and trust while fostering more equitable healthcare systems. More than half of the countries included in this paper found that workshops on communication and health literacy in the medical field improved treatment outcomes. There is also evidence that points to a need for better efforts toward global health diplomacy and improved consistency and delivery concerning doctor-patient conversations and doctor-doctor consultations.

Beyond clinical interactions, this study contributes to broader discussions on health information diplomacy by examining how effective communication builds trust, improves transparency, and promotes more equitable healthcare systems.

Keywords:
Healthcare Communication; Information Studies; Medical Education; Information Literacy; Health Diplomacy

Mentor(s):
Bethany McGowan (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1092

Presentation Time: Session 1: 9:00-10:00am

Dietary Fibers and the Gut: A Functional Approach to Microbiome Assessment

STEM

Authors(s):

Norah Riley Kopolow† (Science)

Abstract:

Gut microbiomes are vital to our overall health and wellness, with community dysbiosis being directly related to issues such as IBD and even colorectal cancer. Daily gut function is supported by dietary fibers, which gut microbiota utilize to maintain a healthy community. Vast differences between gut communities of different individuals make expensive genetic sequencing and diagnostic testing challenging to interpret. In contrast, focusing on overall community function may prove to be advantageous. Due to the heavy influence dietary fibers have on gut microbiota, in vitro fermentation responses can be used to understand community function and their relationships with fibers. Fermentation kinetics (changes in pH and gas) were measured using in vitro fermentation of arabinoxylan, inulin, resistant maltodextrin, resistant starch, and wheat bran inoculated with fecal bacteria. Interindividual differences and differences between fermentations of dietary fibers between all individuals have been observed, with inulin generally being fermented quickly and arabinoxylan slowly in comparison to other substrates. In addition, fermentation of all substrates except for inulin generally decreased from week 0 to week 12 measurements. Data relating to fermentation kinetics of different dietary fibers could be used to assess the community composition and overall function of the gut, leading to more effective and efficient ways of treating dysbiosis.

Keywords:

Microbiome; In Vitro Fermentation; Dietary Fibers

Mentor(s):

Stephen R Lindemann (Purdue University)

Other Acknowledgement(s):

Adam Robert Quinn (Agriculture)

Poster Presentation Abstract Number: 1093

Presentation Time: Session 1: 9:00-10:00am

Assessing Lead Levels in Human Bone with Portable XRF Technology

STEM

Authors(s):

Grace Ann Kowis† (HHS)

Abstract:

This study investigates the role of cumulative metal exposure in neurodegeneration among an elderly population, focusing on Alzheimer's disease (AD). Using a portable X-ray fluorescence (XRF) device, metal concentrations in skull bones from 110 elderly donors, including AD patients, were measured. Each bone was non-invasively scanned for 12 minutes, and the data were processed using MATLAB software to analyze metal concentrations, particularly lead (Pb). Comparisons were made between bone Pb concentrations across different APOE genotypes and sexes. The study also examined the association between bone Pb levels and cognitive diagnosis, as well as neuropathological status. The findings suggest that bone lead accumulation may be linked to cognitive deterioration and neuropathological alterations, highlighting the potential impact of environmental toxins on neurodegenerative diseases.

Keywords:

Lead (Pb); Bone; XRF Technology; Alzheimer; Neurodegeneration

Mentor(s):

Linda Nie (Purdue University); Catherine Jean Shukle (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1094

Presentation Time: Session 1: 9:00-10:00am

Accelerated Matrix Processor - Convolution Acceleration Architecture

STEM

Authors(s):

Saandiya KPS Mohan† (Engineering); Vinay Pundith* (Engineering); Charles James Wagner* (Engineering)

Abstract:

The AFTx07, a RISC-V processor developed by SoCET (system-on-chip extension technologies), features an in-progress Accelerated Matrix Processor (AMP) specifically focused on offloading matrix multiplication tasks from the CPU. Efficient data management is crucial for optimizing the performance of AMP, particularly in convolutional neural networks (CNNs), where memory bandwidth can become a bottleneck. Traditional approaches to handling convolution operations, such as image-to-column transformation (im2col), require large memory footprints and frequent off-chip memory accesses, leading to increased latency and power consumption. To address this, we explore strategies for optimizing data reuse and memory locality by designing a buffer that efficiently handles im2col operations, ensuring a continuous data supply to the AMP's compute units while minimizing redundant memory operations. Our approach focuses on structuring data flow and storage mechanisms to maximize locality and reduce bandwidth consumption, enabling efficient reuse of overlapping data in convolution operations without unnecessary reloads. This reduces the reliance on expensive DRAM transactions and improves overall hardware utilization. We implement this strategy in SystemVerilog, integrating it with our AMP architecture (systolic array). This work highlights the importance of optimized memory access patterns in hardware accelerators, providing a foundation for existing and future optimizations.

Keywords:

Data Reuse; AI Hardware; Systolic Array; Im2Col; Locality

Mentor(s):

Malcolm Lloyd Seib McClymont (Engineering); Mark Johnson (Purdue University); Anand Raghunathan (Purdue University); Fan Jing Hoon (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1095

Presentation Time: Session 1: 9:00-10:00am

Predicting GDP Growth: Using Data - Driven Insights to Uncover Economic Trends

Business Case Study

Authors(s):

Anisa Krvavac† (DSB); Adam Taesoo Bae† (DSB); Ian Spencer Lutz† (DSB); Jacob Matthew Embleton† (DSB); Alex Lukowiecki Caridi† (DSB)

Abstract:

Our project uses historical macroeconomic data to forecast GDP growth rates for multiple countries. Accurately predicting GDP growth is crucial as it facilitates informed decision-making for businesses and policymakers seeking to navigate complex economic systems, mitigate financial risks, promote business development, and maintain long-term economic stability. The research question explicitly addressed is: Which macroeconomic indicators most significantly influence GDP growth rates across diverse national economies? To explore this question thoroughly, we sourced comprehensive and current macroeconomic data from the World Bank database. The data preprocessing involves rigorous missing value imputation, outlier detection and correction, and data normalization procedures to ensure robust and high-quality analysis. To enhance the predictive strength of our model, we employ advanced feature engineering techniques, including the creation of lag features, economic ratios, and polynomial transformations. Our analytical framework utilizes both Multiple Linear Regression and Decision Trees to identify and quantify the impact of significant socioeconomic indicators on GDP growth. We evaluate the performance and accuracy of our predictive models using established metrics such as Root Mean Squared Error (RMSE), R-Squared, and Mean Absolute Error (MAE), ensuring precise and reliable interpretations of our findings. Our findings highlight critical relationships between GDP growth and key macroeconomic indicators, including inflation rate, Foreign Direct Investment (FDI), government expenditure, and trade balance. By uncovering these fundamental relationships, we provide actionable insights into factors driving economic expansion and contraction, thereby offering valuable guidance for future economic forecasting endeavors. Ultimately, this project underscores the profound relevance of data-driven decision-making in economics and finance. Through the refinement of predictive methodologies and the thoughtful selection of relevant data sources, our work significantly contributes to scholarly understanding and practical

application in global economic policy formulation and investment strategy planning.

Keywords:
Economic Forecasting; Data Analysis; Predictive Analytics

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1096

Presentation Time: Session 1: 9:00-10:00am

Variable Bragg x-ray beam splitters

STEM

Authors(s):

Madeline Zofia Kwasniewski† (Science); Brijesh B Patel* (Science)

Abstract:

Beam splitters are currently utilized in a variety of advanced x-ray instruments and will be essential for extending quantum optics techniques to x-rays. A new fabrication method has produced thinned Bragg diffracting silicon devices with variable reflectivity and transmission coefficients and negligible absorption losses. Diffraction measurements confirm that the silicon continues to exhibit perfect crystal diffraction even for thicknesses below two microns. Devices are machined from standard wafers, with the thinned regions contained within a robust frame of unperturbed crystal for ease of handling.

Keywords:

Quantum Optics; X-Ray Interferometry; Silicon Fabrication

Mentor(s):

Stephen M Durbin (Purdue University)

Other Acknowledgement(s):

Liam Thomas Powers (Science)

Poster Presentation Abstract Number: 1097

Presentation Time: Session 1: 9:00-10:00am

APPS: Style Transfer

STEM

Authors(s):

Bhavya Lakhina† (DSB|JMHC); Kathleen Elane O'Sullivan† (Engineering|JMHC); Gavin Noel Hendrix† (Engineering)

Abstract:

This VIP focuses on developing an Android App that enables a user to perform image style transfer, taking the artistic style from one image and modifying another to match that style. The user will have the ability to either upload images from their camera or camera roll, or choose from a selection of images with particular artistic styles optimized for performance. The project aims to create a flexible model that can be applied to images of any category and any size.

Our work builds on the neural style transfer approach introduced by Gatys et al., utilizing convolutional neural networks (CNNs) to extract and manipulate feature representations. Specifically, we optimize a loss function that balances content preservation and style adaptation by utilizing feature maps from a pre-trained network. We have implemented an initial shallow CNN model and are actively expanding this to incorporate the 16-layer VGG network to improve style fidelity and image quality.

Beyond model development, we have created an Android app with preliminary functionality, allowing users to select content and style images. Our ongoing work focuses on integrating the full model into the mobile application while optimizing performance for real-time inference. Future efforts will involve enhancing computational efficiency, improving user interactivity, and refining model generalization across diverse image styles.

Keywords:

Neural Style Transfer; CNN; Optimization; Android App

Mentor(s):

Carla Zoltowski (Purdue University); Fengqing Zhu (Purdue University); Soudabeh Taghian Dinani (Purdue University); Edward J Delp (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1098

Presentation Time: Session 1: 9:00-10:00am

How pasture-raised laying hens impact the abundance of surrounding wildlife in Northwestern Indiana

STEM

Authors(s):

Claire Elizabeth Lang† (Science)

Abstract:

Less than 10 percent of all eggs produced in the United States come from laying hens raised in cage-free systems. However, increasing demands for ethically sourced eggs are upturning this trend and pushing industries to turn towards free-range, organic, and pasture-raised practices. Despite this effort, many poultry farmers still hesitate to change to an outdoor system due to concerns about predation and disease transmission from wildlife. The aim of this study is to assess the presence of wildlife around pasture-raised hens. Five trail cameras will be placed along the perimeter of a pasture fenced with movable solar powered electric netting that surrounds 3 mobile laying hen units with 300 chickens each at the Animal Science Research and Education Center (ASREC) to quantify and monitor wildlife movements around the poultry pasture. The cameras will be placed two weeks before hens are introduced to track wildlife prior to any effect of the hens and will remain through the life of the flock. This will allow us to evaluate the influence of pasture-raised hens on wildlife in the surrounding area. The data will be collected by browsing through images taken by the trail cameras and recording the species and the abundance of each species in each picture. By measuring the abundance of wildlife around the pasture-raised laying hens at the ASREC farm, we can measure the concern for predation and diseases to provide data to farmers considering moving to pastured egg production.

Keywords:

Laying Hen; Pasture; Wildlife; Trail Cameras; Movement

Mentor(s):

Darrin M Karcher (Purdue University); Sara Elizabeth Cloft (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1099

Presentation Time: Session 1: 9:00-10:00am

I2C Verification Using Universial Verification Methodology

STEM

Authors(s):

Bradley Reed Lawrence† (Engineering)

Abstract:

This project focus on applying Universal Verification Methodology (UVM) to verify an implementation of the I2C communication protocol created for use on SoCET's AFTx chipset. This project involved building a structured UVM test bench out of modular components. These components are then constrained and used to created random stimuli to simulate a wide variety of transactions the hardware could encounter. This automatic generation of stimuli allows more reliable verification of the I2C design and functionality. This project demonstrates the practical application and usability of industry standard verification techniques for projects of varying sizes as well as the inherent advantages of using UVM over traditional verification methods.

Keywords:

I2C; Universal Verification Methodology

Mentor(s):

Mark Johnson (Purdue University)

Other Acknowledgement(s):

Colin James Chambers (Engineering)

Poster Presentation Abstract Number: 1100

Presentation Time: Session 1: 9:00-10:00am

Analysis of Neutron-Induced Degradation in Commercial Optical Transceivers

STEM

Authors(s):

Jocelyn E Lee† (Engineering)

Abstract:

In the realm of space exploration, communication remains a top priority. With numerous experiments being performed in space, there needs to be reliable transmission of data to and from spacecraft. Optical transceivers have become a possible option for next generation space communication. However, radiation events such as galactic cosmic rays, solar flares, and trapped radiation can make technology unreliable to the point of failure. This research intends to explore the effects of a neutron environment on commercial optical transceivers to improve understanding of radiation-hardness for future space applications. Degradation will primarily be measured by the number of single event upsets(SEUs) in an optical transceiver. Using the Nuclear Engineering Department's Subcritical Pile, the optical transceiver will send data monitored for any discrepancies while exposed to neutron radiation. It is expected that, the longer the optical transceiver is exposed to the subrcritical pile, the greater the percentage of SEUs in transmitted data.

Keywords:

[no keywords provided]

Mentor(s):

Hannah Pike (Engineering)

Other Acknowledgement(s):

Peter Bermel (Purdue University); Stylianos Chatzidakis (Purdue University)

Poster Presentation Abstract Number: 1101

Presentation Time: Session 1: 9:00-10:00am

Forecasting Monthly Bag Distribution: Improving Delivery Efficiency Through Data

Business Case Study

Authors(s):

Josiah John Linnemann† (DSB)

Abstract:

The goal of this project is to predict the number of bags needed in a month by different foster placement agencies based on historical delivery data. This model will allow the nonprofit that packs and delivers the bags to optimize resource utilization, enabling them to refill their inventory around needs. This will allow the nonprofit to better serve its community, as this model will reduce the likelihood of the nonprofit running out of inventory needed to serve their community.

Exploratory data analysis identified several missing values in the dataset, which were handled by imputing zeros to support robust regression analysis. Additionally, a new variable, "days since the last delivery," was introduced, significantly enhancing the predictive capability of the initial models. These feature expansions and data imputations provide valuable additional information, improving the accuracy of predicting the number of bags delivered to each organization through supervised machine learning techniques, including linear regression, K-nearest neighbors, decision tree models, and smoothing splines.

Initial findings indicate that the most significant predictor is the days since the last delivery. Early predictive models also suggest that the delivery month isn't a significant predictor, but the agency receiving the delivery is a significant predictor. This project shows the impact predictive modeling can have on improving efficiency in nonprofit agencies. The tactics used in this project can be generalized to other business sectors and used to improve the efficiency of those businesses as well.

Keywords:

Data Analytics; Prediction Modeling; Forecasting; Non-Profit; Distribution

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1102

Presentation Time: Session 1: 9:00-10:00am

Law of large number of the maximal particle in a branching system of random walks in random environment

STEM

Authors(s):

Xiaoyu Liu‡ (Science|JMHC)

Abstract:

Branching random walks (BRWs) are a class of stochastic processes with rich structural properties and deep connections to physical phenomena such as diffusion and surface growth. By introducing random environments into this framework—resulting in branching random walks in random environments (BRWREs)—we model scenarios where particles experience spatially independent, location-based perturbations. This extension provides a more realistic representation of diffusion and surface growth processes in noisy or disordered settings. Although BRWs have been extensively studied, the BRWRE model remains relatively unexplored, with many fundamental properties still undetermined. In this work, we investigate the behavior of BRWREs, focusing on key aspects such as the limiting speed of the maximal particle and the overall limiting distribution of the process.

Keywords:

Random Walk in Random Environment; Large Deviations; Law of Large Number; Branching Random Walk; Probability

Mentor(s):

Jonathon R Peterson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1103

Presentation Time: Session 1: 9:00-10:00am

The Relationship Between Task-Irrelevant Variability and Sensorimotor Adaptation in Speech

STEM

Authors(s):

Justin Edward Logar† (HHS); Ashley Elaine Fissel† (HHS|JMHC)

Abstract:

Sensorimotor adaptation occurs when the sensorimotor system adjusts movements because sensory signals do not match the predicted motor outcomes. A prior arm-reaching study suggests that sensorimotor adaptation might be associated with task-irrelevant variability—movement variations that do not affect outcomes, like the various arm-joint motions producing identical trajectories of a tennis racket. According to the study, adaptation may operate through system identification (i.e., building dynamic systems models), where higher task-irrelevant variability reflects how the sensorimotor system actively maps its own dynamics, facilitating and enhancing adaptive behaviors. To date, however, this relationship remains untested in speech production.

To address this gap, we recruited fifteen adult participants to repeat "talk," "tech," and "tuck" in a pseudo-random order for a total of 180 trials. The first 90 trials were unperturbed (i.e., baseline), and real-time perturbed auditory feedback (i.e., increased formants) of the produced speech sounds was provided in the subsequent 90 trials to induce adaptation. We recorded the audio with a microphone and orofacial movements using an articulograph. We analyzed baseline trials to determine task-irrelevant variability in movements, which was correlated adaptation measured by formant frequency changes during perturbed trials.

We found that the relationship between task-irrelevant variability and adaptation was different across words, suggesting that the role of system identification may be word-dependent in speech motor control. Our findings also challenge the previous work, demonstrating that speech adaptation may be fundamentally different from arm-reaching movement, possibly due to stronger reliance on auditory feedback.

Keywords:

Motor Learning; Speech; Sensorimotor Adaptation; Task-Irrelevant Variability; Auditory

Mentor(s):

Kwang Seob Kim (Purdue University); Satyajit S Ambike (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1104

Presentation Time: Session 1: 9:00-10:00am

A Machine Learning Approach to Estimating Evolving Flood Hazards

STEM

Authors(s):

Brenna Kari Losch† (Engineering)

Abstract:

Louisiana's coastal landscape is always changing. As sea levels rise and land subsides, salinity intrudes on fresh water and induces changes in vegetation and erosion. CPRA has implemented billions of dollars in marsh creation, river diversion, and other restoration projects that influence morphology and change the flood risk profile of the coastal zone.

At the same time, computational models used to estimate flood hazard can be expensive or time-consuming to run, making them infeasible to run on every combination of projects, time periods, and climate futures being considered by the Coastal Master Plan process. In this talk, we apply machine learning algorithms to data from the 2023 Coastal Master Plan. Using the landscapes and sea level conditions as inputs and flood hazard estimates from the Coastal Louisiana Risk Assessment (CLARA) model as training data, we are able to accurately predict the probability distribution of flood hazards. We will present example results illustrating an ability to quickly evaluate the risk reduction impacts of coastal restoration projects.

Keywords:

Climate Change; Machine Learning; Risk Assessment; Coastal Restoration; Flood Hazards

Mentor(s):

Mohammad Ahmadi Gharehtoragh (Engineering); David R Johnson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1105

Presentation Time: Session 1: 9:00-10:00am

Analyzing Biofilm Growth on PVC-coated Magnetic Beads for High-throughput Microbiome Applications

STEM

Authors(s):

Mallory A Luse† (Agriculture|Engineering)

Abstract:

To understand microbiome function, high-throughput experimental platforms, enabled by liquid handling robots, are essential for efficiently analyzing microbial assembly and interactions. However, their ability to handle solid materials is limited, so generalizable methods have been developed to enable these robots to manipulate magnets, allowing them to work with solid surfaces where many microbes thrive. To replicate the surface properties found in many systems, a method has been developed to generate small polyvinyl chloride (PVC) coated stainless steel beads that can be handled by the robot. Small-scale environments were recreated in glass jars to ensure that PVC beads are representative of other PVC surfaces and can be replicable for microbiome analysis. Drinking water and hydroponic systems were modeled using jar tests, as both systems often have PVC materials. Each individual system contained fabricated PVC beads and PVC pipe coupons. Flow cytometry and DNA extraction methods were used to assess biomass growth in the bulk water and the biofilm. Two extraction kits were tested to compare DNA yield from a variety of samples. These results were analyzed to optimize raw DNA yield, which can be used in downstream sequencing and qPCR analysis. Experimental data shows that beads and coupons obtain similar DNA yields per surface area, highlighting the viability of this method as a low-cost alternative to PVC pipe coupons. Overall, this research aims to develop optimized methods that allow liquid-handling robots to study the microbiome on diverse solid materials, improving the safety of water systems.

Keywords:

Microbiome; Liquid-Handling Robot; Flow Cytometry; DNA Extraction; Water System Safety

Mentor(s):

Caitlin Rose Proctor (Purdue University); Arval Viji Elango (Agriculture); Roland Conrad Wilhelm (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1106

Presentation Time: Session 1: 9:00-10:00am

The Effects of Various Materials on the Reclamation and Germination of Fungal Spores.

STEM

Authors(s):

Robert james Lyon† (Agriculture)

Abstract:

This study examines the effects of various farm machine materials on the germination and retention of fungal spores. The experiment tested nine different materials: aluminum, brass, cotton, denim, nylon, oak (wood), stainless and rusted steel, and tire rubber. The fungal species evaluated represent genera known to cause disease in agricultural settings: Fusarium equiseti, Penicillium lividum, and Cladosporium cladosporioides. Each material was inoculated with a known concentration of conidia and hyphal fragments from the three fungal species with two technical replicates, for a total of 12 time points. Every week, one point was removed from each of the two technical material replicants, recovered spores were placed on a PDA agar plug on a sterile glass slide, and incubated in a humidity chamber. After two days, the agar plugs were examined under a microscope, and overall growth was ranked on a 1–5 scale: 1 indicating no growth and 5 indicating dense growth. The spore growth experiment is ongoing, but preliminary results suggest that fungal spores on cotton, denim, oak (wood), and rusted steel surfaces exhibit the most growth, while those on tire rubber and stainless steel show the least. Additionally, this study is also assessing which surfaces facilitate the release of fungal spores. Current findings suggest that denim and cotton clothing, oak (wood) surfaces, and rusted machinery or tools may provide favorable environments for pathogenic spores and may require active sterilization to mitigate their spread.

Keywords:

Fungi; Pathogen; Farm

Mentor(s):

Daniel B Raudabaugh (Purdue University); Mary Aime (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1107

Presentation Time: Session 1: 9:00-10:00am

Advancing Space Exploration with Origami-Inspired Robot Design and Prototyping

STEM

Authors(s):

Sishir Mahavadi† (Engineering); Prisha Rachakonda‡ (Polytechnic); Tanya Vijay‡ (Engineering); Jacob Daniel‡ (Engineering|JMHC); Adina Ioana Margineantu‡ (Science)

Abstract:

Reflector antennas for low-earth orbit are particularly useful devices for the collection and transfer of data between systems in space. Shape-changing antennas provide specific advantages for this, as they allow for the manipulation of antenna structures to enhance the directivity of transmission or the absorption of signal waves for analysis. However, actuating a shape-changing mechanism remains complex, reducing their usability and practicality. This project aims to tackle this challenge by developing a shape-changing antenna assisted by an origami-based mechanical base layer to perform consistent actuation in space. The design of the base layer will be based on a water bump geometry, which has previously been studied for its applications in creating parabolic shapes suitable for the antenna geometry being studied. Initially, a parametric model of the structure will be developed using computer-aided design (CAD). The model will then be optimized for 3D printing with various filament types, including TPU and PLA. Various prototyped 3D printed structures will then be tested in the laboratory for verification of their elastic strength, ductility, and ability to geometrically conform to the parabolic shape. The parametric model will then be iterated upon to develop a final water bump sheet that can be integrated with the antenna for testing proper actuation and shape changing. Expected end results will provide an indication of the fidelity of the actuation mechanism, as well as the accuracy of the mathematical model in producing valid antenna configurations.

Keywords:

Origami; Space; Aerospace; Robotics

Mentor(s):

Ran Dai (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1108

Presentation Time: Session 1: 9:00-10:00am

Minimizing Inhibition of qPCR Amplification in Water Samples with Variable Metal Content

STEM

Authors(s):

Lillian Grace Maldia† (Engineering)

Abstract:

There are few regulations on private domestic wells; placing the responsibility of drinking water safety onto well-owners. Despite its importance, water quality testing is often neglected for financial and time constraints. Limited research has been done on microbial water quality, excluding fecal pathogen risk following flooding. One challenge was determining how to prevent the variable metal content of samples from inhibiting microbial methods. Metals are present at variable levels within each well, and certain metals can complicate reliability of quantitative results. This study utilized volunteers to examine water quality, with an emphasis on characterizing the microbiome. Over two years, 37 private well-owners in Indiana provided 121 samples sourced from kitchen sinks and outdoor spigots. DNA was extracted from these samples, which was used to quantify bacteria Pseudomonas aeruginosa, Legionella pneumophila, and Mycobacterium?with quantitative Polymerase Chain Reaction (qPCR) analysis. Before qPCR analysis, an ideal dilution factor needed to be established, based on Qubit results of DNA concentrations and Inductively Coupled Plasma Optical Emission Spectroscopy results of metal concentrations. While over diluting DNA will not allow for appropriate limits of quantification, under diluting will allow metals remaining in the extracted DNA to inhibit amplification in qPCR. A series of dilution plates were done to determine the best dilution for all of the samples. It was determined that a 50x dilution was most appropriate. While the results are specific to this research, the method for determining dilution will be impactful in establishing a baseline on how to characterize microbiomes in variable waters.?

Keywords:

Drinking Water; qPCR; Well Water; Microbiomes; Metal Content

Mentor(s):

Caitlin Rose Proctor (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1109

Presentation Time: Session 1: 9:00-10:00am

Does Airplane Pollution Elevate Elemental Lead Concentration in Soil?

STEM

Authors(s):

Jacob Alan Malone† (HHS|JMHC); Katelyn Riddle‡ (HHS)

Abstract:

The Federal Aviation Administration has set a goal to eliminate lead in general aviation fuels by 2030. Communities impacted by heavy general aviation traffic include minority and low-income communities, which can lead to education and health disparities in both children and adults due to lead exposure. This study characterizes soil lead concentrations, comparing distance from the airport (“ring”) and cardinal direction (“spoke”). A total of 165 soil samples were collected in rings at distance of 0.1, 0.25, 0.5, and 1 miles from the airport along 4 spokes. Samples were processed by drying, sieving, and weighing to ensure uniform density before lead concentrations were measured using X-Ray Fluorescence (XRF) analysis. Out of N=165 samples analyzed to date, median lead concentration was 23.71 ppm (interquartile range: 19.86, 31.14) and 1 (0.61%) sample was higher than the US EPA reference level of 200 ppm. Analyses are underway, including evaluation by ring and spoke designation. Results will provide evidence regarding whether soil lead concentration is related to airport proximity.

Keywords:

Lead; Airport; FAA; Community Health; Heavy Metals

Mentor(s):

Ellen M Wells (Purdue University); Jung Hyun Lee (HHS)

Other Acknowledgement(s):

Emily G Marvel (HHS); Ashley Jean Hannah (HHS)

Poster Presentation Abstract Number: 1110
Presentation Time: Session 1: 9:00-10:00am

SRAM on a System-on-Chip

STEM

Authors(s):
Antonios Maniatis† (Engineering)

Abstract:
On-chip memory provides orders of magnitude latency improvements over memory held off chip for microprocessors. Static random access memory (SRAM) is the standard implementation for its high access speed, density, and common device process to logic. However, SoCET's most recent SoC, the AFTx07, uses standard logic flip-flops as its on-chip memory. This crude form of memory limits the amount of memory that can fit onto the chip. Replacing the current on-chip memory with SRAM would improve all future design iterations. The implementation of SRAM comes with design challenges. Creating standard cells from scratch is an extremely complicated process that requires prohibitive time, energy, and technical skills

Instead, we implement the SRAM cell library in the 130nm PDKprovided by Skywater Technologies that can be used to piece together the small macros into a larger SRAM array.The relevant IP is a 16x16 bit array, so in order to reach a size of 16kB, the amount of memory that the AFTx07 currently has, 512 macros will need to be pieced together either through a digital implementation flow or directly creating a single macro with subcomponents using VLSI tools. A disadvantage of the digital implementation approach is the excessive address decoding overhead that will be necessary to access the correct parts of the SRAM while the low-level piecing together of cells into a single macro requires device level design and verification of physical effects. Despite overheads, there should still be an improvement to the chip's memory density and the success of the design will be quantitatively determined using power, performance, and area (PPA) analysis, a common metric used in SoC design.

Keywords:
[no keywords provided]

Mentor(s):
Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1111

Presentation Time: Session 1: 9:00-10:00am

Model optimization for nanodevices and functionalized material

STEM

Authors(s):

Jeremy Jingrui Mao† (Engineering)

Abstract:

Density functional theory (DFT) is a powerful computational tool for analyzing electronic properties such as charge density distribution, density of states, and band structure of various materials. Different DFT models are used for different applications: for example, a local density approximation DFT model is notorious for its underestimation of band gap energies, which creates the need for improved hybrid functional models including electron exchange-correlation interactions. Despite their benefits however, hybrid functional simulations are computationally demanding and expensive. In response to this challenge, we use hybrid functionals on Vienna ab initio Simulation Package (VASP) and Purdue's Nanoelectronic Modeling Tools (NEMO5) software to simulate various materials. We then parametrize the results using self-optimizing algorithms to enable faster nanodevice simulations. By comparing band gap energies and structures to those found in literature, we validate our methodology and refine simulation parameters. This approach advances the goal of nanodevice simulations that are 6 orders of magnitude faster than state-of-the-art DFT tools.

Keywords:

Density Functional Theory; Nanodevices; VASP; NEMO5

Mentor(s):

Manas Pratap (Engineering); Tillmann C Kubis (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1112

Presentation Time: Session 1: 9:00-10:00am

Characterization of Envelope Following Responses to Complex Stimuli

STEM

Authors(s):

Jax Patrick Marrone† (Engineering)

Abstract:

Clinical hearing loss diagnostics rely on auditory thresholds, a measure of hearing sensitivity. Thresholds can be recorded objectively using auditory brainstem responses (ABRs) to pure-tone stimuli, but they alone are incapable of diagnosing complex auditory deficits such as speech-processing difficulties. Envelope following responses (EFRs) elicited by neural populations responding to the envelope of a sound provide a more sensitive diagnostic metric. Prior studies assessed EFRs to two complex stimuli: dynamic amplitude-modulated (dAM) stimuli and speech-tokens, both capturing nuanced temporal processing. However, it remains unclear how EFRs to dAM and speech token stimuli compare. Understanding these differences is critical for identification of specific mechanisms underlying hearing loss variations, ultimately facilitating more targeted interventions. To investigate this, two dAM stimuli variations were created using a stationary carrier (Gaussian noise or 8 kHz pure tone) added to an amplitude-modulated envelope. Both possess an exponential time-varying frequency trajectory ranging 2.5 Hz-1.5 kHz over a one-second window. Four speech-token variations were created using an audio recording of a male-voiced “Purdue”. Either a Gaussian noise or 8 kHz tone carrier was added to the speech envelope. The stimulus was either rectified or not. Rodent subjects were exposed to small-arms fire (SAF) like noise to induce hearing damage. EFRs were recorded eight weeks post-exposure and spectrally specific analyses were performed on the EFRs from each stimulus. Cluster analysis will be used to investigate the unique properties of each stimulus, with emphasis placed on the ability to detect underlying auditory system damage not identified using current clinical standards.

Keywords:

Auditory Neuroscience; Hidden Hearing Loss; Envelope Following Response; Auditory Brainstem Response; Signal Processing

Mentor(s):

Edward L Bartlett (Purdue University); Meredith Christine Ziliak (Science)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1113

Presentation Time: Session 1: 9:00-10:00am

Indigenous Cultural Preservation and Economic Development through Tourism- A Scoping Review

Social Science

Authors(s):

Mason Talavou Al Martin† (DSB|JMHC)

Abstract:

Many indigenous groups and researchers from many fields have identified the preservation of indigenous culture and the promotion of economic development through tourism as key objectives. Indigenous groups have employed many different strategies have been employed to achieve these goals and scholars discuss these practices in the existing literature. This study is a scoping review to synthesize the literature and examine how different indigenous groups around the world use tourism to promote both cultural preservation and economic development. Preliminary results indicate that indigenous communities utilize a wide range of strategies including – but not limited to – ecotourism, cultural ceremonies, art, and festivals. By synthesizing the relevant literature, the findings of this study will provide insights into the effectiveness of various types of strategies employed. This understanding can help both researchers and indigenous communities apply best practices to tourism initiatives that support cultural sustainability and economic growth as well as indicating promising directions for future research.

Keywords:

Indigenous; Culture; Tourism; Preservation; Scoping

Mentor(s):

Jason Ware (Purdue University); Scotty Secrist (Purdue University)

Other Acknowledgement(s):

Bethany McGowan (Purdue University)

Poster Presentation Abstract Number: 1114

Presentation Time: Session 1: 9:00-10:00am

Advanced Imaging Techniques for Characterizing Bound Water, Porosity, and T1 Relaxation

STEM

Authors(s):

Vedha Masuraha† (Engineering)

Abstract:

In recent years, medical imaging has seen a surge in focus, especially when accurately assessing the properties of porous systems like porosity, bound water content, and T1 relaxation time. Accurate determination of these properties is crucial for a variety of applications. Traditional techniques often fail to provide high-resolution and comprehensive data, especially in complex systems where the interactions between water molecules and porous media are intricate. There is an essential need for high-resolution and robust imaging techniques capable of capturing the intricacies of these parameters in complex systems. The novel Rosette trajectory approach will be combined with Magnetic Resonance Imaging (MRI) to explore and quantify three key parameters in porous materials: bound water content, porosity, and T1 relaxation time. The methodology incorporates advanced imaging protocols designed to capture high-resolution images from complex structures. Based on preliminary tests and the application of the Rosette trajectory in combination with MRI imaging, the expected results are improved sensitivity, higher resolution, and better accuracy in quantifying bound water content, porosity, and T1 relaxation times.

Keywords:

T1 Relaxation Time; Pore and Bound Water; Rosette Trajectory

Mentor(s):

Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgement(s):

Farhan Sadik (Engineering)

Poster Presentation Abstract Number: 1115

Presentation Time: Session 1: 9:00-10:00am

Analyzing Anisotropies in Supernova Remnant Simulations under Magnetic Fields

STEM

Authors(s):

Kaeli McGinty† (Science)

Abstract:

When a star reaches its end of life, it creates a massive explosion known as a supernova. After the supernova ends, the original stellar material is ejected out into a large structure which is called a supernova remnant (SNR). Researchers have simulated SNR formations using hydrodynamics and the models are accurate for replicating the small scale structures seen in real SNRs. However, the models fail to replicate the large scale anisotropies seen in the real SNRs. We introduce a weak magnetic field to the resulting simulated SNR. The magnetic field enhances the X-ray emission of the gas along the magnetic field lines. We synthetically calculate the X-ray emission from the gas density. We then calculate multipole moments of the SNR X-ray emission and compare them to real data.

Keywords:

Astrophysics; Supernova; Anisotropy; Magnetic Field; Simulation

Mentor(s):

Paul Cole Duffell (Purdue University)

Other Acknowledgement(s):

Miranda Elizabeth Pikus (Science)

Poster Presentation Abstract Number: 1116

Presentation Time: Session 1: 9:00-10:00am

Understanding Experiences and Beliefs Surrounding Cervical Cancer Among Women Experiencing Homelessness

Social Science

Authors(s):

Shivani Naayak† (HHS); Arshia Bhuvana Rama‡ (Science); Lauren M Hopkins‡ (Science); Gavin Sung-Hei Chiu‡ (Science)

Abstract:

Cervical cancer screening can prevent cervical cancer before it starts or detect it early when treatment is more likely to be successful. However, people experiencing homelessness (PEH) have disproportionately low screening rates and up to four times higher cervical cancer incidence and mortality rates compared to housed individuals. PEH face unique individual and structural-level barriers to preventive care, and no framework exists for screening strategies in shelters or community health clinics where PEH typically seek care. The purpose of this qualitative study is to understand cervical cancer screening experiences, knowledge, attitudes, and beliefs among PEH, including barriers and facilitators to screening, in order to inform an intervention to improve screening access. Semi-structured interviews with n=30 PEH from two homeless shelters in Indiana were conducted between April and May 2024. Interview transcripts were coded using a thematic analysis approach in NVivo qualitative coding software to identify patterns and themes related to cervical cancer screening experience, knowledge, attitudes and beliefs. While PEH experience and knowledge with cervical cancer screening varied, many believed that screening was important to them individually and to their community, with emerging themes around self-care and the importance of education. Key barriers and facilitators to cervical cancer screening were identified, including providing vaginal self-sampling as an option at the shelter. Findings from this study are being used to inform efforts to improve cervical cancer screening access and awareness in these communities.

Keywords:

Cervical Cancer; Barriers; Screening; People Experiencing Homelessness; Qualitative

Mentor(s):

Natalia Maria Rodriguez (Purdue University); Lara Nicole Balian (Purdue University); Rebecca A Ziolkowski (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1117

Presentation Time: Session 1: 9:00-10:00am

The Role of Fumarase in DNA Damage Repair Mechanisms

STEM

Authors(s):
Ainsley Marie Newett† (Agriculture)

Abstract:
[Abstract Redacted]

Keywords:
[no keywords provided]

Mentor(s):
Ann L Kirchmaier (Purdue University)

Other Acknowledgement(s):
Thomas Rex Sheeley (Agriculture)

Poster Presentation Abstract Number: 1118

Presentation Time: Session 1: 9:00-10:00am

The Impact of Early Caregiver Linguistic Input on Children's Later Speech Sound Development

STEM

Authors(s):

Emma Niecikowski† (Science|JMHC)

Abstract:

Children develop linguistic skills across many domains, including vocabulary, syntax, and articulation abilities. This development is partially influenced by environmental stimuli and social interactions with adults, including interactions with their caregivers. Caregiver input is especially important for children with delayed language development. Less is known about how caregiver input specifically affects speech sound development. To better understand this relationship, the proposed study will investigate the association between caregivers' verbal responsiveness and reading practices when children are 18 months old and children's articulation skills at 3 years of age. We will address two research questions: first, are measures of caregiver's early linguistic interactions correlated with children's articulation abilities; and second, does this relationship differ between children with a history of typical language development and children with a history of delayed language development? We will use the Reading subscale and Parental Verbal Responsivity subscale of the StimQ2 Questionnaire as a measure of early parental language input at 18 months of age and the Goldman-Fristoe Test of Articulation, 3rd Edition (GFTA-3) as a measure of children's articulation skills at 3 years of age. A regression analysis will be completed to determine the impact of StimQ2 scores on 3-year GFTA-3 scores. We predict that both StimQ2 subscales will positively predict GFTA-3 scores and that this relationship will be stronger among children with a history of language delay. This will allow us to better understand the impact of early caregiver input on later articulation development.

Keywords:

Articulation; Parental Input; Language Development; Linguistics; Verbal Responsivity

Mentor(s):

Arielle Borovsky (Purdue University); Philip Robert Curtis (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1119

Presentation Time: Session 1: 9:00-10:00am

The Impact of Corn Hybrid and Nitrogen Fertilization on Specific Root Architecture Parameters and Root Exudation

STEM

Authors(s):

Travis James Nixon† (Agriculture|Engineering|JMHC)

Abstract:

Intensive agriculture practices have contributed to significant soil carbon loss, releasing approximately 133 billion tons of carbon into the atmosphere. Plant roots play a crucial role in combatting soil carbon loss, by releasing root exudates into the soil, stimulating microbial communities, and then forming stable soil organic matter which reduces the soil carbon loss to the atmosphere. We have collected exudate data from a greenhouse study, looking at two corn hybrids (short and tall), under varying nitrogen application rates (0, 60, 180 lbs./acre). Root exudate collection was done prior to root parameter scanning via the Purdue Ag. Alumni Plant Phenotyping Facility (AAPF). We hypothesize moderate nitrogen application to soil will promote optimal root characteristics, including total root length, root count, root tip count, root crown angle, and distance from the crown. These enhanced root traits will then promote soil carbon building in corn compared to other nitrogen treatments.

Keywords:

Root Exudation; Soil Carbon; Root Architecture; Corn; Nitrogen Fertilization

Mentor(s):

Carson Howard Pearl (Agriculture); Yichao Rui (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1120

Presentation Time: Session 1: 9:00-10:00am

Traumatic Brain Injury and Contact Sports on Cognitive Performance

Social Science

Authors(s):

Oyindamola Olutofunmi Odelowo† (HHS)

Abstract:

Recent high-profile cases of youth experiencing severe injury from sports-related head injuries have heightened awareness about the safety of some youth sports. Additionally, chronic traumatic encephalopathy, which has been associated with a history of experiencing traumatic brain injury (TBI), has been found in several deceased contact sport athletes. Although knowledge of these potential risks has contributed to enrollment declines in some sports (e.g., football), every year, millions of children in the U.S. play contact sports. Young athletes enroll in sports with their families hoping that the health and social benefits outweigh potential risks. The present study will test whether participation in contact sports and TBI are associated with cognitive performance (i.e., memory) over time, controlling for age and extreme sport participation.

Data are from 11,878 adolescents in the Adolescent Brain Cognitive Development (ABCD) study, which had parents report sports participation and TBI for youth, and youth complete a working memory task at three timepoints (T1: 9-10 years, T3: 11-12 years, T5: 13-14 years). To test whether increase in TBI severity and contact within sports is associated with decreased cognitive performance, we will perform a series of multilevel models in which timepoints (level 1) are nested within individuals (level 2). First, the intercept only model will be estimated to calculate intra-class correlation (ICC) which proportions variance in cognitive performance to within- and between-person components. Secondly, we will estimate a model including covariates of age and extreme sport participation. Building upon previous models we will iteratively include TBI and contact sports.

Keywords:

TBI; Contact Sports; Memory; Youth Sports

Mentor(s):

Paul A Robbins (Purdue University)

Other Acknowledgement(s):
Kristine Marceau (Purdue University); Amy Milin Loviska (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1121

Presentation Time: Session 1: 9:00-10:00am

Mechanosynthesis of Urea-Gypsum Cocrystals: a Plant Study

STEM

Authors(s):

Tovia Grace Owens† (Agriculture|Engineering)

Abstract:

Leaching of fertilizers from agricultural land is a major source of fresh and saltwater pollution in the United States. An emerging method to combat this is cocrystallization - a technique which alters specific properties of compounds, often solubility. Chemical compounds are bonded together to form a crystalline lattice which inherits certain properties from the active and coforming reactants. This can be performed through thermomechanical means (e.g. milling and grinding) or direct growth of crystals from solution and is a highly empirical process. Cocrystal studies have been performed on agricultural materials with the intention of reducing their solubility for fertilizer application.

This is a plant study to evaluate the effectiveness of urea-gypsum cocrystal (URCASU) fertilizer compared with standard urea fertilizers. Laboratory-prepared URCASU, technical urea, commercial urea, and urea mixed with gum are formed into 8 mm compacts. These compacts are then applied in five replications, with an additional control, across two sets of pots: one filled with ACRE silt loam and the other with potting soil. The compacts are applied in conjunction with constant amounts of phosphorous and potassium. Then, spinach is started in each pot and thinned down to one plant per pot. The size of the plants is tracked biweekly along with the chlorophyll content of the leaves. The pots are placed on trays and held within plastic trash bags to allow for the collection and testing of water runoff for fertilizer leaching. At the end of the experiment the nitrogen uptake and nitrogen use efficiency will be calculated.

Keywords:

Mechanosynthesis; Nitrogen Leaching; Plant Study; Cocrystals

Mentor(s):

Rose Prabin Kingsly Ambrose (Purdue University); Vidya Kanaganamaradi Nagaraju (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1122

Presentation Time: Session 1: 9:00-10:00am

Melodic Medicine: Exploring the Impact of Music Therapy on Individuals with Aphasia

Humanities

Authors(s):

Anjali S Patel† (HHS|JMHC)

Abstract:

Music has become a daily companion for many, serving as a source of focus during one's studies, relaxation, or emotional expression. Beyond these everyday uses, music has healing properties, particularly for individuals with Aphasia. Aphasia is a language disorder primarily caused by strokes that damage the left hemisphere of the brain resulting in profound communication difficulties regarding speaking and comprehension. One-third of stroke survivors are affected with aphasia, highlighting the need for new therapeutic approaches to improve speech recovery and their quality as this disorder is affecting more and more people (Le n.p.). This exploratory research aims to investigate the effectiveness of music therapy as a possible intervention method for patients suffering from Aphasia. To better understand the potential of music therapy, I conducted a preliminary literature review on the different benefits it has on the brain such as its ability to stimulate neuroplasticity, improvements of the patient's psychological well-being, and examined the efficacy of existing music therapy techniques such as Melodic Intonation Therapy (MIT). It is clear that there are many benefits, however, its effectiveness can vary because of the type and severity of aphasia. To be precise, there are 8 different types of aphasia with a variety of symptoms therefore one Music therapy technique that may work on one patient may not produce the same outcome on another. Although this is a promising start, further research is essential to develop tailored music therapy approaches that cater to each individual’s specific needs and goals.

Keywords:

Music Therapy; Aphasia; Preliminary Literature Review; Language Disorder; Brain

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1123

Presentation Time: Session 1: 9:00-10:00am

Impact of Various Songs as Waking Stimuli on Female College Students

STEM

Authors(s):

Valentina Victoria Sienna Perera† (Science)

Abstract:

Having an effective alarm can give college students peace of mind knowing they won't sleep through their class and will start their day with minimal anxiety and panic. However, alarms on the market tend to be ineffective or increase stress among students stemming from underlying tones and wave frequencies. Recent research into waking stimuli has focused on identifying effective waking and comfort-inducing auditory stimuli. Numerous studies were done to test various volume amplitudes, tones of sound, and emotional response to sound. My research will go more in-depth with sound stimuli, specifically music, looking at the impact of genre, and volume. The goal is to develop an effective alarm that wakes up a female college student with maximum comfort. Women are specifically examined because they are generally marginalized within studies. Furthermore, the study seeks to minimize the impact of biological differences; this is achieved by focusing on a single gender. A week-long experiment will take place to collect data. Participants will set up a daily alarm consisting of a specific sound at set volume and time increments. The default Apple Clock app acts as the alarm with music files being uploaded as alarm sounds. Participants provide quantitative and qualitative data through surveys. This research is necessary because college is a time where students experience the most stress-filled and sleepless days of their lives, and a reliable alarm would make the college experience substantially easier to handle.

Keywords:

Waking Stimuli; Women; Sleep Study; Stimulus; Comfortable Wake

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1124

Presentation Time: Session 1: 9:00-10:00am

PoliticaLens: An R-shiny Application to Evaluate Political Bias in American News

Business Case Study

Authors(s):

Gabriel L Ponsot† (DSB); Caleb Zachariah Brunton† (DSB); Umar Yasser† (DSB); Conrad Sebastian Lin† (DSB)

Abstract:

This study develops an R-shiny application called PoliticaLens that estimates the political bias from news articles. The motivation for this research is that the public trust in traditional news media has been at an all time low. According to a 2024 Gallup poll, only 31% of Americans expressed a “great deal” or “fair amount” of confidence in the media to report the news “fully, accurately and fairly [1].” News has become so politically polar that we posit there is a significant market for those who would like to have articles reviewed for political neutrality prior to deciding to read them. PoliticaLens is trained on thousands of recent news articles from popular news sources and labeled as politically left, center, or right. Using this training set and subsequent textual analysis, an end user can provide a new article which and be informed if the article is politically center or not.

Keywords:

Bias; Misinformation; Media; Predictive Modeling; R-Shiny

Mentor(s):

Matthew Lanham (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1125

Presentation Time: Session 1: 9:00-10:00am

Investigating the Role of ATP2b1a in Neutrophil Migration

STEM

Authors(s):

Caroline Powell† (Science); Conwy Zheng‡ (Agriculture|Engineering)

Abstract:

Neutrophils are the body's first defense against pathogens, being one of the first immune cells to respond to an infection, rapidly migrating to the site of infection to fight off these invaders. Once clearance of infection is complete, neutrophils resolve inflammation through apoptosis and/or reverse migration back into the bloodstream. This is why proper migration of these immune cells is crucial for sustaining a healthy and balanced immune system.

Our lab utilizes microRNA (miR) and zebrafish as an animal model to discover genes that may play a role in regulating neutrophil migration. When overexpressing miR-375 in zebrafish, it was found to show a decrease in motility and recruitment of neutrophils to an infection site or tail wound site. Through RNA sequencing of miR-375 overexpressing fish compared to control, we discovered the ATP2b1a gene to be significantly down-regulated and thus potentially be playing a role in the observed phenotype.

The ATP2b1a gene, analogous to the ATP2b1 gene in humans, codes for an ATPase plasma membrane Ca2+ transporter, pumping Ca2+ out of the cell. Ca2+ signaling plays a crucial role in many neutrophil functions, including polarization, chemotaxis, phagocytosis, and degranulation. In this study, we further investigate the importance of the ATP2b1a/ATP2b1 gene in overall neutrophil function via multiple assays conducted in our ATP2b1a TSKO zebrafish system or in ATP2b1 knockout HL-60 cell lines. We have found significant impairments in migration and other neutrophil functions in both model systems.

Keywords:

Neutrophil; Migration; ATP2b1a; microRNA-375; Calcium Signaling

Mentor(s):

Daniel Kim (Science)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1126

Presentation Time: Session 1: 9:00-10:00am

Ph altering drug on Ebola Virus Cytoplasmic Entry

STEM

Authors(s):

Cassidy Lynn Poynter† (HHS)

Abstract:

This study investigates the effects of a pH-altering drug on Ebola virus cytoplasmic entry, specifically targeting the cysteine protease cathepsin B. Cathepsin B plays a crucial role in viral entry by cleaving the glycan cap of the Ebola virus glycoprotein, facilitating membrane fusion and viral replication within the host cell. The drug Diphyllin and its synthesized derivatives were examined for their ability to inhibit viral fusion by disrupting the V-ATPase proton pump. To assess cathepsin B activity, HEK293 cells were treated with a fluorescent AFC-tagged substrate, which fluoresces upon cleavage. Control experiments confirmed cathepsin activity and its complete inhibition by the cysteine protease inhibitor e64D. When V-ATPase-targeting drugs were introduced, cathepsin B activity was significantly reduced. These findings contribute to a deeper understanding of Ebola virus entry inhibition and support the potential development of Diphyllin derivatives as pH-modulating antiviral therapies.

Keywords:

[no keywords provided]

Mentor(s):

Robert V Stahelin (Purdue University); Hannah M Woods (Pharmacy)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1128

Presentation Time: Session 1: 9:00-10:00am

Expected Value Returns when Sports Betting with Probability and Statistics

STEM

Authors(s):

Grant Pryor† (Science)

Abstract:

The sports world is powered by money, with players making millions of dollars annually and the sports bettors wagering hundreds of billions per year. Many advanced probability models are used in sports betting to create odds for teams and players. Inferential statistics are also used to generate these odds. Probability gives us the likelihood an event will occur based on expected populations (such as a team's total points) and inferential statistics provides information based on an expected sample (such as a player's total points). This research will aim to show if there is any way that a sports bettor can use both probability and statistics to create an expected profit over time. Research suggests that small deviations in expected odds can create an advantage for bettors. In fact, data shows that expected profits can be obtained when there is only a single point difference between a calculated line and the lines set by betting sites. While it is impossible to obtain a 100% probability rate in an unknown situation, a positive expected profit can give bettors an edge over sportsbooks. However, in most cases, these bets don't generate enough certainty to make the wager statistically significant.

Keywords:

Sports Betting; Probability; Statistics; Profit

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1129

Presentation Time: Session 1: 9:00-10:00am

Machining Process Monitoring of Additively Manufactured Fiber-Reinforced Composites

STEM

Authors(s):

Varunavi Kaveri Raghuraman† (Engineering); Sucheol Woo‡ (Polytechnic); Andrew R Sheedy* (Engineering)

Abstract:

Additive manufacturing of fiber-reinforced composites is a growing technology used to create advanced composite parts and production tooling. High surface quality is essential for dimensional accuracy and performance but machining composites presents challenges such as fiber pullout, unintended material removal, polymer overheating, and tool wear. Real-time monitoring of machining parameters is crucial for improving process control and surface quality, yet robust monitoring strategies remain lacking. Key process indicators such as temperature, vibration, and sound can provide insights into machining stability and defect formation. This study seeks to establish relationships between these monitored parameters and the resulting surface finish, enabling better optimization of machining conditions. Experiments will be conducted on carbon fiber-reinforced Acrylonitrile Butadiene Styrene (ABS) composite using a CNC machining setup. Temperature measurements will be obtained via thermal imaging to monitor heat distribution throughout the experiment in the workpiece and surrounding area. An accelerometer will capture spindle vibrations to assess machining stability, while an acoustic sound sensor positioned near the machine's rigid body will record audio signals for sound analysis. Raspberry Pi hardware and MTConnect Agent, which standardizes collected data, will be used to analyze trends linking process parameters to surface finish characteristics and machining strategies. Increased temperature, excessive vibrations, and irregular sound patterns are expected to correlate with surface defects and accelerated tool wear. The study seeks to determine optimal machining conditions that minimize these effects while ensuring high-quality surface finishes. By refining real-time monitoring practices, this research will enhance machining efficiency and consistency in ABS composite tooling.

Keywords:

Monitoring; Data Analysis; Additive Manufacturing; CNC Machining; Fiber-Reinforced Composites

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Garam Kim (Purdue University); Eduardo Barocio Vaca (Purdue University)

Other Acknowledgement(s):
Jiho Lee (Purdue University); Yuseop Sim (Engineering)

Poster Presentation Abstract Number: 1130

Presentation Time: Session 1: 9:00-10:00am

Design, Manufacture, and Test of a Micro Gas Turbine.

STEM

Authors(s):

Kavina Tirumamagal Rajan† (Engineering); Anjali Patel† (Engineering)

Abstract:

Microturbine power systems have received considerable interest in recent years, offering a compact and lightweight source of power for off-grid electricity generation. When a waste-heat recovery system is used, these devices can achieve a high efficiency and are capable of running on a wide range of fuels with relatively low maintenance. The present work focuses on the design and manufacture of a single-spool micro gas-turbine engine, designed for compatibility testing with three sustainable gaseous fuels: Natural gas, methane, and hydrogen. Methodology is presented for the rapid design of a centrifugal compressor, annular gaseous combustor, and single-stage axial turbine. Also discussed is rotordynamic analysis, and the design of an electronic control system to ensure safe operation of the turbomachine. Additionally manufacturing plans and material post-processing (including heat-treating) is presented. This gas-generator is configured to produce an exhaust energy content of 100 kW, currently being exhausted through a converging nozzle to produce 220 newtons of thrust. Future integrations of this device with a power turbine for energy generation will be explored. The goal of this work is to document the design, manufacture, and test of an accessible micro-gas turbine engine for future studies in sustainable gaseous fuels.

Keywords:

Gas Turbine; Turbine; Turbojet; Combined Heat and Power; Sustainable Fuels

Mentor(s):

Suman Chakraborty (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1131

Presentation Time: Session 1: 9:00-10:00am

Investigating the Effects of Chemogenetic Manipulation of the Lateral Habenula (LHb) on Social Behavior in Scn2a-Deficient Mice

STEM

Authors(s):

Rineet Ranga† (HHS)

Abstract:

Autism spectrum disorder (ASD) is a neurodevelopmental disorder affecting 1 in 36 children, characterized by deficits in social communication. ASD has been associated with various genes; however, SCN2A, a gene encoding a sodium ion channel (Nav1.2), has been identified as one of the leading monogenic causes of ASD. Our lab has characterized a novel mouse model of SCN2A deficiency, which recapitulates many of the phenotypes seen in ASD patients. Patients with ASD have been found to have structural and functional defects in multiple brain regions, such as the Ventral Tegmental Area, Dorsal Raphe Nucleus (DRN), and the Lateral Habenula (LHb). The LHb sends and receives serotonergic projections to and from monoaminergic brain regions like the DRN, and serotonin has been shown to modulate social activity, a core phenotype in ASD patients. Our study evaluated the chemogenetic activation and inactivation of the LHb in Scn2a-deficient mice using Designer Receptors Activated by Designer Drugs (DREADDs). We found that activation of the LHb increases sociability in Scn2a-deficient mice during the Three-Chamber Assay and Stranger Interaction Test. We further evaluated if the activation of neurons from the DRN to LHb could rescue the social deficiencies seen in Scn2a-deficient mice and found that activation of these projections increases the sociability of Scn2a-deficient mice. Our results suggest that the LHb and projections from the DRN to the LHb play a crucial role in modulating social behavior in Scn2a-deficient mice.

Keywords:

SCN2A; Autism; Lateral Habenula; DREADDs; Dorsal Raphe

Mentor(s):

Brody Alan Deming (Pharmacy)

Other Acknowledgement(s):

Akila Abeyaratna (Purdue University)

Poster Presentation Abstract Number: 1132

Presentation Time: Session 1: 9:00-10:00am

Determining Antimicrobial Resistance in Bovine Respiratory Disease Bacteria

STEM

Authors(s):

Mackenzie Grace Roche† (Science|JMHC); Adela Stephanie Fuentes‡ (Agriculture)

Abstract:

Bovine Respiratory Disease (BRD) is a leading cause of death in cattle, due to its highly contagious nature and the absence of a rapid testing method to determine treatment. Cattle are typically treated immediately to limit the spread of disease, and the use of antibiotics is usually administered without knowledge of the cause of disease. This can contribute to antibiotic resistance. Commonly isolated antibiotic-resistant bacteria involved in BRD include Mannheimia haemolytica, Pasteurella multocida, and Histophilus somni. In this study, these pathogens will be isolated, determine their antibiotic resistance phenotypes and genotypes, and then determine the concordance rates of their phenotypic and genotypic resistance. The bacterial pathogens will be collected using nasal, nasopharyngeal, or lung tissue samples. Sequence preparation will be carried out using Illumina DNA Prep kit. Samples will be placed in broth, diluted if necessary, and streaked onto a TSA with 5% Sheep Blood agar plate. The plates will be incubated in 5% CO2 at 37°C for 24-48 hours. After incubation, bacteria will be identified by PCR assays and MALDI-TOF. Following identification, isolates will be sequenced, and resistant bacteria will be identified using antibiotic susceptibility testing. Determining the concordance rates of antibiotic resistance genes will aid in the ability to predict phenotypic resistance and further the development of rapid testing methods for antibiotic resistance in BRD pathogens.

Keywords:

Bovine Respiratory Disease; Antimicrobial Resistance; Antibiotics; Identification; Concordance Rates

Mentor(s):

Timothy Johnson (Purdue University); Audrey Christine Ellis (Agriculture)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1133

Presentation Time: Session 1: 9:00-10:00am

Thermal Fatigue of Adhesive Bonding in Modular Additively Manufactured Fiber-Reinforced Composite Tooling

STEM

Authors(s):

Lucas Emanuel Rodrigues† (Engineering); Meghana Kumar‡ (Engineering|JMHC)

Abstract:

The adoption of additively manufactured fiber-reinforced composite tooling in composite part fabrication has grown due to its ability to reduce production costs and lead times. However, the dimensional constraints of 3D printing necessitate modular fabrication, with separate tooling sections being joined together. Adhesives are commonly used for bonding due to their ease of application and ability to maintain a vacuum-sealed surface. During high temperature curing processes (up to 180°C) in composite manufacturing, adhesive joints degrade due to mismatches in the coefficients of thermal expansion (CTE) between bonded sections. These failures compromise the structural reliability and vacuum integrity of the tooling. To investigate the effects of thermal cycling on adhesive joint performance, vacuum decay tests will monitor the extent of vacuum integrity loss over repeated cycles, while thermogravimetric analysis (TGA) will be used to evaluate adhesive decomposition behavior under elevated temperatures. Test specimens are composed of Polyethersulfone (PESU) reinforced with 25% carbon fiber by weight, bonded using a high-temperature epoxy adhesive between three distinct bonding plane orientations: printing & transverse (1-2), printing & stacking (1-3), and transverse & stacking (2-3). After 15 thermal cycles, changes in vacuum performance and adhesive thermal stability are assessed. Due to the anisotropic nature of additively manufactured materials, differences in thermal and mechanical properties between bonded surfaces are expected to influence adhesive degradation rates. Bonding orientations with stronger mechanical properties, such as 1-2, are anticipated to show less adhesive fatigue, ultimately prolonging tooling lifespan and improving vacuum reliability in modular composite tooling processes.

Keywords:

Composite Manufacturing; Composite Tooling; Modular Tooling; Additive Manufacturing; Thermal Fatigue

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Garam Kim (Purdue University); Eduardo Barocio Vaca (Purdue University); Paul Kyu-Hwan Park (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1134

Presentation Time: Session 1: 9:00-10:00am

Identifying sex-dependent metabolic signatures in IBD

STEM

Authors(s):

Shanlin Ruan† (HHS)

Abstract:

Ulcerative colitis, a form of inflammatory bowel disease, is a chronic inflammatory condition affecting the colon, with disease susceptibility influenced by genetic, immune, and environmental factors. Analytic data from this study indicate that males are more prone to developing UC, suggesting potential sex-specific differences in disease mechanisms. To explore this further, we employ genome-scale metabolic modeling and computational analysis to identify sex-dependent metabolic signatures in UC. By analyzing patient-derived metabolic data, we investigate variations in gene expression and metabolic flux between male and female UC patients using computational tools in Cobrapy and running the flux sampling analysis. Our findings highlight distinct metabolic pathways and enzymatic activities that may contribute to differential disease susceptibility and progression. Future research will validate these results by analyzing patient datasets from other studies. If these external datasets support our findings, this would strengthen the evidence for sex-specific metabolic differences in UC, eventually coming up with a more sex-specific therapeutic approach and targeted drug interventions.

Keywords:

Ulcerative Colitis; Inflammatory Bowel Disease; Multi-Omics Integration; Computational Biology; Gut Microbiome

Mentor(s):

Boyu Jiang (HHS); Priyanka Baloni (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1135

Presentation Time: Session 1: 9:00-10:00am

Electrical Characterization of Defects in CuIn1-xGaxSe2 (CIGSe) Solar Cells

STEM

Authors(s):

Yutika Vasudeo Sawant† (Science|JMHC)

Abstract:

The CIGSe solar cells are promising thin-film technology due to their high absorption coefficient and ability to absorb sunlight strongly, resulting in a much thinner film than other semiconductor materials. Improving their power conversion efficiency (PCE) requires careful analysis of electrical responses in the crystal structures. The purpose of this research is to characterize defects in solution-processed CuIn1-xGaxSe2 (CIGSe) solar cells by identifying their energies, concentrations, types, and locations using electrical characterization techniques. These methods include measuring the current-voltage (IV) curves of the samples, performing external quantum efficiency (EQE%), measuring capacitance-voltage (CV), conducting drive-level capacitance profiling (DLCP) and admittance spectroscopy (AS). Each method yields vital information in characterizing the cells. The IV curves will give a broad overview of cell performance through short-circuit current Jsc, open circuit voltage Voc, series resistances Rs, and shunt resistances Rshunt parameters. EQE will spectrally resolve the Jsc to help identify the non-radiative recombination location in the material. AS combined with DLCP and CV measurements expect to show us the type and location of the defects. As will help us find activation energies Ea that define the type of a defect. The project will bridge the underlying physics with experimental data to learn more about the defects in CIGSe solar cells. The obtained characteristics of these defects can help identify their causes and mitigate them in the future through improved processing conditions, creating higher-efficiency cells.

Keywords:

Solar Cells; Defects; DLCP; EQE; IV Curves

Mentor(s):

Juan Sebastian Alban Dominguez (Engineering); Rakesh Agrawal (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1136

Presentation Time: Session 1: 9:00-10:00am

Depth Estimation Model for Autonomous Driving

STEM

Authors(s):

Sarah Sawhney† (Engineering); Taehoon Kim† (Engineering); Ian Tseng† (Engineering); David Andrew Slater‡ (DSB|JMHC)

Abstract:

This project enhances depth estimation for autonomous driving by fusing LiDAR and RGB data from the KITTI dataset. We explore three distinct approaches and conduct a comparative analysis. Building on last semester's solution, where a pretrained ResNet-18 was fine-tuned for depth estimation, the first approach develops a custom U-Net trained from scratch, incorporating interpolation to fill gaps in sparse LiDAR data. The second approach improves a CNN-based model by integrating a new data loader that handles variable image and depth map sizes, enhancing preprocessing and performance. The third approach employs a simple custom encoder-decoder CNN that predicts depth maps directly from RGB images. Preliminary results indicate improved depth continuity and clarity across methods.

Keywords:

[no keywords provided]

Mentor(s):

Shreya Ghosh (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1137

Presentation Time: Session 1: 9:00-10:00am

Genetically engineering Anti-HER2 Car-Macrophages and in-vivo optical imaging of 4T1.2-HER2T breast cancer mouse model treated with bacteria-enhanced immunotherapy

STEM

Authors(s):

Abigail Wang Schroeder† (HHS); Hannah Faith Abdon‡ (HHS|JMHC)

Abstract:

Chimeric Antigen Receptor (CAR) macrophages are used in immunotherapy to treat solid tumors by penetrating the tumor and phagocytizing malignant tissue. Car-macrophages may even be capable of infiltrating cold tumors, or tumors that are unlikely to trigger strong immune responses. A lentiviral vector system was chosen to transduce the macrophages due to its ability to affect many different cells and tissues, its stable integration of genetic material into the host, and the capabilities for it to be used in both cell culture and in-vivo. We designed a third-generation Anti-HER2 Car-macrophage lentivirus. The lentivirus was commercially constructed by Creative Biogene to express the scFv(HER2)-CD28-41BB-CD3? CAR construct under an EF1? promoter. The construct also included a puromycin resistance gene for cell selection after labeling, and a GFP reporter gene for fluorescence viewing of successfully transduced cells. The lentivirus was used to transduce RAW 264.7 murine macrophage cells into Anti-HER2 Car-macrophages that can infiltrate and ingest tumors. Additionally, tumor-tropic Salmonella Typhimurium VNP20009 derivatives expressing anti-cancer proteins were used to enhance the immune response and the polarization of M1-like macrophages at the tumor site. The RAW 264.7 macrophages were also labeled with DiR, a lipophilic, near-infrared fluorescent cyanine dye with an excitation of 748 nm and an emission of 780 nm. The labeled macrophages can be viewed and tracked in-vivo using a near-infrared imaging system like the Spectral Ami Optical Imaging System.

Keywords:

Car-Macrophage; DiR; Lentivirus

Mentor(s):

Qiuhong He (Purdue University)

Other Acknowledgement(s):

Sung-Jin Kim (Purdue University); Hyunsup Han (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1138

Presentation Time: Session 1: 9:00-10:00am

Structural and Functional Analysis of Ras Isoforms in Phospholipase C-epsilon Signaling

STEM

Authors(s):

Canyen Locke Setser† (Science)

Abstract:

The Ras family of small GTPases plays a critical role in cellular signaling, proliferation, and the regulation of phospholipase C-epsilon (PLC-epsilon). PLC-epsilon is one of 6 different isozymes in the PLC family. This family of lipases hydrolyze the phospholipid phosphatidylinositol 4,5-bisphosphate (PIP2). This creates two secondary messengers; diacylglycerol (DAG) and inositol 1,4,5-triphosphate (IP3), which activate protein kinase C (PKC) and calcium channels, respectively. Ras regulates PLC-epsilon by binding to the RA2 domain, which is one of two C-terminal Ras association (RA) domains. There are four isoforms of Ras: H-Ras, N-Ras, K-Ras4A, and K-Ras4B. These all share a common G-domain but have different hypervariable regions (HVRs), which contains the membrane targeting region. We hypothesize that the differences in the HVR promote localization of PLC-epsilon to substrate-enriched regions of the cell membrane. In this study, we will generate different Ras chimeras using Takara Infusion Cloning and SnapGene. We will test these chimeras in cell-based activity assays to uncover possible mechanisms of interaction and localization of PLC-epsilon to the plasma membrane. Our study of Ras isoform-specific interactions with PLC-epsilon could provide insights into how Ras signaling influences tumorigenesis in pancreatic, lung, and colorectal cancers and how PLC-epsilon leads to cardiac hypertrophy in response to chronic cardiac stress.

Keywords:

Ras Isoforms; Phospholipase C-Epsilon; Signal Transduction; Chimera Generation; Membrane Localization

Mentor(s):

Ketaki A Mahurkar (Science); Angeline M Lyon (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1139

Presentation Time: Session 1: 9:00-10:00am

Design of Logic-Based Genetic Circuits Using RNA Aptamers for Inflammatory Bowel Disease Biomarker Response.

STEM

Authors(s):

Prisha Nitin Shethia† (Engineering|JMHC)

Abstract:

Inflammatory Bowel Disease (IBD) is a complex and chronic inflammatory condition that poses significant challenges to modern medicine. Characterized by complex pathogenesis and significant

inter-patient variability, IBD demands innovative molecular approaches that transcend traditional therapeutic strategies. However, the currently available clinical interventions for IBD are frequently limited by their broad-spectrum approach, often resulting in suboptimal management of inflammatory mechanisms. The complex and dynamic nature of intestinal inflammation necessitates advanced molecular technologies for accurate biomarker detection and targeted intervention. RNA molecules, as programmable biomolecules with diverse biological functions, provide a powerful foundation for such innovations. Among these, RNA aptamer-based logic circuits stand out as a groundbreaking solution, offering unparalleled potential to create intelligent molecular systems capable of dynamically interacting with disease-specific inflammatory proteins. Leveraging advanced synthetic biology principles and molecular engineering approaches. Our research pioneers a comprehensive engineering approach to designing logic-based genetic circuits that utilize RNA aptamer technology for precise molecular recognition and controlled genetic expression in the probiotic bacteria Lactobacillus crispatus. The inherent adaptability and established safety profile of Lactobacillus strains position them as ideal vectors for complex molecular engineering strategies. Our approach combines computational design with experimental validation, focusing on developing responsive genetic circuits within Lactobacillus strains. This methodology promises to revolutionize our understanding of IBD management, offering potential applications in personalized medicine, targeted therapeutic interventions, and dynamic disease monitoring

Keywords:

RNA Aptamers; Genetic Circuits; Inflammatory Bowel Disease; Synthetic Biology; Biomarker Detection

Mentor(s):
Derrick Dankwa (Engineering); Leopold Noel Green (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1140

Presentation Time: Session 1: 9:00-10:00am

Exploring Hawaiian Grammar: Structure, Adaptability, and Linguistic Preservation

Humanities

Authors(s):

Prasiddhi Shivakumaran† (HHS)

Abstract:

Language endangerment often happens because of popular belief that certain Indigenous languages are "primitive" or not capable of adapting to modern ideas and paradigms. This misconception can lead to weaker support for Indigenous language learning, preservation and revitalization. In reality, all languages have complex rules and can adapt to new concepts, but sociohistorical factors—colonization, discrimination, and policies that favor dominant languages—are often the driving factors for the endangerment of these languages; Hawaiian is one such language.

Descriptive research involving the documentation of lexical and functional categories and their environments, along with designing a standardized method for collecting and analyzing these linguistic data, is crucial for demonstrating the complexity and adaptability of the structures inherent to the Hawaiian language. Syntactic analysis shows that Hawaiian, like all natural languages, follows systematic yet typologically diverse grammatical rules that allow for nuanced expression, contrary to certain beliefs. Thereby, scholars can illustrate Hawaiian's rich morphology and syntax, countering the misconception that it is a "primitive" language. This classification also helps clarify how Hawaiian can generate neologisms to accommodate modern concepts, such as technology, proving that its adaptability is not inherently limited by its structure.

Our research aims to demonstrate the structures of noun-determiner phrases, complementizers, and pronoun structures in Hawaiian, in comparison to English grammar, reinforcing how Hawaiian follows systematic grammatical rules that are just as structured and expressive as those in English. By highlighting these elements, our research challenges linguistics misconceptions, reinforcing the necessity for Hawaiian's legitimacy, revitalization and preservation.

Keywords:

Typological Diversity; Syntactic Analysis; Endangered Language; Hawaiian; Neologisms

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Elena Benedicto (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1141

Presentation Time: Session 1: 9:00-10:00am

AI-Based Walkability Ecosystem: A Personalized, Social and Adaptive Solution to Urban Mobility and Public Health

STEM

Authors(s):

Diya Singh† (Science)

Abstract:

This project focuses on developing an Artifical Intelligence(AI)-powered Walkability Assistant, a mobile application designed to promote physical activity and improve public health by addressing urban walkability challenges. The app aims to leverage AI to provide incentivised personalized walking routes and real-time guidance tailored to individual user preferences, environmental conditions, and health data. By integrating data from wearable devices, environmental sensors, and mapping services, the system would dynamically adapt to weather, air quality, and user fitness levels to optimize walking experiences while incorporating behavioral psychology principles to deliver motivational prompts and personalized recommendations for sustained engagement. The project's first phase involves a comparative analysis of existing walkability apps and a requirements analysis for diverse user groups to identify gaps in current solutions and ensure inclusivity in design. These findings will guide the development of the Walkability Assistant, ensuring it addresses barriers such as environmental discomfort and lack of motivation while fostering community-building through group walking challenges and progress sharing. The platform aims to reduce sedentary behavior through its multi-faceted approach while promoting mental, physical, and social well-being. This initiative combines advanced AI technologies with urban planning insights to create a scalable solution for improving walkability in diverse environments. The Walkability Assistant has the potential to enhance urban mobility, support healthier lifestyles, and contribute to more inclusive and sustainable cities.

Keywords:

Artificial Intelligence; Walkability; Public Health; Urban Mobility; Behavioral Psychology

Mentor(s):

Gaurav Nanda (Purdue University); Jaeil Lee (Purdue University); Xinran Y Lehto (Purdue University); Mark R Lehto (Purdue University); Elizabeth A Richards (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1142

Presentation Time: Session 1: 9:00-10:00am

Modelling Thermophysical Properties and IMFs of Refrigerant Mixtures

STEM

Authors(s):

Nishtha Singh† (Engineering); Tanvir Kaur* (Engineering)

Abstract:

Refrigerant mixtures are commonly used in HVAC systems, and developing low-GWP alternatives to hydrofluorocarbons (HFCs) requires understanding their thermophysical properties. This research focuses on modeling intermolecular forces in refrigerant mixtures using Perturbed Chain - Statistical Associating Fluid Theory (PC-SAFT) and numerical methods. PC-SAFT is a thermodynamic model that describes the relationships between temperature, pressure, volume, and other properties.

Using REFPROP and Python, models for pure refrigerants were created and validated against published REFPROP data. Thermophysical properties like temperature, pressure, density, entropy, solubility, and mass fractions in mixtures were analyzed. Additionally, vector addition techniques are being explored to improve models for refrigerant mixtures not available in REFPROP, allowing for predictions based on known behaviors of individual components.

This model helps predict thermophysical properties of zeotropic and other refrigerant mixtures under various conditions, aiding in the evaluation of alternative refrigerants. It contributes to the development of sustainable HVAC solutions that reduce reliance on high-GWP refrigerants.

Keywords:

PC SAFT; Intermolecular Forces; Refrigerant Mixtures; REFPROP; Low GWP

Mentor(s):

Riley Bradley Barta (Purdue University)

Other Acknowledgement(s):

Kyle Allen Shepard (Engineering)

Poster Presentation Abstract Number: 1143

Presentation Time: Session 1: 9:00-10:00am

A Chiplet Communication Protocol for Post-Tapeout Heterogeneous Integration

STEM

Authors(s):

Devin Singh† (Engineering); Michael Jeffery Dick† (Engineering); Andrew Michael Lykken† (Engineering); Luca Renato Simoni† (Engineering)

Abstract:

Chiplet-based architectures provide improved flexibility compared to traditional monolithic designs by splitting a single design into a network of communicating chips. To enable chiplet architectures for Purdue System-on-a-Chip Extension Technologies (SoCET) designs, we develop a lightweight networking stack intended for chiplet communication. The stack consists of a packet protocol dictating how data is communicated between devices, a data link layer that controls the transport of packets, and a physical layer that sends packets across physical connections. We implement a 3-stage pipelined switch that can reach a maximum frequency of 92.35MHz. We improve the switch architecture using speculative switch allocation to boost the theoretical maximum throughput by 12.8% from 109MB/s to 123MB/s. The switches support runtime-configured routing tables which enables arbitrary topology decisions to be made after tape-out. To facilitate router initialization and memory transfers, reusable software libraries are written to configure router lookup tables, initialize endpoint configurations, and construct data packets. To control and monitor the network, a supporting software library with a PCIE-based API is created to perform network enumeration, read/write capabilities, and other useful functions. A packet sniffer is constructed using consumer microcontrollers to trace packet communication between chiplets to aid debugging and demonstration. We target integration on printed circuit boards due to their low manufacturing cost and ease of prototyping, however, these components are flexible enough to be easily integrated with a faster silicon interposer-based physical layer. This networking infrastructure will allow SoCET to have more rapid tapeouts and flexible post-tapeout heterogeneous integration.

Keywords:

System-on-a-Chip; Chiplet; Digital Design

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Cole Aaron Nelson (Engineering); Mark Johnson (Purdue University); Jacob Chappell (Engineering); Conor James Green (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1144

Presentation Time: Session 1: 9:00-10:00am

GUI-Based Segmentation and Quantitative Analysis of Aortic Aneurysms in M-Mode Echocardiography

STEM

Authors(s):

Samskrithi Sivakumar† (Science)

Abstract:

Aortic aneurysms are a serious cardiovascular condition due to pathological expansion. If undiagnosed and left untreated, these can rupture or dissect, leading to life-threatening complications. Hence, early detection and continuous monitoring are crucial for effectively managing patients with aortic aneurysms. One of the principal methods used for the diagnosis of this condition is through echocardiography, a widely used, non-invasive ultrasound imaging technique. Echocardiography can be used to quantify the size of the aorta at numerous locations. This study presents quantitative methods for analyzing aortic vessel motion using M-mode imaging, focusing on detecting aneurysm-related abnormalities. The system integrates multiple image processing techniques, including contouring, tracking, and timing analysis, to extract key features of the aortic root and the ascending aorta. This research builds on an existing framework and focuses primarily on finalizing the graphical user interface (GUI). We then worked to optimize the underlying code for improved efficiency and usability. The GUI is designed to provide the user with an intuitive user experience that facilitates interactions with the analysis tools. Code optimization aims to enhance computational performance, ensuring faster and more accurate processing of echocardiographic data. By using automated image processing and machine learning techniques, we aim to reduce interobserver variability and provide a tool that aids accurate and early detection of aortic aneurysms.

Keywords:

Aortic Aneurysms; Medical Image Analysis; Echocardiography; Graphical User Interface (GUI)

Mentor(s):

Craig Goergen (Purdue University); Shubh Parag Mehta (Engineering); Benjamin Landis (Indiana University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1145

Presentation Time: Session 1: 9:00-10:00am

Characterization of the contribution of the Mediator complex subunit MED23 to H3K27me3 homeostasis in Arabidopsis thaliana

STEM

Authors(s):

Shelby Sliger† (Agriculture|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Joseph P Ogas (Purdue University); Jiaxin Long (Purdue University); Clint C S Chapple (Purdue University); Pete E Pascuzzi (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1146

Presentation Time: Session 1: 9:00-10:00am

Design of an 8-Bit Digital-to-Analog Converter with Thermometer Decoder and Custom Two-Stage Operational Amplifier in TSMC180 Technology

STEM

Authors(s):

Nathaniel A Smith† (Engineering)

Abstract:

This paper presents the design of an 8-bit Digital-to-Analog Converter (DAC) using a thermometer-coded decoder and custom two-stage operational amplifier in TSMC180 technology. The hybrid DAC architecture optimizes performance and area efficiency. The thermometer decoder improves linearity by minimizing glitch energy. The custom two-stage op-amp, with a telescopic cascode first stage and common-source second stage, provides high gain, low offset, and sufficient bandwidth. Simulations confirm the design's compliance with specifications. This work demonstrates the effectiveness of integrating digital and analog techniques for medium resolution DACs.

Keywords:

Digital-to-Analog Converter (DAC); Segmented R-2R Ladder; System-on-Chip (SoC)

Mentor(s):

Dali Lai (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1147

Presentation Time: Session 1: 9:00-10:00am

A Patient Decision Support Tool for Simplifying Medical Information

Business Case Study

Authors(s):

Cooper William Springs† (DSB); Ethan Mathew Lebon† (DSB); Ian Spencer Lutz† (DSB); Aruneeth Ranjan Sil† (DSB)

Abstract:

This study develops an R-Shiny application that helps patients understand their medical visits by summarizing conditions, medications, and follow-up instructions in plain language. The tool integrates MedlinePlus API, OpenFDA drug labeling data, and PubMedBERT to retrieve and simplify healthcare information. By using publicly available data, the app ensures accessibility without the need for complex approvals. The motivation for this research is patients often struggle to interpret complex medical records and follow treatment instructions properly. Many rely on online searches for medical explanations, which can lead to misinformation and confusion. This study aims to bridge the gap between medical documentation and patient understanding by automating the retrieval and simplification of health information using free, publicly available sources. This user-friendly front-end interface extracts key medical terms from visit summaries, retrieves plain-language disease explanations from MedlinePlus, and pulls medication details from OpenFDA. Data-driven information is presented in a clear format to improve patient understanding.

Keywords:

Healthcare; Transparency; Medical Records; Text Mining; R-Shiny

Mentor(s):

Matthew Lanham (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1148

Presentation Time: Session 1: 9:00-10:00am

The Cytotron: A Revolutionary Approach to Non-Invasive Cellular Therapy

Humanities

Authors(s):

Katelyn Elizabeth Stetter† (HHS)

Abstract:

The Cytotron, or Rotational Field Quantum Magnetic Resonance (RFQMR), is an emerging non-invasive therapy designed to target abnormal cells for regeneration or degeneration, offering potential breakthroughs in treating cancer, neurodegenerative disorders, and organ fibrosis. Unlike traditional treatments like chemotherapy and radiation, the Cytotron uses controlled radio waves to selectively alter cellular behavior, reducing collateral damage to healthy tissues. While promising, the technology faces criticism due to limited clinical trials, high costs, and restricted accessibility, with availability in only a handful of countries. However, real-life cases, such as the fictionalized story of Lucca in Lucca's World, illustrate the urgency for alternative treatments as families pursue any possibility of improving their loved one's prognosis. As research progresses, the Cytotron could redefine medical treatment by providing a targeted, non-invasive alternative to conventional therapies. As more clinical trials are conducted, the Cytotron's credibility and acceptance in the medical community may increase, leading to broader adoption. The financial and geographical barriers currently limiting access could diminish with regulatory approval and insurance coverage, making the treatment more feasible for a wider range of patients. Ultimately, the Cytotron represents a significant step toward personalized, non-invasive medicine, offering hope to those battling life-threatening and degenerative diseases.

Keywords:

Cytotron; Rotational Field Quantum Magnetic Resonance (RFQMR); Non-Invasive Treatment; Tissue Regeneration; Cancer Therapy

Mentor(s):

Beth Elly Baumgartner (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1149

Presentation Time: Session 1: 9:00-10:00am

Improving NK Cell Function in Solid Tumors for Immunotherapy

STEM

Authors(s):

Drake William Strait† (Agriculture|Engineering|JMHC); Kyle Kai-Yuan Han† (Agriculture|Engineering)

Abstract:

Natural Killer (NK) cells are innate immune cells that have emerged as clinically-promising effectors for cancer immunotherapy. Due to its safety and high efficiency, chimeric antigen receptor (CAR)-NK cell therapy has demonstrated promise in targeting aggressive solid tumors such as osteosarcoma. In osteosarcoma, the tumor microenvironment (TME) is highly inhibitory to NK cells through the generation of immunosuppressors such as adenosine and chloroquine. This phenomenon, where tumor cells implement comprehensive strategies to suppress the immune system via anti-tumor immune response, is called immune escape. As a result, in osteosarcoma and other solid tumors, NK cells are functionally impaired, lacking the ability to resist tumor progression and unable to sustain anti-tumor activity. By genetically engineering NK cells, it is possible to redirect immunometabolic suppression and effectively target osteosarcoma, enhancing cell function. However, a more thorough understanding of the immunosuppressive TME and the effect of these therapeutic interventions is needed. The goal of this project is to understand the role of the immunosuppressive osteosarcoma TME on the function of NK cells, in order to improve their effector responses. To achieve this, NK cell viability and cytotoxicity are determined in response to adenosine, chloroquine and osteosarcoma cells in different concentrations via flow cytometry-based phenotyping. By more deeply understanding the key functions of immunosuppressants and pharmacological agents on NK cells in the TME, novel immunoengineering techniques can be utilized to engineer genetic knock-out cancer or NK cells using electroporation and CRISPR/Cas9Test for improved anti-tumor activity.

Keywords:

Immunotherapy; Immunoengineering; Osteosarcoma; Pharmaceuticals; Genetic Engineering

Mentor(s):

Sandro Matosevic (Purdue University); Kumar Rishabh (Interdisciplinary & Special Programs)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1150

Presentation Time: Session 1: 9:00-10:00am

Genetic Insights into the Conservation of the Western Chicken Turtle

STEM

Authors(s):

Ethan Scott Streckfuss† (Agriculture|Engineering|JMHC)

Abstract:

The Western Chicken Turtle (Deirochelys reticularia miara) is a species thought to be in decline. The purpose of this study was to understand the genetic diversity of the Western Chicken Turtle, how it relates to similar species, and how it varies by location. Measures of genetic diversity such as heterozygosity show the capability of a species to adapt to environmental changes, and thus a lack of genetic diversity is associated with a reduction in species' fitness. We were also interested in leveraging our dataset to determine if chicken turtles have genetic (GSD) or temperature dependent sex determination (TSD) by testing for the presence of sex chromosomes. This dataset was conducted with whole genome sequencing of 89 individuals. First, software was used to create figures showing heterozygosity comparisons. We used geospatial analysis to interpolate individual heterozygosity across our sampling distribution in Texas. Additionally, we compared average heterozygosity to that of other reptile species with known conservation listings of threatened, endangered, or no concern. Our results showed that the Western Chicken Turtle has a heterozygosity value most similar to species of high concern, specifically in the southwest section of their region. Finally, we used a specialized software to test for sex-linked scaffolds that would indicate the presence of sex chromosomes. No clear sex-linked scaffolds were detected, indicating that these turtles likely utilize TSD. Biologists and Conservationists may be able to use our results to inform management of the Western Chicken Turtle.

Keywords:

[no keywords provided]

Mentor(s):

Natalie Marion Allen (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1151

Presentation Time: Session 1: 9:00-10:00am

Analyzing Excavated Jewelry from Fort Ouiatenon

Social Science

Authors(s):

Kyah Elizabeth Sturm† (Liberal Arts)

Abstract:

Fort Ouiatenon was established by the French in 1717, and was the first French fort erected in Indiana. Excavations in the 1970s by Michigan State University recovered thousands of artifacts including a variety of metal jewelry from Europe. Many of these objects feature imitation gemstones of glass or lead paste, which was an 18th century French innovation. This poster presents the initial findings of an investigation into this class of artifact that was used to express multiple aspects of identity, and may have also been items of trade to Indigenous people participating in the fur trade. Additional research including materials analysis will provide greater insight into the construction of jewelry in this era, as well as the daily lives of people interacting with and residing at the fort.

Keywords:

[no keywords provided]

Mentor(s):

Harold Kory Cooper (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1152

Presentation Time: Session 1: 9:00-10:00am

Can Radio Data Help Us Understand the Late-Time Optical Emission of Core-Collapse Supernovae?

STEM

Authors(s):

Madeline G Taylor† (Science)

Abstract:

Supernovae are one of the most crucial objects for uncovering more information about our Universe. Supernova explosions create the heavy elements of the periodic table, along with the dust and molecules necessary for the formation of new stars and planets. Here, we present new work aiming to interpret the gas ejected in supernova explosions using spectroscopy obtained hundreds of days after core-collapse. Through our analysis of the presence of observed emission line profiles, we are able to test hypotheses about how the oxygen-rich gas that traces explosion dynamics is distributed. We aim to improve constraints on the explosion mechanism(s) and the environments into which SNe expand through an increase in sample size (N~40) as compared to previous efforts. Radio emission can be used to further constrain the nature of the late time optical emission line profiles. Radio emission, which is associated with synchrotron radiation, is indicative of the interaction between the initial supernova blast wave and surrounding circumstellar material shed by the progenitor star prior to explosion, can be used to further constrain the nature of the late time optical emission line profiles. Line profile asymmetry is a combination of differing possibilities; a clump of gas moving in the direction of Earth, the lack of uniformity within the supernova explosion itself, or spherical distribution with a circumstellar disk present because of the supernovae taking place in a binary star system.

Keywords:

Astrophysics; Supernovae; Spectroscopy; Radio; High-Energy

Mentor(s):

Danny Milisavljevic (Purdue University)

Other Acknowledgement(s):

Danielle Dickinson (Science)

Poster Presentation Abstract Number: 1153

Presentation Time: Session 1: 9:00-10:00am

Time-compressed discourse comprehension in young and older adults: behavioral and fNIRS analyses

STEM

Authors(s):

Taylor Alexis Teague† (HHS); Cade Dale Magnuson* (Engineering)

Abstract:

Purpose: Real-world communication, also known as discourse comprehension, requires more complex cognitive-linguistic processing than the brief, isolated sentences typically used in clinical audiology settings. Assessing discourse comprehension provides a more ecologically valid approach to quantify an individual's communication abilities. This study examined the cognitive factors, such as working memory and temporal processing speed, involved in speech-perception among younger and older adults when listening to speech stimuli that simulated challenging real-world communication conditions. We hypothesized that age-related declines in working memory and temporal processing speed would negatively impact comprehension ability.

Methods: Behavioral and neuroimaging measures assessed discourse comprehension in 40 normal-hearing participants (20 young, 20 older). Participants listened to ten short-story narratives that were time compressed to simulate a rapid rate of speech. Listeners were instructed to answer yes-or-no comprehension questions of varying difficulty. Functional near-infrared spectroscopy (fNIRS) was used to measure brain activation in auditory and cognitive regions during the comprehension task. Cognition was evaluated using the Montreal Cognitive Assessment (MoCA) and subtests from the Wechsler Adult Intelligence Scale (WAIS-IV).

Results: fNIRS data revealed distinct neural activation patterns between younger and older adults across question types, highlighting differences in cognitive strategies for discourse processing. Older adults relied more on higher-order processing regions when answering difficult questions.

Implications: These results suggest that understanding the interaction between cognition and aging in real-world listening scenarios can inform more effective audiological rehabilitation strategies. Understanding and addressing cognitive contributions to speech perception within the context of aging may enhance communication outcomes for older adults.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Discourse Comprehension; Cognition; Audiology; Auditory Neuroscience; fNIRS

Mentor(s):
Maureen Joyce Shader (Purdue University)

Other Acknowledgement(s):
Sandy A Snyder (Purdue University); Cole D Trent (HHS)

Poster Presentation Abstract Number: 1155

Presentation Time: Session 1: 9:00-10:00am

SCALE HI-AP: Spatially Identifying Defects in 2D-Logic Transistors via Photocurrent Imaging

STEM

Authors(s):

Bradon Rowan Timms† (Engineering|JMHC)

Abstract:

Transition metal dichalcogenides or TMDs are on the logic roadmap for semiconductor companies like Intel and IMEC. Implementation methods must be created to fabricate them so that the devices have optimized and uniform performance. Attaining this performance, in turn, requires identifying and then removing the presence of harmful defects induced during fabrication. Photocurrent measurements—in which current is monitored as light is rastered across a device—provide a means to image the location of defects within the device and their energy. For these reasons, this project will leverage photocurrent measurements to help identify processes that optimize the interfaces between gate dielectrics in the TMD. Doing so will improve subthreshold slopes and threshold voltages of the transistors whose optimization is necessary for the introduction of this new transistor class into commercial products.

Keywords:

Nanotechnology; 2D Logic; Transistor; Photocurrent

Mentor(s):

Thomas Edwin Beechem (Purdue University); Sahej Sharma (Engineering)

Other Acknowledgement(s):

Gabriella Maria Schr Torres (Centers & Institutes)

Poster Presentation Abstract Number: 1156

Presentation Time: Session 1: 9:00-10:00am

Characterizing the Spreading Dynamics of High-Tg Polymer Micelles at the Air-Water Interface for ARDS Lung Surfactant Research

STEM

Authors(s):

Calla Grace Tucker† (Engineering); Grace Anne Larkey* (Engineering)

Abstract:

Acute respiratory distress syndrome (ARDS) is a cureless disease developed through many respiratory infections such as the Flu or COVID-19. Previously developed lipid surfactants do not work for treatment of ARDS due to inflammation and blood present in the lungs that inhibit the spreading kinetics. This study focuses on varying concentrations, chemical properties, and nanostructure particle morphology for PS-PEG spherical, PS-PEG cylindrical, PtBMA-PEG, and PB-PEG micelles to understand what controls their spreading kinetics. This was accomplished by measuring the spreading rate of an 8 uL drop of a micelle solution on the air-water interface of a trough. The micelle solutions were created using equilibrium nanoprecipitation. The spreading dynamics of the surfactant were observed by measuring the radius of the Marangoni ridge (visualized using PTFE powder) over a specific period at the air-water interface. It has been shown that high-glass transition temperature (Tg) micelles exhibit universal concentration-dependent spreading behavior, and that the spreading kinetics are controlled by the surface pressure gradient at the Marangoni edge. The consistent spreading behavior is supported by their spreading pressure absorption (SPA) isotherms that show similarities in surface pressure changes as a function of surface area. Low-Tg micelles appear to not show a concentration dependence of their spreading exponent and display different behavior in SPA isotherms. Additional experiments and analysis will be completed in the future to explore how low-Tg micelles possibly undergo surface micelle transformation and micelle merging at the air-water interface which is not covered in the current data.

Keywords:

Polymer; Surfactant; ARDS; Lungs; Marangoni Ridge

Mentor(s):

You-Yeon Won (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Seyoung Kim (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1157

Presentation Time: Session 1: 9:00-10:00am

Maximizing Accuracy in Longitudinal Microbiota Analysis: A Mixed-Model Approach

STEM

Authors(s):

Anjali Vanamala† (Engineering|JMHC)

Abstract:

The gut microbiota is a critical determinant of health, with increasing efforts aimed at characterizing longitudinal microbial changes. However, analyzing longitudinal microbiota data presents challenges, including compositional constraints, zero inflation, and high variability across biological samples and taxa. Existing analysis packages differ significantly in their approaches and accuracy, making selection difficult for researchers. Thus, we evaluated six publicly available microbiota analysis packages: ZIBR, LongDat, ANCOM, NBMM, ZIGMM, and ZINBMM, using Kruskal-Wallis as a control. We generated four artificial datasets with varying levels of zero inflation and variability to assess package performance. We found that package accuracy depended on whether the analysis focused on longitudinal changes or treatment effect, as well as on variability and zero inflation of the taxa. With high variability, ZIGMM and ZINBMM demonstrated the highest accuracy (94.7% and 95.7%, respectively) but failed to converge for some tests. Under high zero inflation, ZIGMM performed best (95% accuracy) but also failed on certain tests. Averaging performance across all tests, ZIGMM achieved the highest accuracy (95.2%) when including failed tests, while Kruskal-Wallis was the most reliable when excluding failures (72.8%). To optimize accuracy, we developed a mixed approach where Kruskal-Wallis serves as a fallback when ZIGMM fails, yielding an overall accuracy of 96.7%. Our finding suggests that integrating ZIGMM with a Kruskal-Wallis fallback provides the most reliable method with maximal accuracy in longitudinal microbiota analysis. In future work, we will explore alternative analysis approaches, including visualizations and network-based methods.?

Keywords:

Longitudinal; Analysis; Microbiome

Mentor(s):

Tzu-Wen L. Cross (Purdue University); Anna R Clapp (HHS)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1158

Presentation Time: Session 1: 9:00-10:00am

Finite Element Analysis in Indentation at Different Constraints

STEM

Authors(s):

Nivrithi S Varghese† (Engineering)

Abstract:

Metals lose ductility and load-bearing capacity due to deformation or fracture, a major issue in infrastructure and manufacturing. Material behavior can be studied using indentation, a widely used process creating high, localized stresses around the target site. While indentation tests provide valuable data, finite element analysis (FEA) offers additional insights into stress-strain distributions that are otherwise challenging to measure. In this study, engineering software ABAQUS is utilized to simulate the indentation of a steel sample, focusing on the response near the edge, providing unprecedented insights into deformation mechanisms and potential mitigation strategies.

The primary objective is to investigate how stress and strain evolve as indentation approaches the edge. By systematically varying the indentation position relative to the free surface, this study examines changes in stress distribution, which may lead to localized failure. FEA simulations will provide a visualization of stress-strain fields to better understand the mechanisms driving these effects.

To validate the simulation, results are compared with experimental indentation data obtained using a Rockwell C hardness tester, which is commonly used to measure the hardness of steels. The findings provide a quantitative understanding of how proximity to an edge influences material response under localized loading, which is critical for applications involving thin structures or components subjected to mechanical contact. This study demonstrates the capability of FEA to complement experimental indentation work by offering detailed stress-strain predictions that enhance the understanding of mechanical behavior in materials. These simulations will help screen the capacity and safety of metals, ultimately strengthening modern-day infrastructure.

Keywords:

Finite Element Analysis; Indentation; Stress-Strain; Simulation; Abaqus

Mentor(s):

Jia-Huei Tien (Engineering); David F Bahr (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1159

Presentation Time: Session 1: 9:00-10:00am

Cost-Effective Recombinant Protein Markers for SDS-PAGE and Western Blot Analysis

STEM

Authors(s):

Karthik Varigonda† (Science|JMHC)

Abstract:

This project establishes the Penn State Protein Ladder system at Purdue University to create an inexpensive and reliable protein molecular weight marker for SDS-PAGE and Western blot using recombinant protein expression and purification techniques. Polycistronic plasmids were isolated from E. coli DH5? cells, sequence verified, and expressed in E. coli C41(DE3) and C43(DE3) cells using a T7 RNA polymerase system. The target proteins were purified via immobilized metal affinity chromatography (IMAC) with a Ni-NTA column using HIS-tags present on the proteins. The final protein marker was assembled by diluting purified proteins to a standardized ratio and mixing to create a reliable molecular weight ladder containing proteins of 10, 20, 30, 40, 50, 60, 80, 100, and 150 kDa. SDS-PAGE and Western blot analysis confirmed successful expression and purification. This method provides a cost-effective alternative to commercial protein markers, demonstrating the feasibility of producing in-house molecular weight standards for protein electrophoresis at Purdue University. Additionally, this approach offers flexibility, as specific proteins can be modified or added to customize molecular weight markers for specialized applications. By optimizing expression and purification strategies, this system could be expanded for use in fluorescent protein markers or multiplexed detection methods, further enhancing its utility in molecular biology research.

Keywords:

Recombinant Expression; SDS-PAGE; Western Blot; Protein Purification; Protein Marker

Mentor(s):

Nicholas Noinaj (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1161

Presentation Time: Session 1: 9:00-10:00am

Extraction of Alkali-Soluble Arabinoxylan

STEM

Authors(s):

Lea Camille Vojslavek† (Science); Han Ye† (Agriculture); Nicole Elizabeth Krishna* (Agriculture); Jasmine Rae Harper* (Science|JMHC); Victoria Bethany Hale* (Science|JMHC)

Abstract:

The following project discusses the extraction of arabinoxylan, a polysaccharide with a xylose backbone, arabinose side chain, and a small amount of other monosaccharides crosslinked by ferulic acid bridges. This extraction process allows for further analysis of this compound in its role as a dietary fiber, as Alkali-soluble Sorghum bran Arabinoxylans (SAX) are known to promote bacterial diversity within the microbiome of the gut. To acquire specifically this compound, the steps of lipid removal through a hexanes treatment, starch & protein removal through enzymatic treatment, disruption of plant lignocellulosic matrix using NaOH and Hydrogen peroxide, precipitation into ethanol, and finally, dialysis and freeze-drying of product, are performed on a starting material of white Sorghum bicolor to select for arabinoxylan. Results of the aforementioned steps have produced about a 12.6% yield in final arabinoxylan extraction mass as compared to source Sorghum initial mass, with minor remnant proteins from the original grain. The appropriate extraction of arabinoxylan and the plethora of subsequent procedures that can be performed with the extracted product may impact both the food industry and the field of gut health in deepening scientific understanding of the inclusion of arabinoxylans as a part of the diet and their role in gastrointestinal health and microbiome as a prebiotic.

Keywords:

Prebiotics; Gut Health; Food Science; Microbiome; Microbiology

Mentor(s):

Stephen R Lindemann (Purdue University)

Other Acknowledgement(s):

Sajal Bhattarai (Agriculture)

Poster Presentation Abstract Number: 1162

Presentation Time: Session 1: 9:00-10:00am

Probing Mass Transport in an Acoustically Levitated Droplet with Novel Electroanalytical Techniques

STEM

Authors(s):

Amber K Wang† (Science)

Abstract:

Studies at the multiphase interface provide essential knowledge of electrolytic species behaviors and interactions beyond the limitations of bulk setups. This research investigates how acoustic levitation influences mass transport mechanisms within a droplet, addressing an understudied area in electroanalytical chemistry with a unique interface. Using cyclic voltammetry on nanoelectrodes, we examined electrochemical processes at the isolated air-liquid interface under varying acoustic conditions. Our first study established the relationship between electrode depth and limiting current in a levitated electrolyte droplet. We then studied the effect of the acoustic field on the interface and mass transport by varying the acoustic levitation voltage. Results revealed that acoustic fields enhance the migration of electroactive species to the nanoelectrode surface through intrinsic factors. This provides fundamental knowledge on acoustic-driven mass transport, creating a precisely tunable system controlled by varying acoustic parameters. The observed results showing the relationship between acoustic field and electrolytic species demonstrate the unique advantages of studying mass transport in a containerless experimental platform, eliminating the need for solid surface contact and enabling microscale droplet exploration with more precision. Our findings have significant implications for enhancing non-contact electroanalytical methods, microvolume sampling techniques, and advanced sensor technologies that can benefit from the unique properties of an air-liquid isolated interface setup with potential applications in pharmaceutical analysis, environmental monitoring, and future studies of multiphase interactions.

Keywords:

Acoustic Levitation; Electrochemistry; Electrodes; Limiting Current; Mass Transport

Mentor(s):

Patrick James Herchenbach (Science); Lynn Elizabeth Krushinski (Science); Jeffrey Edward Dick (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1163

Presentation Time: Session 1: 9:00-10:00am

Structural characterization of sn-isomers of acidic phospholipids using mass spectrometry

STEM

Authors(s):

Haven Nicole Wilson† (Science)

Abstract:

Phosphatidylglycerol (PG) lipids are crucial components of cellular membranes and play a significant role in numerous biological pathways. Naturally occurring in biological systems as a mixture of isomers, these lipids have the same molecular formulas but differ in atom connectivity or spatial orientation of the acyl chains. It has been demonstrated that imbalances in lipid isomer abundances may be used for disease diagnostics. Conventional mass spectrometry (MS) techniques use accurate mass and tandem mass spectrometry (MS/MS) for lipid identification. However, many existing MS/MS techniques provide limited structural information about lipid regioisomers. This work focuses on the development of new strategies for the structural characterization of lipid isomers by integrating solution-phase derivatization with MS/MS. Specifically, we use complexation with manganese (Mn) cations for sn-isomer speciation through MS/MS in positive ionization mode. Using this approach, we have achieved relative sn-isomer quantification of PG lipids by analyzing fragment ions abundance ratios unique to Mn(II) adducts. Additionally, we employed a unique photochemical reaction to convert lipids to their respective hydroperoxides (LOOHs). MS/MS of PG-LOOHs in negative ionization mode generates diagnostic fragments of sn-isomers. The high sensitivity of this reaction allowed us to perform mass spectrometry imaging of mouse brain tissues to reveal unique spatial localizations of sn-isomers and perform their relative quantification. By accurately characterizing sn-isomer distributions of PG lipids, we can gain deeper insights into their role in both health and disease.

Keywords:

Phosphatidylglycerol (PG) Lipids; Mass Spectrometry; Lipid Structure Characterization; Disease Biomarkers; Manganese (Mn) Complexation

Mentor(s):

Sara Mohamed Amer (Science)

Other Acknowledgement(s):
Julia Laskin (Purdue University)

Poster Presentation Abstract Number: 1164

Presentation Time: Session 1: 9:00-10:00am

A Longitudinal Analysis of Developmental Changes in Twitch Patterning during REM Sleep

STEM

Authors(s):

Claire Wolfer-Jenkins† (Science|JMHC)

Abstract:

Sensorimotor development allows infants to gradually learn how to effectively move their body within their surrounding environment. This entails a cyclic process involving neural activity, motor output, and sensory feedback. This process mostly takes place during REM sleep, with the motor output being self-generated, spontaneous movement called twitches. These twitches are key, observable components of sensorimotor development that can help us understand underlying circuitry. Despite this, there are limited studies on the production and patterning of twitches across infancy. My project aims to expand upon research related to twitch patterning standards in infant rats during REM sleep by examining twitches on a macroscale and longitudinally.

In this study, infant rats (n=8) at postnatal day 5 (P5) and postnatal day 12 (P12) are utilized. Sleep is recorded using high-speed video. Behavioral scoring of videos is implemented to classify periods of sleep and a deep learning software (DeepLabCut) tracks limb coordinates. Twitches during sleep are then identified based on calculated limb displacement and analyzed for patterns, including inter-twitch intervals (ITI) and inter-limb associations. Additionally, a machine learning model is being created to help automate twitch scoring. We found differences in the patterning of twitches across the ages studied. The median ITI intervals were higher in P12 rats compared to P5 rats. Preliminary analysis of the inter-limb associations suggest a similar, but not identical, anterior to posterior pattern of twitches.

Keywords:

REM Sleep; Sensorimotor Development; Developmental Neuroscience

Mentor(s):

Jimmy Dooley (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1165

Presentation Time: Session 1: 9:00-10:00am

Detecting SARS-CoV-2, CPV, and CDV in River Otters Using qPCR

STEM

Authors(s):

Jonica Lynn Wooton† (Agriculture|JMHC)

Abstract:

Interspecies transmission of infectious diseases may adversely impact both human and animal health. Therefore, collecting samples from species in habitats that may have human interaction may reveal insights into the prevalence of viral pathogens. River otters may be susceptible to SARS-CoV-2 infection from other wildlife species or humans. Additionally, otters may be vulnerable to transmission of Canine distemper virus (CDV) and Canine parvovirus (CPV) from other carnivores, such as dogs. We hypothesize that SARS-CoV-2, CDV, and CPV will be present in North American river otters (L. canadensis), with prevalence associated with human proximity. Due to nucleic acid composition, the prevalence of these viruses may vary during detection using qPCR. Furthermore, we expect that the prevalence of RNA viruses, SARS-CoV-2, and CDV, will be lower than the DNA virus CDV due to the elevated risk of RNA degradation across samples. To test these hypotheses, nasopharyngeal swabs were collected from over 600 river otters throughout Indiana during 2024 to test for SARS-CoV-2, CDV, and CPV using RT-qPCR. To do this, DNA and RNA were extracted from swabs, and pathogen-specific primers and fluorescent probes were used to detect each pathogen target. Testing of the viral detection assays is in progress, however, no otter samples have yet tested positive for SARS-CoV-2, CDV, or CPV. The absence of viral detection may indicate issues with the method of sample collection, transport, and active infection status of sampled otter populations at collection. Further investigation is being conducted to validate these findings.

Keywords:

[no keywords provided]

Mentor(s):

Jonathan Pasternak (Purdue University); Sarah M Innis (Purdue University)

Other Acknowledgement(s):
Griffin Broviak (Agriculture); Patrick A Zollner (Purdue University)

Poster Presentation Abstract Number: 1166

Presentation Time: Session 1: 9:00-10:00am

Enhancing Lipid Signal and Coverage in Positive Mode ESI-MS using Charged Chemical Derivatives

STEM

Authors(s):

Jenna J Wu† (Pharmacy)

Abstract:

The detection of low-abundance analytes in complex biological samples presents an ongoing challenge in mass spectrometry (MS). One of the common strategies for enhancing the sensitivity of certain classes is through chemical derivatization of the analytes of interest. In this work, we evaluated the effects of two derivatization agents, AMP+ and Girard T, on the improvement of lipid signals in electrospray ionization (ESI) by formation of positively charged chemical derivatives. A mixture of eicosanoids, fatty acids, and amino acids that are commonly ionized in the negative mode was derivatized with each agent and analyzed in the positive modes using ESI-MS. The use of this derivatization strategy allowed for the analysis of weakly acidic analytes without the need to switch modes, providing broader coverage of the biological analytes. Tandem-MS analysis was conducted to confirm identity of the derivatized products, with both agents enhancing signals for target molecules in the positive mode. These findings stress the potential of derivation agents in improving ionization efficiency for comprehensive mass spectrometry analysis of complex biological samples.

Keywords:

[no keywords provided]

Mentor(s):

Syeda Nazifa Wali (Science); Julia Laskin (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1167

Presentation Time: Session 1: 9:00-10:00am

Hybrid Green Hydrogen & Small Module Reactor Technologies for Sustainable Mining

STEM

Authors(s):

Maxim Nickolas Yamilov† (Engineering); Olivia Chen† (Engineering); Marina Mercedes San Martin Rossano† (Engineering); Abdullah Alkazemi† (Engineering); Gowri Ravikumar Bajagur‡ (Engineering); Isaac Yan Shek Cheng‡ (Engineering); Atandrila Chowdhury‡ (Engineering); Jayee Goh‡ (Engineering); James Burrell Hewette‡ (Engineering); Patricia Ewa Leoniuk‡ (Engineering); Saanvi Mahesh‡ (Engineering); Cam Nguyen‡ (Engineering); Jijnasu Prakash Rout‡ (Engineering); Shashank Varamballi‡ (Engineering); Kaylie Emerson Virkus‡ (Engineering)

Abstract:

The main goal of this project is to evaluate a sustainable mining solution based on the integration of advanced Small Modular Reactors (SMRs) with renewable energy systems for production of green hydrogen and to power operations in remote copper mining locations in Chile and Peru. The advanced SMRs are considered efficient low-emission energy sources, that generate electricity in a safe and more energy efficient manner making them more reliable compared to other traditional nuclear fission reactors. This study analyzes implementation of a gas turbine model TM2500 (60Hz) and the Xe-100 SMR for the Crystal Copper Mining project in northern Chile. An online emissions calculator provided by GE Vernova is used to obtain data for the selected gas turbine model, obtaining key data such as infrastructure requirements on electrical output and water supply, hydrogen flow rate, the potential CO2 savings in taxes (USD), and emissions (g/kWh). This data is then used to analyze and compare the financial pressures incurred from the implementation of the SMR. After obtaining key data from both cross-referenced online sources and GE Vernova's calculator(s), the HOMER Pro microgrid optimization software is used to create clear visuals to display different combinations of data, as well as to determine the most efficient combinations. The visual infographs show functionality cycles for the different parts of the SMR and other clean energy combinations, how these combinations vary by location of the mining site, as well as cost and ROI metrics.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
SMR; Sustainable; Small Modular Reactor; Mining; Green Hydrogen

Mentor(s):
John W Sheffield (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1168

Presentation Time: Session 1: 9:00-10:00am

Tracking Cognitive Strategies using EEG signals

STEM

Authors(s):

Peter Zakariya† (Science)

Abstract:

While participants perform cognitive tasks, simultaneous electroencephalography (EEG) recordings enable us to examine abstract representations in the human brain. We are specifically looking into decoding non-sensory statistical information—such as the switch likelihood associated with an image—which could be strategically used to enhance cognitive flexibility and reduce the behavioral costs of task-switching. Moving beyond traditional EEG analysis that examines activity from individual electrodes across time, we leverage support vector machine (SVM) models to decode patterns from multiple electrodes. By training this model separately at different time points and employing cluster-based permutation tests, we are able to show that decoding accuracy peaks approximately 100 ms to 200 ms after stimulus onset—much earlier than what traditional methods have identified. Furthermore, by examining feature importance weights, we identify areas of the brain that play a key role in representing switch likelihood information. Lastly, we also find cross-subject generalization, indicating that multivariate EEG patterns reliably capture abstract representations at the population level. This project lays the groundwork for understanding how humans utilize probabilistic information to enhance cognitive flexibility.

Keywords:

EEG Analysis; Cognitive Strategies; Machine Learning

Mentor(s):

Yu-Chin Chiu (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1169

Presentation Time: Session 1: 9:00-10:00am

Investigating the mediating effects of ESG for corporate equity and financial performance in specific levels: A case study of China's A-share listed companies

Business Case Study

Authors(s):

Yuhang Zhai† (Agriculture); Runjie Wu† (Agriculture)

Abstract:

In this study, we explore the mediating effect of Environmental, Social, and Governance (ESG) on the relationship between the concentration of corporate equity and corporate financial performance, using a sample of financial data of China's A-share listed companies. The objective is to analyze how ESG behaves as a mediator at different levels of equity concentration, so that we can provide insight into how companies with varying equity concentrations can optimize ESG to enhance their financial performance. Using a mediating analysis with a fixed-effects higher-order panel data regression, and controlling for company size, leverage rate, and OCFA, we find that ESG has a significantly positive mediating effect when corporate equity concentration is greater than approximately 45 percent. These findings highlight that a company with a more concentrated equity structure should take ESG into their long-term strategy. That is, the positive mediating effect of ESG can be harnessed by the company to enhance their financial performance. This study provides practical implications for investors and managers of these companies as well, and stresses the importance of sustainability practices with specific equity structures.

Keywords:

ESG; Mediation Effect; Corporate Equity Concentration; Corporate Financial Performance; China's A-share Listed Companies

Mentor(s):

Michael S Delgado (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1170

Presentation Time: Session 1: 9:00-10:00am

Adult Intelligibility Ratings of Preschoolers With and Without Speech Sound Disorders

STEM

Authors(s):

Zoe Zhang† (HHS|JMHC); Jillian Grace Robbins† (HHS); Lauren Mae Hammond† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

Speech Sound Disorder; Intelligibility; Bilingualism; Children

Mentor(s):

Francoise Brosseau-Lapre (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1171
Presentation Time: STEW N/A at N/A

Fiber Length Analysis of Recycled Polymeric Composites

STEM

Authors(s):
Benjamin Leon Spergel† (Engineering)

Abstract:
The increasing use of fiber-reinforced polymer (FRP) composites in automotive and industrial applications is driven by their lightweight properties, which improve fuel efficiency and performance. However, recycling these materials presents challenges, particularly in maintaining fiber length, a critical factor in preserving mechanical properties. Repeated processing cycles often lead to fiber shortening, reducing the strength and durability of recycled composites. This research analyzes fiber length distribution in recycled glass fiber-reinforced polypropylene composites across different processing configurations and rounds of recycling. Using a burn-off process, fibers are separated and analyzed through microscopy and image analysis software to quantify fiber degradation. Additionally, the study evaluates the impact of adding virgin material and chopped preform on fiber length retention, with the goal of achieving a consistent fiber length distribution across recycling cycles to maintain mechanical performance. The expected results suggest that fiber length will progressively decrease with each recycling cycle, leading to a decline in mechanical performance. This research aims to provide valuable insights into improving recycling strategies for FRP composites, leading to more efficient and environmentally sustainable reuse in high-performance applications.

Keywords:
Composite; Fiber Length; Recycling

Mentor(s):
Alyson S Pickering (Engineering)

Other Acknowledgement(s):
Jan-Anders E Mansson (Purdue University)

Poster Presentation Abstract Number: 1200

Presentation Time: Session 2: 10:30-11:30am

CAR-Macrophage engineering to treat immunologically cold breast cancer in VNP20009 bacteria-enhanced immunotherapy

STEM

Authors(s):

Hannah Faith Abdon† (HHS|JMHC); Abigail Wang Schroeder‡ (HHS)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Sung-Jin Kim (Purdue University); Hyunsup Han (HHS); Qiuhong He (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1201

Presentation Time: Session 2: 10:30-11:30am

Bacteriophage Skitty: A Comparative Study Between the MicroProtein Gene 73 and Defined Gene 56

STEM

Authors(s):

Leilani Grace Agngarayngay† (Agriculture|Engineering); Julia Lauren Marino† (Agriculture|Engineering|JMHC); Samhita Mysore Shantharam† (Agriculture|Engineering|JMHC); Alexis Lucille Ador Bernal† (Agriculture|Engineering)

Abstract:

Bacteriophages are viruses that infect bacterial cells; they constitute useful applications within genetic engineering, biotechnology, and pharmaceuticals. Microproteins are compact proteins encoded from small open reading frames (ORF) and are often disregarded by automatic bacteriophage gene annotation programs such as GeneMark and Glimmer. Within arthrobacteriophage Skitty, this project investigates differences between gene 56 and the previously deleted gene 73 and auto-annotation programs' failure to identify microprotein functions. NCBI, MiPFinder, AlphaFold, HHPred and STRING programs were utilized for genome annotation of selected gene 73 and a defined control gene. NCBI and HHPred allowed for comparison within the protein domain homology, AlphaFold allowed for visualization of gene 73, MiPFinder allowed for function identification, and the STRING database permitted prediction of protein-protein interactions. By the comparison of genes 56 and 73 within Skitty's genome, it was found that additional analysis programs can permit hypothetical protein gene function identification. The use of the programs to successfully identify hypothetical protein function calls can lead to future bacteriophage research, as well as improvement of the genome annotation process. From the data presented by the auto-annotation programs, the previously discarded gene 73 gathered enough evidence to be considered a microprotein. Due to the gap within bacteriophage and genome annotation databases, further analysis to verify the function and structure of this microprotein would involve wet lab procedures such as affinity purifications, mass spectrometry analysis, and protein-protein interaction assays.

Keywords:

Bacteriophage; MicroProtein; Protein-Protein Interactions; Biotechnology

Mentor(s):
Kari L Clase (Purdue University); Julia Ann Simler (Agriculture)

Other Acknowledgement(s):
Opeyemi Samuel Oduniyi (Agriculture); Marcelo Inaki I Guerrero Montalvan (Agriculture)

Poster Presentation Abstract Number: 1202

Presentation Time: Session 2: 10:30-11:30am

SoCET I2C Controller Design

STEM

Authors(s):

Fatma Mohamed Ahmed Youssef Alagroudy† (Engineering); Yara Ahmed Mohamed Abbas† (Engineering)

Abstract:

The goal of this project is to integrate an I2C controller into the AFTx08 chip, a custom RISC-V based microcontroller developed by SoCET. I2C (Inter-Integrated Circuit) is a serial communication protocol that enables short-distance communication between devices. The controller will support key protocol features, including multi-master communication, allowing multiple devices (up to 128) to initiate data transfer and receive data.

To validate the design, the controller will be tested and prototyped using FPGA emulation, enabling real-world communication with other devices. The implementation process involves several critical steps, including designing the top-level architecture and its subcomponents, RTL design of the I2C subsystem, FPGA-based validation, and design flow analysis to evaluate power, area, and timing metrics, ensuring compatibility with future tape outs. These efforts aim to deliver a robust, efficient, and scalable I2C controller for integration into the AFTx08 System on Chip.

Keywords:

SoCET; I2C; FPGA Validation; Serial Communication Protocol; Digital Design

Mentor(s):

Cole Aaron Nelson (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1203

Presentation Time: Session 2: 10:30-11:30am

Mechanisms of tuning cytotoxic T cell activation via artificial triggering

STEM

Authors(s):

Alex James Alonzo† (Science|JMHC)

Abstract:

Cytotoxic T cells are key mediators of adaptive immunity with the capacity to secrete molecules to directly eliminate target cells. Artificial triggering of T cell receptors (TCRs) has enabled retargeting this killing capacity toward designated ‘prey’ cells such as tumors. Chemically self-assembling nanorings (CSANs) have been used to actuate the CD3 or alpha/beta subunits of the TCR via mechanical triggering induced by crosslinking with tumor-associated antigenic (TAA) markers. We focus on EGFR as a prototypical TAA in breast, ovarian, and non-small cell lung cancers. Interestingly, CSANs pulling on different components of the TCR, in this context, give rise to differential killing outcomes. The mechanistic underpinnings for these differences could provide tunable levers to control T cell activation during tumor evolution. Specifically, I focus on visualizing and measuring differences in membrane-proximal signaling by the TCR and downstream activation markers of cytokine secretion. I use a membrane mimic with EGFR to simulate tumor cells and CSANs to bind respective subunits of the TCR. Microscopy, using a membrane-selective imaging technique, total internal reflection fluorescence microscopy, with fluorescent molecules to track activation markers, provides access to single cell behaviors across the T cell population. These methods will elucidate how artificial triggering of the TCR results in differential activation. Tuning cytotoxicity using CSANs serves as a promising direction in improving T cell therapeutics.

Keywords:

T Cell; Immunotherapy; TIRF; Reconstitution; Single Cell Imaging

Mentor(s):

Joy Wu (Science); Shalini T Low-Nam (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1204

Presentation Time: Session 2: 10:30-11:30am

The role of weeds as a non-crop habitat for aphid pests in high tunnel systems

STEM

Authors(s):

Isabela I Arias† (Agriculture)

Abstract:

High tunnels have become an increasingly common tool on specialty crop farms in Indiana and throughout temperate regions. Their structure protects crops against the elements while capturing solar radiation to maintain higher temperatures to facilitate winter and spring crop production. However, the environment within the high tunnel provides conditions that are ideal for soft-bodied pests, such as aphids, leading to higher populations on high tunnel crops compared to the open-field. Aphids are a diverse group of insects that vector plant diseases and secrete a sugary substance called ‘honeydew’ that can drop on leaves and fruit, harboring sooty mold growth that reduces crop marketability. Our research investigated the species complex and host association of aphids in high tunnels. Data on aphid species and abundance on crops and weeds was collected from more than 15 farms across Indiana during the months of December-April across two growing seasons. Myzus perisciae, or the green peach aphid, was and was found on a wide variety of crops and weeds. 'Macrosiphum pallidum', or wild rose aphid, was also a common aphid species found on cut flowers but appeared to prefer the weed species Lamium amplexicaule “henbit deadnettle” as a non-crop habitat. This study provides information regarding the role of non-crop weeds on aphid dynamics in a high tunnel cropping system, allowing farmers to determine pest risk, and potential alternative prey for beneficial insects and supports targeted weed management to reduce aphid pest pressures.

Keywords:

Insect Biology; Weed Science; IPM; Biology; Taxonomy

Mentor(s):

Laura L Ingwell (Purdue University); Samantha Willden (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1205

Presentation Time: Session 2: 10:30-11:30am

Risk, Reward, and Frustration: What Drives Decision-Making?

Social Science

Authors(s):

Maria Paula Armenta† (HHS)

Abstract:

This study examined how frustration impacts decision-making, specifically in relation to loss aversion, a key concept from Prospect Theory. Loss aversion, as described by Kahneman and Tversky, shows that people experience the pain of losses more strongly than the satisfaction of equal gains, and these losses can often lead to frustration. While extensively researched, the interaction between frustration and loss aversion remains less understood, particularly in risk-taking behaviors. This study explored whether individuals take greater risks to avoid losses or to minimize frustration, and which factor is more aversive in decision-making. One hundred sixty participants were randomly assigned to either a gain group, where they could accumulate points, or a loss group, where they started with points and lost them based on performance. Participants completed 108 trials involving easy and difficult tasks which required precise timing to stop a stopwatch at three seconds. Feedback on points and performance was provided after each trial, and frustration levels were recorded at the end of the experiment. Results showed that frustration levels were significantly higher in the loss group. Initially, participants in the loss group chose the difficult task more frequently, but their risk-taking declined over time. In contrast, the gain group had a more stable patter across all trials. These findings suggest that frustration may be a stronger motivator in decision-making than loss aversion, as participants appeared to shift strategies primarily to reduce frustration rather than to prevent further losses.

Keywords:

Frustration; Decision-Making; Task Difficulty; Risk-Taking Behavior

Mentor(s):

Sebastien Helie (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1206

Presentation Time: Session 2: 10:30-11:30am

Enhancing Data Efficiency in 3D Nuclei Segmentation for Light Sheet Microscopy Data using Deep Learning

STEM

Authors(s):

Velan Arunmozhi† (Science); Ian Kwan Yin Lam‡ (Science)

Abstract:

In zebrafish embryos, analyzing nuclei position and specific protein level is crucial for studying cell behavior and gene regulation, but traditional image processing methods struggle with accuracy and generalizability. To address this, we previously developed NISNet3D (3D Nuclei Instance Segmentation Network), a neural network-based 3D nuclei segmentation package. However, due to large 3D image volume and GPU memory limitations, this model can not process high-resolution, large-volume images created by a light sheet microscopy. This research seeks to address these data challenges. First, the data will be preprocessed by downsizing the image's resolution and cropping it into sub-volumes for NISNet3D to process. These sub-volumes will be small enough for the model to use as inputs. The output images will then be stitched back together and upscaled to its original dimensions. Metrics will be calculated to quantify the differences between the output and expected results. A prototype of this modified pipeline will be first tested with a sample embryo to evaluate its effectiveness. This strategy is expected to enhance data handling, reduce storage requirements, and preserve segmentation accuracy. The model's output can also help image data analysis and quantification for other extensive volume organism data.

Keywords:

[no keywords provided]

Mentor(s):

Linlin Li (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1207

Presentation Time: Session 2: 10:30-11:30am

Exploration of the Intersection of Mental Health and Lifestyle Factors Hartford city, IN

STEM

Authors(s):

Tamia A Austin† (HHS); Hannah Ashley Bard* (HHS)

Abstract:

Mental health is essential for overall well-being. Mental health was identified as a concern among the citizens in Hartford City, IN. In response, here we conducted a cross-sectional study that examines the association between marital status, self-reported mental health, and health behaviors among 284 Blackford County adults. We conducted a survey, including demographics, marital status, current and prior mental health, and substance use. Participants reported their health status using a Likert scale. Microsoft Excel was used for data analysis; descriptive statistics, and Pearson's chi-square tests were used to assess associations. Marital status was significantly associated with self-reported general mental health ($?^2 = 24.114$, $p = 0.019$); but not with mental health 12 months ago. Current fair/poor health was reported among 2/36 widowed individuals (N=2; 5.6%), 26/147 married (N=26; 17.7%), living with a partner 5/13 (38.5%), single 11/41 (26.8%), and divorced 11/45 (24.4%). Although no significant associations were found between marital status and overall substance use, the relationship between cigarette usage and marital status approached statistical significance ($Chi^2 = 9.06$, $p = 0.0596$). Mental health outcomes varied by marital status, with individuals living with a partner being the most likely to report fair/poor mental health. Cigarette usage exhibited a near-significant association with marital status, warranting further investigation. Future research could explore additional demographic and social determinants affecting mental health.

Keywords:

[no keywords provided]

Mentor(s):

Ellen M Wells (Purdue University)

Other Acknowledgement(s):

Edem Fabrice Sededji (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1208

Presentation Time: Session 2: 10:30-11:30am

Metal-Insulator-Metal Capacitor Manufacturing and Design

STEM

Authors(s):

Dilay Aygun† (Engineering); Ryan Prado Bailey† (Engineering|JMHC); Charlita Sinmak† (Engineering); Matyas Kubon† (Engineering); Laksh Nagpal† (Engineering); Ashwin Amit Parab† (Engineering)

Abstract:

Metal-Insulator-Metal (MIM) capacitors are extensively utilized in Integrated Circuits (ICs), particularly in Radio Frequency (RF) and analog applications due to their stability and high capacitance density. This research focuses on the fabrication and characterization of parallel plate MIM capacitors using advanced nanofabrication techniques, with an emphasis on Statistical Process Control (SPC). SPC refers to measurements of controlled variations in critical parameters of a process flow and the subsequent employment of statistical methods to optimize both yield and quality of microelectronics manufacturing processes.

The capacitors are fabricated on a total of 8 identical 4-inch silicon wafers, each containing 5 evenly spaced arrays of capacitors with varying dimensions. The material stack consists of a Ti/Ni bottom electrode, HfO2 insulating dielectric layer, and a Ti/Al top electrode. The fabrication process involves Physical Vapor Deposition (PVD) for deposition of metal layers, Atomic Layer Deposition (ALD) for deposition of the dielectric layer, photolithography for patterning, and dry etching for structuring. SPC data is collected on metal and oxide film thickness, and electrical properties of the manufactured capacitors using a P7 profilometer, F40-UV thickness measurement instrument, and a manually operated probing station.

Through SPC, this research aims to analyze the impact of varying MIM capacitor dimensions on the capacitance while simultaneously examining variations in film thicknesses and step heights throughout the manufacturing processes. By identifying process abnormalities, such as extreme surface layer roughness or excessive leakage currents, and improving manufacturing consistency, the team aims to minimize within-wafer and batch-to-batch deviations, ensuring more reliable production.

Keywords:

M-I-M; Nanofabrication; Capacitors; SPC; Cleanroom

Mentor(s):
Zhihong Chen (Purdue University); Joerg Appenzeller (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1209

Presentation Time: Session 2: 10:30-11:30am

"Looking for friends...:" A Case Study of the Grooming Strategies and Victim Responses for one Offender and 500 Potential Victims

STEM

Authors(s):

Brycen Jesse Baldwin† (Polytechnic); Caroline Marie Sponhauer† (Liberal Arts)

Abstract:

[Abstract Redacted]

Keywords:

Internet Grooming; Child Sex Offenders; Social Media; High-Risk Behaviors; Self-Disclosures

Mentor(s):

Kathryn Seigfried-Spellar (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1210

Presentation Time: Session 2: 10:30-11:30am

Developing an MRI Compatible Loading Device for Real Time Mapping of Cortical Bone Mechanical Properties via UTE-MRI

STEM

Authors(s):

Grant Andrew Belush† (Engineering|JMHC)

Abstract:

Understanding the mechanical properties of bones is critical for early detection of fracture risk. Analysis of water and collagen content in bones using ultrashort echo time (UTE) magnetic resonance imaging (MRI) has been proposed to estimate bone strength and detect fracture risk before traditional methods, such as measuring bone mineral density using dual-energy X-ray absorptiometry (DXA) scans. However, there is currently no way to map bone strain in vivo, so fracture prediction is difficult. This research aims to utilize UTE-MRI to map strain in bones under load in real time. This will provide information about how the bone reacts to loads and improve fracture risk detection. An MRI safe device will be developed to apply loads to the tibia of a rat in vivo. The device will fit within the MRI scanner and load the bone while MRI images of the bone are acquired. Then, the MRI data will be analyzed using tools from the MATLAB Image Analysis Library to map strain within the bone. This data will provide a clearer understanding of how the bone reacts to different loads and help to identify critical regions of high strain within the bone. Additionally, the ability to map strain in real time should allow for earlier detection of fracture risk in patients.

Keywords:

Bone Mechanical Properties; UTE-MRI; Strain Mapping

Mentor(s):

Peter Asiwaju Olayooye (Engineering); Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1211

Presentation Time: Session 2: 10:30-11:30am

A Genomic Analysis of Global House Dust Mite Allergen Diversit

STEM

Authors(s):

Sarah M Bennett† (Science|JMHC)

Abstract:

Pyroglyphid house dust mites are a prevalent source of indoor allergens and are found globally, affecting about 30% of the world population. Although currently a number of allergens have been discovered in three house dust species, for which genomic data are available, the global diversity of allergen groups is unknown. Our study has sequenced genomes of 52 species of house dust mites to deduce genes encoding thirty-eight allergen groups and analyze global allergen diversity. The DNA samples come from mite colonies collected globally in North America, South America, the Caribbean, Europe, Southeast Asia, Africa, Australia, and New Zealand. DNA was extracted using the ultra-low input DNA methodology; 52 Illumina libraries were generated to get 52 mite species at a coverage of 40-100x for each sample (1-10 mite individuals). To inf er allergen encoding genes, the sequence data was mapped using three genomic reference sequences with gene boundaries confirmed by transcriptomic data. One of the references was generated by us using advanced gene prediction frameworks. Our annotated genomes will be deposited into GenBank. Our project provided high-quality gene models confirmed by transcriptomic evidence for the complete set of allergens for 52 species of house dust mites and their relatives. This will allow for better understanding of the allergy sensitization patterns and will improve allergy vaccine therapies, which will account for the actual diversity of house dust allergens at a global scale.

Keywords:

House-Dust Mites; Allergens; Genomic Sequencing

Mentor(s):

Qixin He (Purdue University); Pavel Borisovich Klimov (Purdue University)

Other Acknowledgement(s):

Bradley Keith Broyles (Science)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1212

Presentation Time: Session 2: 10:30-11:30am

Lift Analysis on Diamond-Shaped Airfoils in Supersonic Free-Stream Velocities

STEM

Authors(s):

Tanuj Bhat† (Engineering); Krish Samir Mehta† (Engineering); Tanush Ashok† (Engineering); Edward X Sun† (Engineering|JMHC); Arjun Aneja† (Engineering)

Abstract:

The study of diamond airfoils in supersonic flow is critical to aerospace engineering, particularly in the design of high-speed aircraft, missiles, and spaceplanes. Understanding how lift varies with geometric parameters at various supersonic free-stream velocities allows a better understanding of how to improve performance in such applications. This research investigates the lift characteristics of a diamond airfoil in supersonic flow by comparing calculated lift values from theoretical equations, computational fluid dynamics (CFD) simulations, and experimental wind tunnel testing. Multiple diamond airfoils with the same general geometry will be tested, varying in only the geometric internal angle to assess their effects on lift generation. A key objective is to determine whether force balance is maintained, providing insight into the reliability of theoretical and computational models in supersonic regimes. Additionally, this research analyzes shockwave behavior around the diamond airfoil, focusing on the expansion fan generated at the top corner and the shocks formed at the front and rear tips. We will be measuring the angle that these expansion fans form with the diamond airfoil at various velocities. Experimental testing will be conducted in a supersonic wind tunnel, utilizing schlieren imaging to visualize shockwave angles and compare them with theoretical predictions. By integrating empirical, numerical, and experimental approaches, this study enhances the understanding of high-speed aerodynamics and contributes to the advancement of supersonic vehicle design.

Keywords:

Supersonics; Aerodynamics; Wind Tunnel; Diamond Airfoil; Schlieren Imaging

Mentor(s):

Curtis Earl Marshall (Purdue University); Brandon C Chynoweth (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1213

Presentation Time: Session 2: 10:30-11:30am

Headed rebars vs. headed studs for precast concrete connections

STEM

Authors(s):

Sanath Bhavankar† (Engineering|JMHC); Nickolas Koe* (Engineering); Hamond Rahardjo* (Engineering)

Abstract:

Anchorages are used frequently in reinforced concrete structures to connect structural steel elements to concrete structural elements. In current version of design codes, that governs construction rules and regulations, two versions of anchorages are allowed which includes headed smooth studs and headed rebar studs. The primary difference between the two configurations is the smoothness of the anchors. As per the current design codes, both the versions are equivalent, i.e., both the versions will have the same load capacity. However, no experimental study has been conducted to validate this hypothesis. In this project, both configurations of headed rebars and headed studs are compared experimentally in terms of total capacity and stiffness. A total of 36 tension tests will be conducted to understand the influence of various parameters like depth of studs, proximity to an edge, effect of asymmetric loading, etc. on the total capacity of anchors. The results will be utilized to update the current design codes, making them accurate and safer.

Keywords:

Anchorages; Design Codes; Asymmetric Loading; Reinforced Concrete; Headed Studs

Mentor(s):

Deepak Suthar (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1214
Presentation Time: Session 2: 10:30-11:30am

The Effect of Diet on Social Behavior in Mantled Howler (Alouatta paliatta) and Spider Monkeys (Ateles geoffroyi)

STEM

Authors(s):
Elaina Caroline Bowlds† (Liberal Arts)

Abstract:
Differences in diet between folivorous and frugivorous primates may influence social dynamics, particularly time allocated to social interactions. This study examines how dietary strategies shape social interactions in wild howler monkeys (Alouatta palliata) and spider monkeys (Ateles geoffroyi), two species with distinct feeding ecologies and social structures. Conducted at the La Suerte Biological Field Station in Costa Rica over a six-day period in January 2025, this research investigates differences in activity budgets and nearest-neighbor proximity to understand how diet impacts social behavior. It was hypothesized that spider monkeys, due to their frugivorous diet and fission-fusion social system, would exhibit greater variability in spacing and higher levels of social behavior than the more folivorous howler monkeys, which form more cohesive groups. Behavioral data were collected using 20-minute focal samples, recording activity states and social proximity. The results indicate that while both species exhibited low overall rates of social behavior, their activity budgets differed significantly. Howler monkeys spent more time resting, likely due to the energetic constraints of a leaf-based diet, whereas spider monkeys allocated more time to feeding and travel. Nearest-neighbor data further revealed that howler monkeys maintained closer proximity to group members, while spider monkeys were more frequently observed at greater distances or out of sight. These findings support the hypothesis that dietary strategies are a driving force of primate sociality. This study highlights the importance of spatial relationships as an important measure of social interactions. Future research should examine how seasonal fluctuations in food availability influence social proximity patterns.

Keywords:
[no keywords provided]

Mentor(s):
Stacy Lindshield (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1215

Presentation Time: Session 2: 10:30-11:30am

The Isolation of a Novel Cystobasidium sp. Using a Differential Density Centrifugation Method

STEM

Authors(s):

Brieana Elise Branton† (Agriculture)

Abstract:

Lichens are complex life forms that result from a symbiotic partnership between a filamentous fungus, called the mycobiont, and a photosynthesizing alga, called the photobiont. We hypothesized that yeast species, unrelated to the mycobiont, are also closely associated with the algal layer of lichens. Therefore, this research aims to isolate lichen-associated yeast species by evaluating and modifying an existing differential density centrifugation method. To separate yeasts from lichens, we followed a method similar to that described in the paper “An Improved Method for the Separation of Lichen Symbionts”, with modifications to isolate yeasts from the centrifugation process rather than algal cells and filamentous fungi. Dry lichen samples were rinsed and soaked in distilled water to remove contaminants. The samples were then crushed and centrifuged multiple times over 80% potassium iodide to separate hyphal fungi from algal cells. Samples were pipetted from around the algal layer, which formed near the 5 mL mark in the centrifugation tubes, in an attempt to isolate yeasts. Preliminary observations indicate that this method successfully separates different yeast types from lichens. Current molecular work also suggests that this method has isolated a novel Cystobasidium species. Morphological, physiological, and molecular characterization of this novel species is ongoing. This research is significant because existing methods for separating algal cells and yeasts are unreliable, and developing a more effective technique will facilitate greater species discovery.

Keywords:

Lichens; Cystobasidium; Centrifugation; Yeast

Mentor(s):

Daniel B Raudabaugh (Purdue University); Mary Aime (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1216

Presentation Time: Session 2: 10:30-11:30am

Isolating Bryophyte-Associated Fungi and Assessing Their Pathogenic Potential

STEM

Authors(s):

Josephine Capwell Brigham† (Agriculture)

Abstract:

[Abstract Redacted]

Keywords:

Moss; Ecology

Mentor(s):

Daniel B Raudabaugh (Purdue University)

Other Acknowledgement(s):

Mary Aime (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1217

Presentation Time: Session 2: 10:30-11:30am

Person Over Product: Prioritizing Customer Relations Over Product Knowledge Ensures Business Longevity

Social Science

Authors(s):

Sarah Grace Burris† (Exploratory Studies|Other)

Abstract:

[Abstract Redacted]

Keywords:

Customer; Product; Relations; Connection; Sales

Mentor(s):

Catherine Jean Shukle (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1218

Presentation Time: Session 2: 10:30-11:30am

Using Music Therapy to Uncover Asian/American Teen Archetypes

Social Science

Authors(s):

Gael Calderon Sermeno† (HHS); Michelle Wan† (HHS); Reese Caroline Pinkley‡ (HHS); Ana Elena Pasi Rojas* (HHS)

Abstract:

Music therapy was developed to help people with trauma. It has been found to improve levels of depression and anxiety. Since COVID-19, music therapists have embraced telemedicine, allowing more individuals to access therapy non-traditionally. Research indicates that telemedicine effectively delivers music therapy and removes a critical barrier for adolescents seeking therapy. In our study, we used music therapy in a novel way - by having adolescents focus on their identity to express who they were, who they are, and who they will be. This non-traditional therapy is perfect for the Asian/ American community, who have a stigma around therapy. In this presentation, I will explain our approach to music therapy and how it differs from traditional music therapy. I will explain our approach and the findings of this study, which are individual archetypes for each teen, and introduce the similarities and differences between these archetypes.

Keywords:

CIAB; Teen Health; Asian/American; Rural

Mentor(s):

Stewart C Chang Alexander (Purdue University); Pamela Sari (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1219

Presentation Time: Session 2: 10:30-11:30am

System-on-Chip Verification - Applying UVM to Verify RTL Designs

STEM

Authors(s):

Siddarth Balaji Calidas† (Engineering); Andrew James Larkins† (Engineering)

Abstract:

System-on-Chip Extension Technology (SoCET) is a research team within the school of Electrical and Computer Engineering (ECE) which focuses on giving students hands on experience with the full process of bringing up a system-on-chip (SoC). The SoC design workflow consists first of implementing a design for a certain module in a hardware description language (HDL), such as SystemVerilog. HDLs allow chip designers to write code that models the functionality of a digital circuit. These design implementations must be verified thoroughly to avoid manufacturing defective chips – a costly mistake. All aspects of the chip's designs must be tested by probing a simulated module with sample inputs and ensuring the outputs match what was expected. By using test stimuli that cover the entire design, engineers can be confident the implementation is correct. The SoCET verification team utilizes the Universal Verification Methodology (UVM) framework to develop robust and reusable test benches for verifying HDL implementations. My project involves applying UVM to verify a digital general-purpose input/output (GPIO) multiplexer. This device will allow a single GPIO pin to take on multiple functions by internally controlling which of several signals are driven to it, thereby expanding the functionality of the limited set of GPIO pins on our microcontroller. Verification of this module involves planning test cases, implementing the testbench, writing all the test cases, and developing infrastructure to check if the input produced the expected output. My work, along with the rest of the SoCET verification team, will prevent any faulty parts from reaching tapeout.

Keywords:

Semiconductors; UVM; Chips; Verification

Mentor(s):

Vishnu Chaithanya Lagudu (Engineering); Isaac P Hagedorn (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1220

Presentation Time: Session 2: 10:30-11:30am

Decoding College Costs: How Are Rising Tuition Prices Shaping Access and Profit?

Social Science

Authors(s):

Rebecca Grace Caliendo† (DSB); Nayfa Johan† (DSB)

Abstract:

The popular narrative surrounding college tuition in the United States is rife with notions of outrageous prices and incessant escalation, but this perception of extortionate tuition demands is only partly true. A closer examination of tuition trends from 2008 to 2023, using data from the Integrated Postsecondary Education Data System (IPEDS), offers insight beyond the prevailing indictment. While sticker prices have risen faster than inflation, financial aid expansion has helped lower the actual cost of attendance—net price—relative to inflation. The simplest explanation is that high sticker prices often serve as a signal of quality and prestige, allowing institutions to engage in differential pricing. On average, for every $100 increase in sticker price, students receive $7 in additional aid at public institutions, and $29 at private institutions. By increasing tuition while offering targeted discounts, colleges have the opportunity to maximize revenue based on students' ability to pay. However, our review of Pell Grant participation shows that as sticker prices rise, the share of Pell-eligible students falls, suggesting that the most expensive schools are less accessible to low-income students. Public universities also use residency-based price discrimination to raise revenue, increasing out-of-state tuition at a faster rate while enrolling more out-of-state students. Taken together, these pricing strategies raise potential concerns about accessibility and equity in higher education.

Keywords:

Higher Education; College Costs; Tuition Trends; Financial Aid; Pricing Strategies

Mentor(s):

David L Hummels (Purdue University); Karis Pressler (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1221

Presentation Time: Session 2: 10:30-11:30am

SCALE HI-AP: Electromigration Failures in Cu-micro bumps with Sn-Ag solder caps

STEM

Authors(s):

Caroline Marie Cameron† (Engineering)

Abstract:

As computer chips become increasingly advanced, their designs grow more compact each year. This shrinkage of electrical components results in higher current density, which can lead to electromigration. Electromigration is the movement of atoms within a material caused by electrical current. At high current densities, the heat generated can displace atoms, forming ‘vacancies’ and ‘deposits.’ Over time, the expansion of vacancies can sever the circuit, resulting in an open-circuit, while the growth of deposits may create unintended connections, leading to short-circuits.

This research project is investigating the effect of electromigration on the time to failure of copper micro bumps with Sn-Ag caps interconnects at various temperatures. Pre-prepared samples are arranged in a daisy chain configuration with each sample containing over 50 copper pillars. Electromigration tests were performed by applying a current density of 4.21×104 A/cm2 to the copper pillar portion of the bumps while simultaneously measuring the resistance across the sample. Each test sample was run until either failure, or the circuit resistance increased by 20%. Testing was performed at both room temperature and 100°C to simulate normal operation temperatures.

Samples will next be polished and analyzed using a scanning electron microscope (SEM). Information gathered from the SEM will be used to explore potential failure sources and gain insights into how and when copper micro bumps with Sn-Ag solder caps fail under electromigration. Additional future testing will include measuring the time to failure of each sample to better understand the relationship between time to failure, temperature and current density.

Keywords:

Semiconductors

Mentor(s):

Shubhra Bansal (Purdue University); Jakob Isaiah Ramos (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Gabriella Maria Schr Torres (Centers & Institutes)

Poster Presentation Abstract Number: 1222

Presentation Time: Session 2: 10:30-11:30am

Multiphase Electrochemiluminescence Microscopy of Competitive Reactions

STEM

Authors(s):

Daniel Michael Carrel† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Electrochemiluminescence; Microscopy; Crystals; Radicals; Precipitation

Mentor(s):

Brady Robert Layman (Science); Megan Leigh Hill (Science); Jeffrey Edward Dick (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1223

Presentation Time: Session 2: 10:30-11:30am

Examining the Role Gender Egalitarianism has on Domestic Violence Policies

Social Science

Authors(s):

Gabrielle Loretta Casement† (Liberal Arts)

Abstract:

Domestic violence is an issue that affects millions of people around the world. Domestic violence is linked to victims having poor mental and physical health, trauma, or in the worst case, victims ending up dead. Most countries in the world have some sort of policy addressing the issue of domestic violence; however, some policies are more effective than others. This can be attributed to several reasons, including cultural views on women and a country's egalitarian attitude. In this study, I examine the relationship between a country's egalitarian perspective on women and the effectiveness of its domestic violence policies. To measure effectiveness, I assess the prevention, victim support, enforcement, and scope of each country's domestic violence policies. Then I use the United Nations Gender Inequality Index and the World Values Survey as well as current literature to assess the level of egalitarianism within each country. I focus my comparative analysis on five countries: the United States, Canada, Mexico, Peru, and Bolivia.

Keywords:

[no keywords provided]

Mentor(s):

Rosalee Clawson (Purdue University)

Other Acknowledgement(s):

Linda Lee Kampe (Purdue University)

Poster Presentation Abstract Number: 1224
Presentation Time: Session 2: 10:30-11:30am

The Role of Transcription Factor Meis2 on Horizontal Cell Survival and Migration

STEM

Authors(s):
Jonah Chang† (HHS|JMHC)

Abstract:
Vision requires the proper development of inhibitory interneurons in the retina. One classification of interneurons is the horizontal cell. Horizontal cells provide inhibitory feedback necessary for edge detection and contrast sensitivity. To carry out these functions, during development, horizontal cells need to proliferate, differentiate, migrate, and obtain the correct morphology. The genes necessary for horizontal cell development are unknown but important for understanding retinal biology and vision. During development, the transcription factor Meis2 is selectively expressed in horizontal cells, but its function remains unknown. Here, we investigated the function of Meis2 in cell migration and survival by deleting it from the mouse retina during development. For all experiments, we compared the conditional knockout mouse line, Ptf1a-Cre; Meis2-Flox/Flox, to heterozygous control mice, Ptf1a-Cre; Meis2-Flox/+. To measure cell migration, retinal sections were obtained from mice at postnatal days 1 (P1), P4, and P7. Tissue samples were cryo-sectioned and immunolabeled with Calbindin and 2H3 to label horizontal cell bodies and dendrites, respectively. To measure cell survival, P14 retinal flat-mounts were immunolabeled with Calbindin. All immunolabeled tissue was imaged by fluorescent confocal microscopy. For analysis, we quantified cell density and vertical position of the horizontal cells to assess cell survival and migration, respectively. For both horizontal cell survival and migration, we found the deletion of Meis2 to have no effect. These data suggest Meis2 is not required for cell migration and survival of developing horizontal cells, but does not rule out its role in other aspects of horizontal cell development and function.

Keywords:
Vision; Genetics; Developmental Biology; Neuroscience; Immunohistochemistry

Mentor(s):
Patrick Kerstein (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Shaherah Yahi Alqahtani (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1225

Presentation Time: Session 2: 10:30-11:30am

Consumption of Short-Form Content on U.S. College Students' Political Opinion

Social Science

Authors(s):

Jin-Jia Chang† (Polytechnic); Sebastian Montano Elbancol Knill† (Polytechnic); Po-Chin Yang† (Engineering)

Abstract:

In the post-U.S. presidential elections, there have been increased worries concerning the influence of the Internet on political opinion. The current research examines how short-form content on Instagram and TikTok shapes American college students' political opinions. Exploring how activity on the web affects political awareness based on the American value of freedom, the research identifies the role played by social media in shaping opinion and spreading both accurate information and misinformation. Using survey data on 100 students and in-depth interviewing (N=3), the study illustrates how short-form content on such sites creates selective exposure and fragmented political narratives. The sites offer greater access to political content, but also entrench ideological divisions and influence political credibility. The data analysis identifies stark patterns in media use and their effects on political affiliation and illustrates how digital content shapes opinions, often without students realizing it. The findings point towards increased digital literacy to make students critically analyze what they read, especially in the context of misinformation and biases in algorithms. The studies examine media consumption's influence on culture and how responsibly sharing content is imperative. Future research should explore ways to encourage deeper critical thinking about digital content and examine how political debates on social media shape public opinion.

Keywords:

Radicalization; Social Media; Biases; Public Opinion; College Students

Mentor(s):

Haiyan Li (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1226

Presentation Time: Session 2: 10:30-11:30am

Stable isotope analysis of archaeological bone for diet reconstruction: A guide to bone preparation

STEM

Authors(s):

Ava Grace Chapman† (Science); Caroline Margaret Sozio† (Liberal Arts)

Abstract:

[Abstract Redacted]

Keywords:

Stable Isotopes; Bone; Paleodiet Reconstruction; Isotope Preparation

Mentor(s):

Melanie M. Beasley (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1227

Presentation Time: Session 2: 10:30-11:30am

Uncovering spatial temporal bone quality changes in progressive chronic kidney disease: Is water a new biomarker for fracture risk?

STEM

Authors(s):

Aurelia Azifa Chelfannisa† (Engineering)

Abstract:

Chronic Kidney Disease (CKD) leads to a gradual decline in kidney function, affecting approximately 10% of the global population. As renal function deteriorates, the risk of bone fracture and associated morbidity significantly increases. Dual-energy X-ray absorptiometry (DXA) is the current standard for evaluating fracture risk but has limited efficacy as fractures frequently occur despite identifying healthy bone mineral density (BMD). Therefore, more accurate methods are needed to identify fracture risk. This study aims to develop a novel technique to analyze bone water distribution over CKD progression and its influence on mechanical properties. Using a rat model of CKD, animals were sacrificed at 5 timepoints throughout disease progression and the tibiae were removed for analysis. Thermogravimetric analysis (TGA) evaluates the water composition of bone by examining the weight loss at various temperature peaks, representing the water content in the different components (free, loosely-bound, tightly-bound, mineral structural water). Fourier Transform Near Infrared (FT-NIR) microscopic imaging captures the spatial distribution of bone components. Post-processing segmentation of data will be performed using the ISys 5.0 software to isolate regions of interest, specifically the water components, within the bone samples. The distribution and composition of water in the bone will then be mapped onto the bone structure and compared across time and groups. Understanding how water is modulated during disease progression will determine its relevance as a biomarker for bone fragility. If found significant, future work can explore MRI-based techniques for clinical assessment of fracture risk in patients by targeting bone water.

Keywords:

Fourier Transform Near Infrared Microscopic Imaging; Thermogravimetric Analysis; Chronic Kidney Disease; Spectroscopy

Mentor(s):

Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1228

Presentation Time: Session 2: 10:30-11:30am

Integrating SIMT and Scalar Cores to Manage Control Flow Divergence

STEM

Authors(s):

Daniel Choi† (Engineering); Hassan Al-alawi† (Engineering); Hunter A Mccollough† (Engineering); Armaan Kanchan† (Engineering); Viet Khoi Pham Khac† (Engineering); Shresth Mathur† (Engineering); Abhiram Saridena† (Engineering); Muhammad Zohaib Ali† (Engineering); Justin Yasuumi‡ (Engineering); Jerry Ronald Chen‡ (Engineering)

Abstract:

GPUs designed with SIMT (single-instruction multiple-data) cores struggle to efficiently handle MIMD (multiple-instruction multiple-data) workloads due to control flow and memory access divergence. When threads take different execution paths or have non-cohesive memory access patterns, performance drops because the threads are serialized. In this project, we focus primarily on handling control flow divergence with tightly coupled SIMT and scalar cores.

We implemented two architectural approaches. The first employs software-defined thread prioritization to classify threads as highly divergent or minimally divergent, assigning the former to the scalar core and the latter to the SIMT core. The second architecture uses a hardware heuristic to predict if a thread will diverge. A thread transfer mechanism dynamically moves diverging threads to the scalar core, waits for the scalar core to process the thread, and then moves it back onto the SIMT core. Using scalar cores in this way has two problematic effects on the memory subsystem: poor bandwidth from small scalar loads over a large bus, and increased pressure on the bus itself. We studied these designs' speedup, efficiency, and memory access patterns to see how they compare with baseline GPUs.

We explored implementing these architectures using cycle-accurate simulators and RTL (Register Transfer Level). Simulation provides performance and efficiency insights, while RTL synthesis captures gate-level timing and resource utilization, allowing us to evaluate power, performance, and area metrics. Our evaluation highlights both the performance potential and hardware trade-offs of tightly coupled SIMT-scalar architectures.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
GPU; SIMT Core; Control Flow Divergence; Scalar Core

Mentor(s):
Sooraj Chetput Venkataraghavan (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):
Lucas William Manalo (Engineering); Phone Myat Paing (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1229

Presentation Time: Session 2: 10:30-11:30am

Scalable tellurene/graphene heterostructure for wearable IR/NIR photodetectors

STEM

Authors(s):

Khushi Choksi† (Engineering)

Abstract:

This research seeks to develop scalable, wearable, low-cost photodetectors optimized for near-infrared applications using tellurene nanoflakes. Initially, the project was centred on creating affordable fNIR systems for portable brain imaging and health monitoring applications. This led to the exploration of Te nanowires and Te nanoflakes as novel materials for photodetector applications to be used in place of a silicon-based system. Tellurium's optoelectronic properties, including high hole mobility and anisotropic photo-response, make it a promising yet largely unexplored candidate. A critical aspect of this study involves conducting detailed photoelectric characterization, including current-voltage (I-V) analysis and Schottky barrier height estimation. A key discovery in this study is the formation of a Schottky junction between Tellurene and Laser-Induced Graphene (LIG), distinguishing the performance of a Metal-Semiconductor (MS) architecture from a Metal-Insulator-Semiconductor (MIS) configuration. By optimizing the material parameters of both Te and LIG, we achieved enhanced photoelectric properties, including improved rectifying behaviour essential for efficient photo response. The integration of Langmuir-Blodgett (LB) transfer techniques for Te nanowire deposition and LIG fabrication allowed for precise electrode design, further boosting sensitivity and performance. While Te has not yet been widely used in photodetectors, this research investigates its potential to serve as a viable material in this capacity. The benefits of this approach include significant cost savings, improved device flexibility, and potential scalability for wearable photodetector applications. By systematically evaluating its properties, we aim to determine whether Te-based photodetectors can provide advantages over conventional semiconductor devices, offering new possibilities in optoelectronics.

Keywords:

Photodetector; Tellerene Nanowires; Wearable Technology; Near-Infrared Spectroscopy; Laser Induced Graphene

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Wenzhuo Wu (Purdue University); Hettiarachchige D Perera (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1230

Presentation Time: Session 2: 10:30-11:30am

From Equations to Interpretations: An Engineering Student's Journey in Qualitative Research

STEM

Authors(s):

Thais da Silva Oliveira Mendes†

Abstract:

The purpose of this poster is to describe the author's immersion process using qualitative research methods through a phenomenography of makerspaces users. In general, engineering students expect scientific experiments to follow strict predictability, seeking a single correct, controllable, and generalizable answer. This expectation, rooted in a positivist approach, contrasts with interpretive approaches, which assume that reality is socially constructed. As a result, multiple realities emerge from individuals' unique experiences. Interpretive research aims to access the subject’s perspective within their context, seeking to understand the multiple layers of meaning involved. This study was based on the development and validation of the Learning Through Making Instrument (LMI) (Pollettini et al., 2024), which led to a survey with approximately forty questions about makerspace usage. Data collection was conducted through interviews with twenty-five university students who use these spaces. They were asked to read the proposed questions and voice their reasoning behind their responses. The data immersion process involved analyzing interview transcripts and taking notes on each individual's context to deeply understand the realities encountered. Early findings suggest that some students emphasized that teamwork and the ease of asking for help contribute to success in personal projects, while others highlighted that learning from mistakes and adapting solutions foster autonomy and knowledge growth. Conducting research using phenomenography presents a challenge for engineering students, as it requires analyzing and classifying different understandings of the same content. However, it is essential for their development as researchers, enhancing their analytical skills, problem-solving abilities, and approach to developing solutions.

Keywords:

Qualitative Research; Phenomenography; Makerspaces; Engineering Education; Learning Through Making

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Leonardo Pollettini Marcos (Engineering); Kerrie Douglas (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1231

Presentation Time: Session 2: 10:30-11:30am

Impacts of dengue virus nonstructural protein NS1 on viral infectivity

STEM

Authors(s):

Bella Kristina Demantes† (Science|JMHC)

Abstract:

Dengue virus (DENV), a member of the Flaviviridae family, has four distinct serotypes and utilizes Aedes mosquitoes as vectors to spread infection. Approximately 400 million people are infected with a dengue virus each year, with most cases occurring in tropical and subtropical regions. Most dengue infections are asymptomatic or result in mild symptoms, but it can also result in severe cases like dengue hemorrhagic fever (DHF) and dengue severe shock syndrome (DSS), which are life-threatening. DENV is translated as a single polyprotein that is then cleaved into three structural proteins capsid [C], premembrane/membrane [prM/M], and envelope [E]) and 7 nonstructural proteins (NS1, NS2A, NS2B, NS3, NS4A, NS4B, and NS5). DENV Non-structural protein 1 (NS1) has been shown to have a critical role in facilitating viral replication and immune evasion, but its impacts on viral infectivity and plaque formation are not fully understood. NS1's effects on DENV-2 infectivity were analyzed by assessing the number of plaques present in Vero cells infected with DENV alone versus cells incubated with purified NS1 protein before infection with DENV. We expect a higher plaque formation in the cells with DENV and NS1, indicating that NS1 enhances DENV infectivity. These results will further our understanding of DENV-host interactions, as well as allow for the development of antiviral treatments with NS1 as a possible therapeutic target.

Keywords:

Dengue; NS1; Dengue Virus; DENV Infection; Nonstructural Protein NS1

Mentor(s):

Mercy Omotinume Orukpe Moses (Science); Richard J Kuhn (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1232

Presentation Time: Session 2: 10:30-11:30am

Enhancing Supply Chain Efficiency with Predictive Supplier Modeling

Business Case Study

Authors(s):

Rileigh Ann Dethy† (DSB); Daniel Robert Gallagher† (DSB); Christos Anastasios Kaiafas‡ (DSB); Ace Setiawan‡ (DSB); Kailey Marie Leuer‡ (DSB); Wentong Zhang‡ (DSB)

Abstract:

This project uses advanced machine learning techniques to develop a predictive model for a large company, aiming to optimize supplier selection for individual purchase order line items. By analyzing historical purchase order data, we apply Principal Component Analysis (PCA) and K-means clustering to identify significant characteristics that influence supplier performance. Our predictive model, using the Random Forest algorithm, uses this data to accurately identify the most reliable suppliers, forecast part delays, and pinpoint problematic components.

These insights enable us to enhance supply chain efficiency by offering suggestions to streamline processes, reduce lead times, and foster more strategic supplier engagements. This project not only simplifies how the company manages its suppliers but also helps to ensure that production runs smoothly, avoiding delays and reducing problems before they start.

Keywords:

Supply Chain; Predictive Models; Forecasting; Optimization; Data Analysis

Mentor(s):

Xing Wang (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1233

Presentation Time: Session 2: 10:30-11:30am

SCALE HI-AP Constitutive Evaluations of High-Temperature SAC-based Solder and Considerations for Thermal Stress Tester Design

STEM

Authors(s):

Brendan Duffy† (Engineering|JMHC)

Abstract:

In heterogeneously-integrated electronic packages, solder joint reliability and silicon component fracture resilience are paramount to device longevity. High-temperature SAC-based alloys offer unique advantages as solder interconnects for System-in-Package assemblies; however their viscoplastic nature complicates the standardization of their constitutive characteristics. For a better understanding of SAC-based constitutive behavior, a closed-loop control micro-precision tester will be utilized to induce double-shear upon joint-scale samples. Constitutive behavior data from monotonic and creep tests will complement microstructural analyses to identify the crack paths' location in advanced packaging solder interconnections. Fracture resilience is also consequential in the long-term mechanical integrity of heterogeneously-integrated components, especially those subject to complex thermal gradients. For an experimental characterization of the ramifications of thermal gradient-induced stress on fracture characteristics, custom silicon samples will be fabricated with prescribed pre-cracks. A four-point-contact fixture will then be designed such that the samples can be isolated in a stable, steady state thermal gradient environment. Transient microstructural analyses of crack propagation will elicit conclusions regarding the effects of thermal stress in advanced packaging devices.

Keywords:

Heterogeneous Integration; Advanced Packaging; Micro-Precision Testing; Crack Propagation; Thermal Gradient

Mentor(s):

Sean Yenyu Lai (Engineering); Ganesh Subbarayan (Purdue University)

Other Acknowledgement(s):

Gabriella Maria Schr Torres (Centers & Institutes)

Poster Presentation Abstract Number: 1234
Presentation Time: Session 2: 10:30-11:30am

Weather Station

STEM

Authors(s):
Jana Mohamed Ga Elsayed† (Engineering); Leen Alshaikh† (Engineering)

Abstract:
This project aims to develop a Mini Weather Station with Real-Time Data Display, providing a compact, cost-effective, and efficient solution for environmental monitoring. By utilizing an Internet of Things (IoT) approach, the weather station will collect and display essential climate parameters such as temperature and humidity. The system will integrate a Raspberry Pi as the core processing unit, working in alongside with a DHT11 or DHT22 sensor for data acquisition. The collected data will be processed and displayed, making it accessible for various applications, including education and research.

One of the unique aspects of the project is its 3D-printed enclosure, which will provide a sustainable and durable housing for the electronic components. The technical components include a display interface (LCD/OLED), a power supply (USB or battery), and optional networking capabilities for remote data access. The project follows a structured methodology, including research, component acquisition, circuit assembly, software development, casing fabrication, system testing, and optimization.

The expected outcome is a fully functional, user-friendly weather station capable of real-time environmental monitoring. By utilizing Purdue University's resources, including 3D printing and python programming tools, this project will provide hands-on learning in IoT development. Additionally, it will serve as a foundation for future enhancements, offering scalability for extended functionalities such as additional sensors, cloud integration, and advanced data analytics.

Keywords:
[no keywords provided]

Mentor(s):
Steven R Dunlop (Purdue University); Stewart F Bauserman (Polytechnic)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1235

Presentation Time: Session 2: 10:30-11:30am

SPC Metal Insulator Metal Team

STEM

Authors(s):

Brandon Anthony Farber† (Engineering|JMHC); Hao Tian Pang† (Engineering); Hsun-Ti Chiang† (Engineering); Nora Miqueleiz-Alonso† (Engineering); Prateek Sinha† (Engineering)

Abstract:

Metal-Insulator-Metal Capacitor SPC Project

Dilay Aygun, Huan wen Mao, Jacob Humphrey, Rakhmatillokhon Avazkhon u Abdubaev?, Hsun-Ti Chiang, Charlita Sinmak, Hao Tian Pang, Ryan Bailey

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This research centers on the development and fabrication of Metal-Insulator-Metal (M-I-M) capacitors, a type of high-quality capacitors manufactured using nanotechnology fabrication techniques. They are extensively utilized in Integrated Circuits (ICs), particularly in Radio Frequency (RF) and analog applications. For the manufacturing flow of these capacitors, we will conduct research and development work to design the process flow and capacitor specifications to later initiate fabrication utilizing Brick’s cleanroom. At the end of the fabrication process, we will collect various types of data like film thickness and dielectric quality for further analysis of the capacitors, specifically to perform the methodological approach, Statistical Process Control (SPC), widely utilized in the IC manufacturing industry.

We have the goal of creating a manufacturing flow for M-I-M capacitors and carrying out SPC work that can be performed in Birck’s cleanroom, using an iterative design method. This process entails the treatment of pre-silicon-oxide deposited 4-inch wafers, by using Atomic Layer Deposition (ALD) to deposit oxide, Physical Vapor Deposition (PVD) to deposit metals,?patterning photoresist through lithography processes and data collection for SPC via probing and profilometry.

Overall, we target to introduce the M-I-M capacitor workflow to Birck's cleanroom and enhance the semiconductor manufacturing process by

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

implementing SPC. This will help to control within wafer and batch deviations by analyzing process, machine, and cleanroom conditions.?

Keywords:
[no keywords provided]

Mentor(s):
Huan wen Mao (Centers & Institutes)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1236

Presentation Time: Session 2: 10:30-11:30am

The Effect of COVID-19 on Second-Year Engineering Students

Social Science

Authors(s):

Amanda Heidi Feeley† (Engineering)

Abstract:

The purpose of this study is to understand how second-year Purdue College of Engineering students' satisfaction with their education was affected by the COVID-19 pandemic. Second-year students were chosen due to the phenomenon called the “sophomore slump” where students’ academic performance and other metrics suffer compared to their first year. Multiple areas of satisfaction were studied, including overall satisfaction, faculty interactions, and interaction with peers. The data was gathered using the Sophomore Experiences Survey, which has been administered to students in the College of Engineering at Purdue from 2013 to 2024 during the spring of their second year in college. This survey captures 12 years of data from 1,932 students. Respondents were asked to choose on a scale of five options from very dissatisfied to very satisfied. When analyzing data, the scale was converted to numerical values with one being very dissatisfied and five being very satisfied. Looking at data across all satisfaction categories, there is a noticeable decline in satisfaction from 2020 to 2021 with there being a 0.56 drop in satisfaction in both faculty interaction and peers. Overall satisfaction did not fully recover until 2023, when it reached above the average score from 2013 to 2024. These declines could be due to the lack of in-person instruction as many classes were online, and the separation that occurred due to social distancing during this time. The findings from this study and survey can be used to understand the impact COVID-19 had on engineering education and how students have recovered.

Keywords:

Engineering Education; COVID-19; Sophomore; Student Satisfaction

Mentor(s):

Eric A Holloway (Purdue University); Beth M Holloway (Purdue University); Fanyi Zhang (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1237

Presentation Time: Session 2: 10:30-11:30am

Effects of Neutrons and Protons on Integrated Circuit Molding Compounds

STEM

Authors(s):

Andrew Owen Fewell† (Engineering)

Abstract:

Electronic components are needed in space for communication with Earth, the Navstar Global Positioning Systems, and in-flight phone communication. A vital component of these systems is the electrically erasable programmable read-only memory (EEPROM). According to previous research, it has been shown the EEPROM suffers many single-event upsets inside the subcritical pile. We seek to discover if the mold covering the integrated circuit provides shielding from neutrons and protons. The physics simulation tools used are Geant4, SRIM, and the NIST XCOM database. Geant4 and SRIM are computer programs that can simulate particle effects with materials, and the NIST XCOM database contains data on how particles interact with materials. These programs were used to assess the effects of protons and neutrons on the molding compounds encapsulating the integrated circuit. We constructed a layered model with the materials of the mold and simulated neutron and proton interactions with it. The mold had more effective shielding towards protons. Neutrons were able to effectively penetrate the mold consistently. This study complements the findings of a previous study where the amount of single-event upsets increased with time. Based on the findings of both studies, we can confirm that the molding compounds covering the integrated circuit does not protect from neutrons and has some resilience against protons. Future work to consider is how changing the epoxy and phenol resins covering the molding can make its shielding more or less effective.

Keywords:

EEPROM; Geant4; Protons; Neutrons; Simulation

Mentor(s):

Peter Bermel (Purdue University); Allen L Garner (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1238

Presentation Time: Session 2: 10:30-11:30am

The Science of Resilience & Related Concepts: A Multi-Level Approach

Creative

Authors(s):

Kate Elena Fitzsimmons† (DSB|JMHC)

Abstract:

Resilience is a critical factor in navigating setbacks and failures across professional, personal, and team environments. This research project, The Science of Resilience & Related Concepts: A Multi-Level Approach, aims to identify common themes and patterns that contribute to resilience at these three levels. By understanding how individuals, teams, and organizations adapt to challenges, this study seeks to provide insights into the mechanisms that foster long-term success and well-being.

The research employs a dual-method approach, combining an extensive literature review with qualitative interviews. The literature review synthesizes existing theories and empirical findings on resilience, including psychological, behavioral, and organizational perspectives. Complementing this, interviews with professionals, team leaders, and individuals who have experienced significant challenges provide firsthand insights into resilience-building strategies. These interviews help uncover practical applications of theoretical concepts, offering a more nuanced understanding of resilience across different contexts.

Preliminary findings suggest that resilience is influenced by adaptive mindset shifts, strong support networks, and structured recovery strategies. Additionally, team resilience appears to be strengthened by clear communication, shared goals, and collective problem-solving. At the organizational level, resilience is often tied to leadership practices, cultural adaptability, and strategic planning.

By identifying recurring patterns and effective resilience-building strategies, this research contributes to a deeper understanding of how individuals and groups navigate adversity. These insights may inform future leadership training, workplace development programs, and personal growth strategies aimed at enhancing resilience in professional and personal settings.

Keywords:
Resilience; Teamwork; Cohesion; Trust; Leadership

Mentor(s):
Bradley J Alge (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1239

Presentation Time: Session 2: 10:30-11:30am

SCALE HI-AP: Evaluation of Radiation Dosage and Microelectronic Reliability in the Cislunar Domain

STEM

Authors(s):

Luke Joseph Fortner† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Cislunar; Radiation; Reliability; Microelectronics

Mentor(s):

Muhammad A Alam (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1240

Presentation Time: Session 2: 10:30-11:30am

Continual Learning for Calorie Estimation of Food Items

STEM

Authors(s):

Connor Bradley Frey† (Science); Joonyeoup Kim† (Engineering); Piotr Stanislaw Nabrzyski† (Engineering); William Benjamin Tao† (Engineering)

Abstract:

Food calorie estimation is crucial for both personal health management and public health research. It allows individuals to monitor their energy intake and make informed dietary choices while providing data on dietary trends that can guide public health interventions. Accurate calorie tracking supports personalized nutrition planning and mitigating the risk of diet-related conditions. This allows it to play a pivotal role in enhancing people's overall wellness and combating chronic diseases. However, traditional estimation methods often fail to capture the dynamic nature of food presentation and evolving eating habits. This leads to reduced accuracy and adaptability over time. In contrast, continuous learning regression models excel by incrementally incorporating new data, thereby sustaining a high prediction accuracy without the need for exhaustive retraining. This method works to minimize the problem of "Catastrophic Forgetting". In this study, we propose a continual learning model inspired by the CLeaR (Continual Learning for Regression Tasks) framework. This would allow our model to predict continuous calorie values from images of diverse food items, enabling real-time updates as new data emerges.

Keywords:

[no keywords provided]

Mentor(s):

Fengqing Zhu (Purdue University); Carla Zoltowski (Purdue University); Edward J Delp (Purdue University); Soudabeh Taghian Dinani (Purdue University); Siddeshwar Raghavan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1241

Presentation Time: Session 2: 10:30-11:30am

Beam Shaping for Vortex Solitons in a 2D Cesium BEC

STEM

Authors(s):

Joshua Matthew Friedman† (Science|JMHC)

Abstract:

Quantum vortices appear in a variety of quantum systems, particularly those exhibiting superfluidity. This research helps investigate vortex solitons—quantum vortices forming in a donut-shaped 2D cesium BEC confined within a circular box trap. A 780 nm blue-detuned beam creates a repulsion that causes the central region to be depleted of atoms. The beam's shape and position within the atomic cloud are precisely controlled using a digital micromirror device (DMD). To optimize the addressing beam's profile, this research replicates the main experiment's optical path and examines aberrations in the profile observed in the experiment. A 780 nm external cavity diode laser (ECDL) produces a beam, which is fiber-coupled to create a Gaussian profile and then directed onto the DMD. The beam is imaged using a CMOS camera through a system including high numerical aperture (NA = 0.5, 0.7) objectives and a back lens. A glass plate simulates the optical effects of the science chamber. A key challenge is producing a sharp-edged addressing beam, crucial for studying vortex solitons. This work characterizes the profile of the DMD beam setup and identifies sources of aberration within the optical setup, evaluating methods to correct them. By refining beam shaping techniques, this research contributes to improved experimental control over quantum vortices in cold atomic systems.

Keywords:

[no keywords provided]

Mentor(s):

Chen-Lung Hung (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1242

Presentation Time: Session 2: 10:30-11:30am

Toward a Seamless User Authentication

STEM

Authors(s):

Andrea Gajic† (Polytechnic|JMHC)

Abstract:

With the rising prevalence of IoT and improved capability of personal devices, there is an increased use of user data, such as images, acoustic signals, and written texts, that are used to identify individuals. But, often, these user identification tasks require large language datasets to develop robust models [1-2]. Yet, obtaining a large-scale dataset is time and resource intensive. Therefore, it is essential to get a deeper understanding of techniques that could allow developing a reasonably good user identification model with a relatively smaller dataset. This project will explore different AI/ML techniques to tackle this challenge and to guide various stakeholders in the future.

References:

[1]. Dibbo, Sayanton V., William Cheung, and Sudip Vhaduri. "On-phone CNN model-based implicit authentication to secure IoT wearables." In The Fifth International Conference on Safety and Security with IoT: SaSeIoT 2021, pp. 19-34. Cham: Springer International Publishing, 2022.

[2]. Vhaduri, Sudip, Sayanton V. Dibbo, and Chih-You Chen. "Predicting a user's demographic identity from leaked samples of health-tracking wearables and understanding associated risks." In 2022 IEEE 10th International Conference on Healthcare Informatics (ICHI), pp. 309-318. IEEE, 2022.

Keywords:

Machine Learning; Few-Shot Learning

Mentor(s):

Sudip Vhaduri (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1244

Presentation Time: Session 2: 10:30-11:30am

Evaluating the effects of genomic selection for heat stress tolerance on the behavior of in utero heat stressed piglets after weaning and transportation.

STEM

Authors(s):

Alejandra Maria Garavito† (Agriculture|JMHC); Shayna Jayne Morris† (Agriculture)

Abstract:

In-utero heat stress (IUHS) has negative effects on piglet postnatal behavior, impacting their welfare and productivity. However, genomic selection can improve heat stress tolerance (TOL), potentially mitigating these effects. Our study aimed to determine whether genomic selection for TOL or heat stress sensitivity (SEN) in F1 gilts impacts the postnatal behavior of IUHS piglets after weaning and transport. We used 237 piglets from 28 sows exposed to either thermoneutral (TN) or heat stress (HS) conditions during pregnancy. At weaning, mixed sex piglets from each litter were selected, yielding the following treatment combinations: TOL+ in utero thermoneutral (IUTN; n = 60), TOL+IUHS (n = 60), SEN+IUTN (n = 59), and SEN+IUHS (n = 58). These piglets were then transported and group housed in 40 nursery pens (n = 6 pigs/pen) for 5 weeks. Piglet behavior was evaluated using an ethogram for standing, feeding and huddling behaviors on days 3, 5, 7, 9, and 11. Data were analyzed in R using Poisson regression models with pen as the experimental unit. IUHS piglets presented reduced activity ($P < 0.05$; 14%) and increased huddling behavior ($P < 0.01$; 6%) compared to IUTN at day 3. However, TOL piglets demonstrated increased huddling at day 3 ($P < 0.01$; 19%) and increase activity on day 9 ($P < 0.05$; 5%) in comparison to SEN piglets. In summary, IUHS piglets presented increased stress related behaviors as expected. However, TOL genomic selection did not protect against its effects in the current generation, and further generations should be evaluated.

Keywords:

Animal Science; Animal Genetics; Gene Editing; Agriculture

Mentor(s):

Luiz Fernando Brito (Purdue University)

Other Acknowledgement(s):

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† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1246

Presentation Time: Session 2: 10:30-11:30am

Data Visualization of the Semiconductor Supply Chain

STEM

Authors(s):

Paraj Goyal† (Science|JMHC)

Abstract:

The semiconductor industry is a complex and multi-faceted industry where companies often specialize in singular phases of semiconductor manufacturing and rely on their competitor's processes to deliver a finished product. This research focuses on representing these connections through visual means, emphasizing the international and codependent nature of the semiconductor industry. We extract information from a variety of sources to visualize how and where major companies develop their semiconductors. Due to the incomplete nature of these datasets, with most companies protecting their manufacturing related data, we produce visualizations that serve as pieces for a larger picture. As a result of these connections, we generate insights into the dependencies and potential weaknesses of this supply chain that could, if interrupted, significantly impact global production.

Keywords:

[no keywords provided]

Mentor(s):

Tho Le (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1247

Presentation Time: Session 2: 10:30-11:30am

Speech Variability, Speech Perception, and Vocabulary Skills in Children With and Without Speech Sound Disorders

STEM

Authors(s):

Emma J Hall† (HHS); Ella Nicole Birgel† (HHS)

Abstract:

Rationale: Children with speech sound disorders (SSD) sometimes produce words inconsistently over repeated attempts, and it has been proposed that variability may indicate underlying representations for words that are underspecified. The current study investigates the relationship between speech variability, speech perception, and expressive and receptive vocabulary skills in children with and without speech sound disorders.

Methods: Twenty-eight children, 14 with typical speech and language development (TD) and 14 with SSD, completed a battery of speech and language measures, a speech perception task, and the Word Inconsistency Assessment to calculate lexical variability and segmental variability.

Conclusion: Children with above-average vocabularies had significantly better speech perception than children with average vocabularies, and lower segmental variability.

Implications: Children with lower vocabularies are at risk for poor speech perception skills. Segmental variability may index specificity and stability of phonological knowledge in children.

Keywords:

Children; Speech Sound Disorders; Speech Accuracy; Speech Perception

Mentor(s):

Francoise Brosseau-Lapre (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1248

Presentation Time: Session 2: 10:30-11:30am

Investigating fibroblast response to porous hydrogel implantation in a mouse model of volumetric muscle loss.

STEM

Authors(s):

Kyle Jeffery Heaton† (Engineering|JMHC)

Abstract:

Volumetric muscle loss (VML) injuries are highly prevalent and often result in fibrotic scarring that reduces muscle function compromising quality of life. Although many biomaterial therapies have been developed to treat VML, an understanding of how biomaterial features affect fibroblast activation and matrix deposition remains unexplored. One challenge lies in identifying fibroblasts in preserved tissue sections. It has been reported that alpha-smooth muscle actin (?-SMA), a well-known marker of activated myofibroblasts in other tissues, does not accurately stain muscle-resident fibroblasts [1]. To explore this further, we stained mouse tibilas anterior muscle cryosections that had been subjected to VML defects and implanted with bulk or porous granular hydrogels with (?-SMA) or platelet-derived growth factor receptor alpha (PDGFRA) antibodies. Additionally, Picro Sirius red collagen staining was performed on the cryosections to stain collagen and scar tissue and to examine correlations between cellular components and the extracellular matrix. Intense staining was observed in the VML defect region and in or around the hydrogel compared to the healthy muscle sections which had minimal staining. There was a difference in cellular invasion between the bulk and the granular hydrogels. Additionally, there was a difference in normalized staining intensity between ?-SMA and PDGFRA with ?-SMA being higher in normalized. Lastly the Picro Sirius Red staining coupled with polarized microscopy showed the presence of collagen with varying birefringence signals suggestive of a differential fibroblast response based on hydrogel implantation length. Our findings demonstrate the importance of antibody selection to stain for diverse fibroblast populations during muscle repair.

Keywords:

[no keywords provided]

Mentor(s):

Taimoor Hasan Qazi (Purdue University)

Other Acknowledgement(s):

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Poster Presentation Abstract Number: 1249

Presentation Time: Session 2: 10:30-11:30am

Improving performance of boards hosting FPGAs for ECELabs.io

STEM

Authors(s):

Brett Michael Heckman† (Engineering|JMHC)

Abstract:

ECELabs.io provides an online tool that allows students to upload their projects onto real Field-Programmable Gate Arrays (FPGA) without having to buy or set them up, allowing students to go further than a simulator and verify that their design is useful in the real world. This research revolves around a new board that efficiently handles this process by combining an ethernet controller, microcontroller, FPGA, and I/O all in one place. This setup aims to improve streaming rate and latency by getting rid of overhead from an operating system. Modifications to the firmware were necessary to ensure proper communication between the ethernet controller and on-board microcontroller that programs the FPGA. Additionally, a centralized server was developed to manage boards and increase the efficiency of communications between the boards and the website. The new boards are promising and help improve the user experience of the FPGA interface on the ECELabs.io website.

Keywords:

[no keywords provided]

Mentor(s):

Junfei Li (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1250

Presentation Time: Session 2: 10:30-11:30am

Analyzing Fan Predictions of Basketball Bracket Winner's: Driven by Fan Brackets and Affinity of Teams

Business Case Study

Authors(s):

Adlyn Aliette Hernandez† (DSB)

Abstract:

One of fans' favorite pastimes during playoff seasons is creating brackets and predicting championship outcomes. However, fan predictions often exhibit biases influenced by their school affinity, geographical location, and media exposure, potentially compromising the accuracy of forecasts. This study explores the question: How does school affinity impact fans' predictions, and how can understanding these biases benefit strategic decision-making in collegiate sports?

Using a data-driven methodology, this project applies unsupervised machine learning techniques, specifically K-means clustering, to identify patterns in fan characteristics and behaviors. The analysis includes evaluating various cluster models to accurately capture distinct fan groups. The expectation is to uncover geographic factors and media consumption patterns as key determinants in fans' predictions, alongside other potential influences such as alumni status or team performance history.

Results from this analysis carry significant implications for NCAA management and sport-adjacent enterprises, including sports retailers, media organizations, and online sports gambling platforms. Strategic benefits include enhanced targeting of advertising campaigns, optimized merchandising efforts tailored to specific fan demographics, and informed planning of premier sporting matchups. Additionally, sports gambling operators can leverage insights into fan biases to refine betting lines and promotional activities, thus driving economic gains. Overall, understanding fan biases through rigorous data analysis provides valuable strategic insights, enhancing both economic and marketing outcomes within the sports industry.

Keywords:

Predictive Analytics; Sports; Biases; Forecasting; Business Applications

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

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Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1251

Presentation Time: Session 2: 10:30-11:30am

A Proposed Planting Palette For Shenandoah National Park

STEM

Authors(s):

Anna Danielle Hildebrand† (Agriculture|JMHC)

Abstract:

Shenandoah National Park, a 200,000 acre park in the Appalachian Highlands' Blue Ridge mountains, was established in 1935 to create one of the United States' first Eastern National Parks. Shenandoah's Skyline Drive, a 105-mile long roadway that runs along the mountain ridge, includes 86 overlook vistas designed to showcase the scenic views of the park. To ensure that these overlooks can be enjoyed in perpetuity by future generations, there is a need to improve the plantings at the overlook sites. The park currently struggles with maintaining viewsheds due to vegetation overgrowth and maintenance challenges. Additionally, each vista has different conditions - such as soils, moisture, aspect, slope, and vegetation - that must be considered in order to choose plants that will thrive there.

To create a successful planting palette that celebrates these differences and provides low-maintenance planting choices, GIS data will be used to classify each overlook into landscape typologies. Based on these determined typologies, plant research will be conducted on plant growth habits and needs for each typology. Research also must be done on projected climate change and disease challenges to ensure longevity of planting choices. This information will be used to create a planting schedule and palette that will thrive in each typology area and educate visitors on the varied environmental conditions that make up Shenandoah's landscape. All these factors must be considered to reach the goal of this project: to propose a planting design that benefits the public's enjoyment of Shenandoah National Park.

Keywords:

Planting Design; Shenandoah National Park; GIS

Mentor(s):

Aaron W Thompson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1252

Presentation Time: Session 2: 10:30-11:30am

SCALE HI-AP : Exploring 2D Tellurium for Advanced Pressure Sensors in Extreme Underwater Environments

STEM

Authors(s):

Remley Grace Hooker† (Engineering)

Abstract:

As underwater autonomous vehicles (UAVs) and deep-sea exploration technologies advance, there is a growing need for pressure sensors that can operate reliably under extreme conditions. This research focuses on the use of 2D tellurium as a novel material for pressure sensors in deep-sea environments, specifically within a range of 0.2 GPa to 1.1 GPa. Due to its unique bandgap modulation, tellurium's electrical conductivity is highly sensitive to changes in pressure, making it an excellent candidate for precise and responsive pressure sensing. This study aims to synthesize and characterize tellurium-based materials, assessing their pressure-responsive properties, and evaluate their effectiveness in maintaining sensor reliability and accuracy under high-pressure conditions. By exploring the potential of tellurium as a pressure-sensitive material, this research seeks to develop advanced sensor solutions that can enhance the performance and resilience of deep-sea exploration technologies.

Keywords:

[no keywords provided]

Mentor(s):

Peide Ye (Purdue University)

Other Acknowledgement(s):

Gabriella Maria Schr Torres (Centers & Institutes)

Poster Presentation Abstract Number: 1253
Presentation Time: Session 2: 10:30-11:30am

SoCET digital circuit design

STEM

Authors(s):
Weichih Hsieh† (Engineering)

Abstract:
Purdue SoCet provides students with hands-on experience in industry-standard design flows, with most subteams focusing on logic and architectural design using standard cells. However, our newly formed subteam is dedicated to custom digital circuit design, where we optimize power, performance, and area (PPA) at the transistor level. Rather than relying on automated synthesis tools, we focus on transistor-level analysis, ensuring that every transistor's size and threshold voltage are carefully optimized for efficiency.

This semester, our team is working on two major projects. The first is designing a high-efficiency SRAM using a full-custom approach in Cadence Virtuoso. Our design will incorporate banking and column multiplexing techniques to improve scalability while implementing read and write assist circuits to enhance stability and performance. Before transitioning to transistor-level implementation, we will first verify the functionality of our SRAM by simulating its RTL model in SystemVerilog.

Our second project is the design of a custom clock generator capable of producing a user-defined output frequency from an external clock source. This circuit must maintain precision and stability while balancing PPA constraints.

By working at the transistor level, we aim to gain a deeper understanding of circuit behavior and develop more efficient designs beyond what is achievable with standard cells.

Keywords:
SRAM; System on Chip; Digital Design; Transistors

Mentor(s):
Abinands Ramshanker (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1255

Presentation Time: Session 2: 10:30-11:30am

Analysis of Icosapent Ethyl Eligibility in Post Acute Myocardial Infarction Patients

STEM

Authors(s):

Faiz M Inamdar† (Pharmacy)

Abstract:

Purpose: At St. Bartholomew's Hospital acute myocardial infarction (AMI) clinic, pharmacist's follow-up with post-AMI patients to optimize secondary prevention medications. Icosapent ethyl has demonstrated triglyceride level reduction on stable statin doses and protection against cardiovascular events[1]. The primary objective of this evaluation was to determine patient eligibility for icosapent ethyl at the 12-week appointment. Secondary objectives included patients meeting partial criteria of the above.

Method: This was a retrospective cohort study evaluating all patients within the AMI clinic who had documented low-density lipoprotein (LDL) and triglyceride levels available at their 12-week appointment. These levels were then used to identify which patients met criteria for using icosapent ethyl at their appointment. Patients are eligible for this treatment if they have established cardiovascular disease, fasting triglycerides of 1.7mmol/liter or higher, LDL levels greater than 1.04mmol/liter and less than or equal to 2.60mmol/liter, and if they are established on statin therapy[2]. This study did not require ethics approval.

Results: A total of 307 patients met inclusion criteria. Out of the included patients, 77% had an LDL level that met icosapent ethyl use criteria, 34% had triglyceride levels that met the criteria, 22% met the criteria of use for both lab values, and 21% of patients were eligible to take icosapent ethyl.

Conclusions: The AMI clinic was able to determine eligibility for icosapent ethyl for nearly a quarter of the patients during this evaluation period. The results of this evaluation demonstrate a significant number of AMI clinic patients would be candidates for icosapent ethyl.

Keywords:

Vascepa; Icosapent Ethyl; Pharmacy; England; Cardiovascular

Mentor(s):

Ellen M Schellhase (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Monica Miller (Purdue University)

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Poster Presentation Abstract Number: 1256

Presentation Time: Session 2: 10:30-11:30am

SCALE HI-AP: Thermo-mechanical Reliability of Metal Embedded Chip Assembly (MECA) Package

STEM

Authors(s):

Parker Joseph Jeffrey† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Shubhra Bansal (Purdue University)

Other Acknowledgement(s):

Gabriella Maria Schr Torres (Centers & Institutes); Haohan Guo (Engineering); Faharia Hasan Bhuiyan (Engineering)

Poster Presentation Abstract Number: 1257

Presentation Time: Session 2: 10:30-11:30am

Molecular Effects of Chlorpyrifos Exposure in Pon-1 (-/-) and Wildtype Rat Models

STEM

Authors(s):

Dia Dipen Jhaveri† (Science); Sofia Schumann‡ (HHS); Matthew Thomas Corson‡ (HHS|JMHC)

Abstract:

Chlorpyrifos (CPF), an organophosphate pesticide, continues to be utilized in the U.S. specifically, in agriculture. It is toxic due to its inhibition of acetylcholinesterase and subsequent cholinergic effects, is further complicated by its potential connection to Parkinson's Disease (PD). The research conducted investigates the interaction between genetic vulnerability—via paraoxonase 1 (Pon1) gene knockout—and CPF exposure, focusing on Parkinson's Disease (PD) risk in a rat model. The study was conducted on male and female 9- to 11-month-old Pon-1 Knockout (KO) and wildtype (WT) Sprague Dawley rats with the dosage group of 2.0 mg/kg and control (2 of each gender in each group). The two ways to see the neurotoxic effect on the brain is neurobehavioral and molecular. Neurobehavioral includes tests such as Postural Instability (PI), Vibrissae elicited forelimb placing (VEBT), and Spontaneous activity also known as the cylinder test. Specifically, we examine the differential effects on the midbrain and striatum, critical regions implicated in PD to investigate molecular effects. While our findings reveal no significant changes in the striatum, alterations in the dopaminergic neurons of the midbrain were observed, suggesting a targeted neurotoxic impact by CPF in this region. The use of DAB staining highlights these effects, providing visual confirmation of dopaminergic neuron degradation in the substantia nigra, yet showing no significant changes in the striatum. DAB staining is a staining technique that uses 3,3'-diaminobenzidine (DAB) to produce a brown precipitate that highlights the location of an antibody.

Keywords:

Chlorpyrifos; DAB Staining; Parkinson; Substantia Nigra; Striatum

Mentor(s):

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Other Acknowledgement(s):

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Poster Presentation Abstract Number: 1258

Presentation Time: Session 2: 10:30-11:30am

Investigating Protein-Protein Interactions for Functional Assembly in Actinobacteriophage GoldDust

STEM

Authors(s):

Manya Devang Kadiwala† (Agriculture); Abigail Nguyen Origer† (Engineering|JMHC); Collin Jayson Kao† (Agriculture|Engineering); Elyse Youngstedt* (Agriculture|Engineering)

Abstract:

Several studies have concluded that genes under 150 nucleotides encode functional proteins contributing to phage development. These shorter genes often lack called functions in auto-annotation processes. Missing functions may be identified by merging smaller gene products and comparing their overall structure to that of larger proteins, providing functional insights. This project investigates the simulated interaction between clustered small proteins, specifically within the Arthrobacter phage GoldDust. It was hypothesized that closely spaced or overlapping short ORFs (sORFs) may represent fragments of a longer gene. The possible combinations of sORFs towards the end of Actinobacteriophage GoldDust's genome were analyzed using AlphaFold. To analyze these combinations, ipTM and pTM scores (indicating protein-protein interaction confidence), pLDDT (measuring structural reliability), and e-values (assessing statistical significance) were used. sORF candidates were chosen by ORF length, gap size between called genes, and coding potential results from the auto-annotation software GeneMark. Preliminary results support this hypothesis. The products of genes 70 and 71 (375 and 165 base pairs, respectively) were combined in AlphaFold and matched a known ParB family partition protein with 71.5% accuracy. ParB proteins play a key role in bacterial chromosome and plasmid segregation, suggesting that this merged gene product may be involved in genome stability and regulation in the phage-host system. Further analysis may improve accuracy, refining GoldDust's annotation. These findings can be expanded to contribute to deeper understanding of phage genome organization.

Keywords:

Bacteriophage; Gene Annotation; Recombination; Protein Structure Prediction

Mentor(s):

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† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Julia Ann Simler (Agriculture); Marcelo Inaki I Guerrero Montalvan (Agriculture)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1259

Presentation Time: Session 2: 10:30-11:30am

Polarity establishment and cytoskeleton rearrangement in early cotton fiber development

STEM

Authors(s):

Maxwell Murphy Kahle† (Engineering|JMHC)

Abstract:

The growth patterns of individual cotton fiber cells determine the quality of renewable textiles. High-quality cotton fibers have large lengths and small diameters. The shape of a cotton fiber is dependent on the mechanics of the cell wall, driven by turgor pressure and influenced by the orientation of cellulose microfibrils. Early cotton fiber cells are initially flat before expanding to a bulbous dome and then finally tapering into an extended cone. We hypothesize that the switch between shapes is directed by the cytoskeleton. Altering the orientation of microtubules, a component of the cytoskeleton, changes the direction of cellulose fiber deposition in the cell wall, which impacts the shape of the fiber. In this work, we tracked changes in microtubule orientation using a strain of cotton modified with a microtubule-binding fluorescent protein. In vitro grown fibers were imaged with confocal microscopy and classified by microtubule orientation with respect to stage of growth, as characterized by fiber length. Microtubules in fibers below 15 µm in length were usually oriented axially toward the dome apex. By 15 µm, microtubules usually oriented more transversely, forming a microtubule depleted zone at the tip, but still lacked significant tapering. By 30 µm, fibers showed visible tapering. From these results, we can investigate how cell stress patterns and microtubule orientation correlate, to test if mechanical stress directs microtubule orientation in growing cotton fibers. These insights into fiber morphogenesis can allow further control over the growth of cotton and the quality of textiles.

Keywords:

Cotton; Microtubule; Cell Wall; Morphogenesis; Confocal Microscopy

Mentor(s):

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Other Acknowledgement(s):

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Poster Presentation Abstract Number: 1260

Presentation Time: Session 2: 10:30-11:30am

Optimizing Enrollment Processes: Leveraging Automation for Operational Efficiency and Multilingual Support

Business Case Study

Authors(s):

Parth Kapila† (Polytechnic)

Abstract:

Manual data entry proved to be a significant bottleneck for the non-profit organization, diminishing efficiency and increasing the administrative workload. By tackling key challenges such as multi-language translation and workflow automation, this project aimed to streamline the organization's enrollment processes and resolve client-user communication barriers. Since a majority of the learners required non-English support, the team prioritized ensuring accessibility for over 40 languages.

To address these challenges, a structured two-phase approach was executed: (1) Process Analysis & Data Integration and (2) Automation Efficiency Enhancement. In the initial phase, comprehensive process mapping was conducted to identify inefficiencies and integration gaps across existing data sources including FormAssembly, Salesforce, and SharePoint. The second phase implemented targeted automation solutions through Microsoft Power Automate, focusing explicitly on multilingual email communication and streamlined data storage within the Salesforce Non-Profit Cloud, significantly reducing the need for manual oversight.

Key findings indicate that automating data processes and multilingual communications markedly decreased administrative workloads, enhanced data accuracy, and substantially improved service accessibility for non-English-speaking users. Integration of Power Automate facilitated immediate automated email generation in learners' preferred languages shortly after form submissions,. The expectation is that it will enhance client-user engagement and satisfaction.

This project presents a clearly defined, replicable model demonstrating the strategic potential of integrating workflow automation in non-profit organizational settings. The outcomes underscore broader implications, particularly the scalable and cost-effective advantages of automation in optimizing data management and ensuring equitable access for linguistically diverse populations. Future research and implementation

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could expand on these findings by exploring further customization of automation tools to accommodate increasingly diverse organizational contexts.

Keywords:
Automation Processes; Data Storage; Multilingual Accessibility; Operational Efficiency; Workflow Optimization

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):
Harsh Srivastava (DSB); Rohan Ajay (DSB)

Poster Presentation Abstract Number: 1261

Presentation Time: Session 2: 10:30-11:30am

The Development of Advanced Bimanual Object Manipulation in a Natural Setting

Social Science

Authors(s):

Riya Ashwin Karpe† (HHS|JMHC)

Abstract:

As infants navigate their developmental journey, acquiring different skills along the way, they discover various approaches to engage with objects. One approach is through role-differentiated bimanual manipulation (RDBM). This technique involves the coordination of both hands for object manipulation, with one hand serving as the stabilizer while the other hand manipulates the object. For our project we examined hour-long videos of infants aged 9-, 12-, 15-, and 18- months and their primary caregiver in a natural home setting as they engaged in their daily activities, coding every instance of RDBM. Observing infant behavior in a natural environment allows researchers to observe day-to-day behavior, in comparison to gathering observations in a controlled laboratory setting. Through the use of Datavyu, a video coding software, we conducted two coding passes for each video. In the first pass, we examined the frequency of object interactions in each age group. In the second pass, we coded instances of RDBM and variables such as if infants were manipulating a toy versus a household object, whether the caregiver demonstrated the action, and the posture of the infant during the interaction. We found that younger infants preferred using toys for RDBM while older infants used both toys and household objects; that caregivers rarely demonstrated RDBM actions; and that sitting was the most common posture for RDBM. Our findings contribute to a deeper understanding of how RDBM is displayed in a natural setting and sheds light on how infants learn to coordinate their movements to better explore their environment.

Keywords:

Motor Development; Infant; Object Interaction

Mentor(s):

Laura J Claxton (Purdue University); Paige A Thompson (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1262

Presentation Time: Session 2: 10:30-11:30am

Effect of temperature on the Ti3AlC2 MAX etching and synthesis of two-dimensional Ti3C2Tx MXene

STEM

Authors(s):

Prerona Kaushik† (Engineering)

Abstract:

The family of two-dimensional (2D) carbides, nitrides, or carbonitrides known as MXenes has grown in the past few years with a wide range of structures. MXenes are synthesized by selective layer etching from layered carbide phases known as MAX phases. MAX phases are a family of layered ternary compounds with the general chemical formula Mn+1AXn, where 'M' is an early transition metal, 'A' is an A-group element (usually aluminum or silicon), 'X' is either carbon or nitrogen, 'n' is typically 1, 2, or 3, and 'n+1' is the number of atomic layers in one unit cell. By selectively etching the A-group element layers in the MAX phases, the Mn+1Xn layers are separated as 2D MXene sheets. MXenes have found applications in diverse fields like energy storage, wearable electronics, and medicine due to their exceptional properties, including high electrical conductivity (~24000 S/cm), redox-active surfaces, and plasmonic behavior. In this study, we investigate the kinetics involved in the etching reaction of the MAX phase precursor for MXene synthesis. By analyzing the change in aluminum content from the MAX phase, we gained insights into the selective etching process from Ti3AlC2 MAX to multilayered Ti3C2Tx MXene. The critical parameter etching temperature (22 °C – 55 °C), was carefully analyzed to understand the etching kinetics while keeping the etchant concentration and reaction time (24 h) constant. The elemental composition of the etched Ti3C2Tx MXene and the quality of single-to-few layer Ti3C2Tx MXene was evaluated using a scanning electron microscope (SEM), X-ray diffractometer (XRD) and energy-dispersive spectroscopy (EDS). The findings of this study contribute to the fundamental knowledge of MXene synthesis and provide valuable information for designing and controlling the synthesis process.

Keywords:

2D Materials; MAX, MXene; Etching Conditions

Mentor(s):

Babak Anasori (Purdue University); Anupma Thakur (Purdue University); Nithin Chandran Balachandran Sajitha (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1263

Presentation Time: Session 2: 10:30-11:30am

Comparing the Role of PP2A-B56a and PP2A-B55a Activation in EGFR Signaling in PDAC

STEM

Authors(s):

Emma Frances Kay† (Science); Ella Rose Deanne Chianis‡ (Science)

Abstract:

Pancreatic Ductal Adenocarcinoma (PDAC) has the worst 5-year survival rate of all major cancers, therefore there is an urgent need for further investigation and research. 90% of all PDAC tumors are driven by a mutation in KRAS, but wild-type EGFR activation is required for tumor oncogenesis. Protein Phosphatase 2A (PP2A) is a serine/threonine phosphatase that can negatively regulate downstream effectors of KRAS. Because of this, PP2A is highly important when considering potential PDAC therapeutic strategies. The PP2A complex is made up of 3 subunits: scaffolding (A), regulatory (B), and catalytic (C). There are many different regulatory B subunits, and the function of the PP2A complex is determined by which particular B subunit is incorporated. In the field, there is a lack of study of the regulatory B units and their effects of PP2A activation. Our lab has found that B56a, previously described as a tumor suppressor, actually promotes tumorigenic phenotypes through the EGFR signaling pathway when it is overexpressed. To determine if this PP2A-driven activation of EGFR signaling and tumorigenic phenotypes is specific to PP2A-B56a, we made a cell line that overexpresses B55a, which is from a different family but has been implicated as a subunit with both tumor suppressive and tumor promotional phenotypes depending on the tissue. Phenotypes of this cell line, including proliferation, clonogenic colony formation, and anchorage independent growth, were compared to B56a. We found that PP2A-B55a does not replicate the increase in tumorigenic phenotypes of the PP2A-B56a complex, suggesting that these changes are specific to PP2A-B56a.

Keywords:

[no keywords provided]

Mentor(s):

Claire M Pfeffer (Science); Brittany Lee Allen-Petersen (Purdue University)

Other Acknowledgement(s):
Brittany Nicole Heil (Science); Sydney Joann Clifford (Purdue University)

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Poster Presentation Abstract Number: 1265

Presentation Time: Session 2: 10:30-11:30am

Finite Element Analysis of Aperiodic Einstein Tile System

STEM

Authors(s):

Brian Arild Kelly† (Engineering)

Abstract:

Ceramics are used in rocket capsule heat shields. Ceramics possess low density, high hardness, and superior insulation properties. However, it is difficult to manufacture large monolithic ceramic structures. Instead, tile assemblies are used. Tile assemblies are commonly made of square or hex shapes and ordered assemblies. Due to the nature of tiling and the stress of a rocket launch, it is common for tiles to fall off the rocket capsule. This can cause structural instability and further damage to the heat shield. As such, it is important for tile structures to remain robust even in the event of a missing tile or hole in the system. This study investigates the aperiodic einstein tile as a superior tile design for this purpose. Using the Abaqus finite element analysis software, an einstein tile system was developed with a hole. This system was then placed under tension to analyze the fracturing characteristics when a tile was removed. Periodic tile systems were also made to compare performance to a baseline. The results of this study could inform future ceramic tile design and be useful in the development of rocket heat shields.

Keywords:

Finite Element Analysis; Einstein Tile Assembly

Mentor(s):

Thomas H Siegmund (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1266

Presentation Time: Session 2: 10:30-11:30am

Investigation the Effect of UV Exposure on Carbon Fiber-Reinforced Thermoplastic Composites

STEM

Authors(s):

Haneul (Sky) Kim† (Polytechnic)

Abstract:

Carbon fiber-reinforced thermoplastic composites (CFRTPs) are widely used in aerospace, automotive, and industrial applications due to their lightweight properties, recyclability, and high mechanical durability. However, prolonged exposure to ultraviolet (UV) radiation can lead to material degradation, potentially reducing their mechanical performance and altering their crystalline structure. Understanding how UV exposure affects these materials is essential for ensuring their long-term reliability in demanding environments. In this study, carbon fiber composites based on polyphenylene sulfide (PPS) and polyamide 6 (PA6) are fabricated using a controlled molding process. The specimens are subjected to UV irradiation for varying durations to simulate long-term environmental exposure. Tensile testing is conducted to evaluate changes in mechanical strength, while differential scanning calorimetry (DSC) is employed to analyze variations in crystallinity. It is expected that UV exposure will cause some degree of mechanical degradation in both PPS- and PA6-based composites, though the extent may vary depending on the polymer matrix. Changes in crystallinity due to UV-induced polymer chain scission or crosslinking are also anticipated. The findings will provide valuable insights into the UV resistance of CFRTPs, helping to optimize material formulations for improved durability. This study is part of an ongoing research initiative exploring the environmental durability of thermoplastic composites. The results will contribute to the development of longer-lasting, high-performance materials for applications where prolonged UV exposure is a critical concern.

Keywords:

UV Light; Degradation; Composites; Thermoplastic; Mechanical Property

Mentor(s):

Garam Kim (Purdue University); Rishabh Pammi (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1267

Presentation Time: Session 2: 10:30-11:30am

Design and Development of a Daughter Board for Caravel eFabless Chiplet Integration

STEM

Authors(s):

Seokjae Kim† (Engineering); Vivek Matta† (Engineering)

Abstract:

This paper presents the design and development of a daughter board to interface with the Caravel eFabless chiplet, utilizing a standardized M.2 connector for seamless integration. The primary objective is to establish reliable communication with the chiplet while ensuring stable power delivery, clock synchronization, and data storage. The board integrates two TLV761 voltage regulators (1.8V and 3.3V), a DSC6001 10MHz MEMS oscillator, a W25Q32JV flash memory module, and an FT232H USB interface for debugging and communication. The development process includes schematic design, component selection, PCB layout, and iterative prototyping. To validate the design, power stability is assessed by measuring voltage ripple and load regulation under different operating conditions. The proposed daughter board enables efficient and reliable communication with the Caravel chiplet, facilitating its use in embedded systems and chiplet-based computing applications.

Keywords:

Caravel eFabless Chiplet; Daughter Board; PCB Design; Testing

Mentor(s):

Matthew A Swabey (Purdue University); Weijing Sebastian Chen (Engineering); Vishnu Chaithanya Lagudu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1268

Presentation Time: Session 2: 10:30-11:30am

Racing Line Optimization with Adaptive Grip Estimation

STEM

Authors(s):

Junyoung Kim† (Engineering); Christian A Choi† (Engineering); Aroldo Fernando Lugo Quintanilla† (Engineering); Nicholas Gentry Viardo* (Engineering)

Abstract:

Adapting to new environments is a critical challenge in autonomous driving, as the system must handle sudden changes at any speed, such as rain, snow, or black ice on highways. Professional racing drivers possess a deep understanding of vehicle dynamics and handling, a skill set mastered by only a select few worldwide. Driving at the limit demands analyzing thousands of inputs to estimate tire grip and navigate the fastest route through evolving conditions. In this work, we aim to optimize racing lines by accurately estimating tire grip and track surface conditions while minimizing the risk of losing traction. Our approach involves real-time grip estimation and continuous exploration of the racing line using sampling-based methods. This strategy reduces uncertainty and enables adaptation to continuously changing environments, resulting in a more robust racing line optimization algorithm.

Keywords:

Autonomous Driving; Motion Planning; Vehicle Dynamics; Physics; Racing

Mentor(s):

Samuel Labi (Purdue University); Andres Felipe Hoyos Moreno (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1269

Presentation Time: Session 2: 10:30-11:30am

Predicting Peoples' Perfect Bracket: A Data-Driven Approach to March Madness Forecasting

Business Case Study

Authors(s):

Lauren Mackenzie Knowlton† (DSB)

Abstract:

This project investigates how participants choose their NCAA March Madness brackets by employing business and predictive analytics techniques. It begins by clearly defining the central research question: Which demographic and behavioral factors most strongly predict bracket selections, and how can these insights be leveraged for improved marketing strategies? To address this question, multiple user-information datasets that detail bracket choices and participant characteristics are analyzed. After rigorous data cleaning—such as median imputation of null values and reduction of noisy variables—exploratory data analysis (EDA) and correlation matrices are conducted to identify key predictors. A logistic regression and Naïve Bayes classification models were applied, using cross-validation methods to select the best-performing models and reduce overfitting.

The findings bear significant implications for sponsors, colleges participating in March Madness, and the NCAA itself by facilitating more targeted marketing strategies. Specifically, accurate model predictions allow stakeholders to segment audiences, tailor promotional campaigns, and optimize overall user engagement for maximum profitability. These predictive insights deepen our understanding of consumer behavior in high-profile sports competitions, offering a competitive edge in sports marketing. Future research can extend these modeling approaches to other sporting events or broader applications of consumer choice prediction.

Keywords:

Predictive; Analytics; Market Value; March Madness; NCAA

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1270

Presentation Time: Session 2: 10:30-11:30am

Experimental study on post-installed anchors under shear loading

STEM

Authors(s):

Nickolas Koe† (Engineering); Sanath Bhavankar* (Engineering|JMHC); Hamond Rahardjo* (Engineering)

Abstract:

Anchors are used in structures to connect steel to concrete structural elements. Typically, cast-in anchors, which are placed in forms before concrete pouring, are utilized. However, due to the intense preplanning and accuracy requirements, cast-in anchors are often misaligned. Additionally, for reinforcing preexisting buildings, installing cast-in anchors is impossible. In such cases, post-installed anchors are used. Post-installed anchors are installed by drilling a hole into concrete and using high-strength epoxy to connect a threaded rod anchor. When these anchors are loaded in shear and close to an edge, concrete edge breakout occurs: a brittle failure mode which often limits the load the anchors can take.

In such edge cases, reinforcing steel bars (rebar) are used to increase the strength of concrete and avoid edge breakout failure, allowing utilization of the full capacity of the anchors. However, this is impossible for existing structures. This project aims to determine the scope of using post-installed rebars installed using high strength epoxy, similarly to post-installed anchors. Large-scale experiments will be conducted with two concrete slab specimens, one with and one without post-installed rebars installed around the post-installed anchors. It is expected that the post-installed rebar will improve the strength and ductility of these anchors, leading to delayed and less sudden failure. Applications of this work include retrofitting existing weak anchors, and techniques for installation of anchors close to an edge.

Keywords:

Concrete; Structural Retrofitting; Concrete Anchorage; Structural Reinforcement; Rebar

Mentor(s):

Deepak Suthar (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1271

Presentation Time: Session 2: 10:30-11:30am

Biological and Behavioral Effects of PCOS on Cognition

STEM

Authors(s):

Linnaea Eileen Krupke† (HHS)

Abstract:

Polycystic Ovary Syndrome (PCOS) is a hormonal disorder that affects 10-15% of women yet remains critically understudied. It is characterized by the Rotterdam criteria: an irregular menstrual cycle, cystic ovaries, and an increase in androgen levels. Recent studies have demonstrated that women with PCOS performed worse than controls on cognitive tests measuring executive function, specifically working memory (Huddleston et al., 2022). Despite this, few rodent models of PCOS successfully replicate cognitive deficits seen in humans. To address this gap, we modeled aspects of PCOS in female adolescent rats by administering dehydroepiandrosterone (DHEA), an androgen proven to induce PCOS. The groups were subcutaneously injected daily with either 6mg/kg of DHEA (experimental) in sesame oil, or pure sesame oil (control), starting at PND 40 and lasting for 25 days. After treatment, rats were characterized as PCOS phenotype or normal phenotype based on the Rotterdam criteria. At the end of treatment, subjects were tested in the Y-Maze, a model of working memory. We hypothesized that animals that developed a PCOS phenotype would display decreased spontaneous alternations in the Y-Maze. In this pilot study, we found a moderate effect size in the hypothesized direction (Cohen's d = 0.62). To examine inflammatory markers, we performed immunohistochemical analysis (IHC) on samples from brain areas associated with spatial memory. Future experiments will have a larger sample size to further test our hypothesis. This work will allow for a better understanding of the consequences of PCOS on spatial working memory and elucidation of mechanisms underlying its effects.

Keywords:

PCOS; Cognitive Impairment; Spatial Memory; Rodent Model; Women

Mentor(s):

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Other Acknowledgement(s):

Claire Elizabeth Miller (HHS)

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Poster Presentation Abstract Number: 1272

Presentation Time: Session 2: 10:30-11:30am

Exploring Older Adults' Privacy Concerns In Robot-Mediated Data Collection

Social Science

Authors(s):

Avery Kruppe† (Polytechnic)

Abstract:

Social robots, capable of human-like interaction, have uses as assistants and companions. To function, social robots rely on sensors that collect personal data and can pose as privacy threats. This project evaluates the level of and types of privacy concerns older adults (65+) have with social robot-mediated data collection. To investigate this, we conducted two participatory design workshops at assisted living facilities in the Lafayette, IN area. The first workshop focused on hands-on demos, education about data collection, and a storyboarding activity on how older adults might use social robots. The second workshop expanded upon the first with a greater focus on privacy and a discussion about how participants might resolve privacy concerns from the storyboard interactions ideated in the first workshop. Data, including survey responses, storyboards, field notes, and discussion transcriptions were analyzed thematically. Privacy concerns included breaches of personal and behavioral data in ad targeting and phishing scams. Various factors including participants' backgrounds (age, tech literacy, income level), as well as, current motivations for technology use contributed to differing levels of concern. The discovery of older adults' privacy concerns and the factors contributing to these emphasize the importance of incorporating older adults in participatory design for technology. When technology such as settings screens are designed with the needs of older adults in mind, there is the potential to increase older adults' comfort with technology and reduce use barriers. This potential and the development of privacy-focused design best practices for older adults are of further study for our lab.

Keywords:

Robots; Privacy; Design; Technology; Qualitative

Mentor(s):

Sooyeon Jeong (Purdue University); Anastasia Kouvaras Ostrowski (Purdue University); Rua Mae Williams (Purdue University)

Other Acknowledgement(s):
Nishchal Jagadeesha (Science); Chorong Park (Polytechnic); Yanfu Liu (Science)

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Poster Presentation Abstract Number: 1273

Presentation Time: Session 2: 10:30-11:30am

Burnout of Museum Workers

Humanities

Authors(s):

Olivia Madison Krzyzanowski† (Agriculture)

Abstract:

This study examines how museum workers across various roles and institutions experience burnout, with the goal of raising awareness of contributing factors and identifying challenges faced by employees. The aim is also to propose solutions for improving staff well-being.

Data were collected from 502 respondents from various backgrounds, who completed an anonymous survey. Respondents were workers in curatorial, education, administration, visitor services roles, and many more. Results revealed that burnout is a significant issue, with 50.6% of respondents reporting frequent or constant burnout. Key contributing factors included high emotional demands, and overwhelming workloads. Visitor-facing roles experienced higher burnout levels, but administrative and curatorial positions also faced considerable stress related to workload and resources. Although, 49.4% of respondents did not experience it frequently, indicating variability based on job roles and museum types. The Copenhagen Burnout Inventory is also used to measure the burnout of the museum workers.

When asked about anxiety, nearly half of respondents reported experiencing symptoms of nervousness or worry multiple days each week, with a significant portion struggling with uncontrollable worry nearly every day. These findings suggest that chronic stress and anxiety are widespread among museum workers, although the specific causes of burnout were not fully determined. Out of the 184 respondents who reported taking action to address their job stress, the top coping mechanisms were seeking support from friends, therapists, and utilizing relaxation techniques. Future research should focus on identifying more factors of burnout to guide effective interventions and support mechanisms for museum employees.

Keywords:

Burnout; Museum; Employees; Survey; Mental Health

Mentor(s):

Mark Wilson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1274

Presentation Time: Session 2: 10:30-11:30am

Thermal Fatigue of Adhesive Bonding in Modular Additively Manufactured Fiber-Reinforced Composite Tooling

STEM

Authors(s):

Meghana Kumar† (Engineering|JMHC); Lucas Emanuel Rodrigues‡ (Engineering)

Abstract:

In the aerospace tooling industry, the use of Large-Scale Additive Manufacturing is expanding and developing quickly. Many of these tools are developed via modular fabrication, which includes developing different printed sections that then assemble together to make a part. These sections are often joined together with an adhesive, which ensures an easy application process, and a strong vacuum-sealed surface. Cyclical thermal effects ranging up to 180 °C, for the epoxy adhesive, are an important consideration, as an inconsistency between the substrate and adhesive's coefficients of thermal expansion (CTE) could impact the adhesive and weaken the structure, to a degree in which it would be unsafe to use for aerospace applications. To combat this, this research will investigate the effects of thermal degradation over the course of multiple curing cycles, and also explore the effects of different orientations. A number of polyethersulfone (PESU) samples will be 3D printed and will then be put through multiple thermal cycles, varying from one to ten in number. In order to test the thermal effects on the samples, double cantilever beam (DCB) fracture tests were performed. As the thermal cycles increased, the fracture toughness weakened. The orientation of the specimens was also analyzed, with the bonding planes in different directions such as printing & transverse (1-2), printing & stacking (1-3), and transverse & stacking (2-3). The result of repeated thermal cycles on the adhesive was investigated by doing simulation analysis.

Keywords:

Additive Manufacturing; Adhesive Bonding; Thermal Fatigue

Mentor(s):

Garam Kim (Purdue University); Paul Kyu-Hwan Park (Polytechnic); Eduardo Barocio Vaca (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1275

Presentation Time: Session 2: 10:30-11:30am

Analyzing and Comparing Tibial and Femoral Bone Loss Patterns Following ACL Rupture

STEM

Authors(s):

Aishwarya Kunigal† (Engineering)

Abstract:

Post-traumatic Osteoarthritis (PTOA) is a degenerative joint disease that develops after joint injury and is marked by changes in cartilage and underlying bone. Researchers use micro-computed tomography (microCT) to visualize bone mineral content by scanning small samples from different angles to create 3D images. For PTOA studies, murine stifles are scanned to measure microstructural properties of mural hindlimbs. Previous studies show compartment-specific differences in bone loss, with the medial side experiencing greater decreases in trabecular number (Tb.N) and increases in trabecular thickness (Tb.Th) compared to the lateral side.

We utilize a non-invasive approach to elicit PTOA by rupturing the anterior cruciate ligament (ACL) using a murine model. This method involves applying a single tibial compression that destabilizes the stifle to produce a mid-substance ACL tear. After 28 days, we euthanize the animals and collect tissues to analyze. Understanding compartment-specific variations is essential for targeting localized bone degeneration in PTOA, with microCT imaging after ACL injury offering key insights into progression.

This study aims to compare bone and mineral loss patterns in tibial and femoral compartments after ACLR at the 14- and 28-day time points. Specific parameters will be evaluated to measure bone loss: Trabecular Bone Volume Fraction (BV/TV), Trabecular Thickness (Tb.Th), Trabecular Separation (Tb.Sp), Trabecular Number (Tb.N), and others. Statistical analysis will be performed using MATLAB and a paired T-test will be used to evaluate the tibial and femoral differences. I hypothesize that the tibia will experience greater bone loss due to its higher mechanical load during weight-bearing stress.

Keywords:

Post-Traumatic Osteoarthritis (PTOA); Micro-Computed Tomography (Micro-CT); Anterior Cruciate Ligament (ACL) Rupture; Bone Loss Patterns; Bone Mineral Content

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Deva Chan (Purdue University); Ryan Michael Meister (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1276

Presentation Time: Session 2: 10:30-11:30am

The Relationship Between State-Level Tobacco Laws and Prevalences in the US: A Mediation Analysis

STEM

Authors(s):

Yen-hsi Lai† (HHS)

Abstract:

Tobacco/Nicotine use is a leading cause of preventable diseases in the US, and state-level tobacco control laws play a crucial role in reducing prevalence. However, it is unclear how these laws influence tobacco/nicotine use. Research has shown that tobacco laws effectively reduce adult tobacco use, while nicotine laws reduce youth nicotine use. This study aims to investigate if nicotine use mediates the relationship between tobacco laws and tobacco prevalence. Data on 2022 state-level tobacco laws were collected from the Center for Disease and Control. The data on 2022 state-level tobacco prevalence and nicotine laws were collected from the American Lung Association. Control variables, including age, sex, race/ethnicity, income, and disability status were included to avoid potential confounding. The mediation analysis will be conducted using PROCESS Model 4 in SPSS. From the model, we observed that the indirect effect of tobacco laws on tobacco prevalence via nicotine was significant (?=0.230, 95% CI: 0.144 to 0.444, $P<0.05$). Nicotine prevalence mediates the relationship between tobacco laws and tobacco prevalence. Our results show that stricter tobacco laws reduce nicotine use, which in turn leads to lower total tobacco prevalence for the overall population in each state in the US. This study could provide insight into the mediating role of nicotine use in the relationship between tobacco laws and tobacco use. The findings may help inform more effective tobacco control policies, particularly in states with varying levels of nicotine prevalence, to reduce tobacco use and improve public health outcomes.

Keywords:

Public Health Legislation; Tobacco Control Laws; Nicotine Prevalence; Tobacco Prevalence; Mediation Model

Mentor(s):

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Other Acknowledgement(s):

Siqi Yang (HHS)

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Poster Presentation Abstract Number: 1277

Presentation Time: Session 2: 10:30-11:30am

Evaluation of Inhibition Concentration, Solubility, and Metabolic Stability Data for Covalent Antimalarial Analogs

STEM

Authors(s):

Zane Anthony Lark† (Pharmacy)

Abstract:

Malaria is a widespread disease, with 40% of the global population vulnerable to infection. Malaria infection is caused by the eukaryotic protozoan parasite, Plasmodium, most notably, the falciparum and vivax strains. Through fragment screening, the Flaherty Lab has identified a compound that could covalently inhibit a vital protein in the Plasmodium parasite. After chemical modifications to the initial hit, we arrived at an analog with nanomolar potency towards the parasite. Early identifiable problems with the analog include poor pharmacokinetic properties, such as solubility and metabolic instability. Through designing, synthesizing, and testing derivatives, this research project will evaluate the variation in inhibition concentration, solubility, and metabolic stability. After synthesis of the newly proposed derivatives, the Lab ran a dose response inhibition assay against the target Plasmodium vivax protein to determine the concentration of compound at 50% inhibition towards the protein. Next, the Lab used a modified procedure utilizing high-performance liquid chromatography to determine the solubility of the new derivatives. Finally, the Lab ran two time-course assays using S9 liver enzyme fractions and incubated glutathione respectively to predict the metabolic half-life stability of the compound derivatives. Analyzing these biological assays informs our decisions on what further chemical modifications we should make to the analog. This will allow us to optimize the combination of efficacy, solubility, and stability to push a final compound with a novel mechanism of action into clinical trials.

Keywords:

Drug Discovery; Anti-Malarial; Pharmacokinetics; Covalent Inhibitor; Lead Optimization

Mentor(s):

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Other Acknowledgement(s):

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University); Katrina Jeanae Holly (Pharmacy); Nagabhushana Chinnenahalli Beeralinga (Purdue University)

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Poster Presentation Abstract Number: 1278

Presentation Time: Session 2: 10:30-11:30am

Metal-Insulator-Metal Capacitor SPC - MIM3

STEM

Authors(s):

Gangsan Lee† (Engineering); Jozue Kim† (Engineering); Brian Martin Dodd† (Engineering); Ella Gores† (Engineering); Haneul (Sky) Kim† (Polytechnic); Sang Soo Ha† (Engineering)

Abstract:

This research focuses on the development and fabrication of Metal-Insulator-Metal (M-I-M) capacitors, a type of high-quality capacitor manufactured using nanotechnology fabrication techniques. These capacitors play a crucial role in Integrated Circuits (ICs), particularly in Radio Frequency (RF) and analog applications. To establish an optimized manufacturing flow, we will conduct research and development to design the process flow and capacitor specifications, followed by fabrication in Birck's cleanroom. After completing the fabrication, we will collect various data, such as film thickness and dielectric quality, to analyze capacitor performance, utilizing Statistical Process Control (SPC), a widely used methodology in IC manufacturing.

Our goal is to introduce a structured manufacturing process for M-I-M capacitors and implement SPC within Birck's cleanroom using an iterative design approach. This process involves treating pre-silicon-oxide deposited 4-inch wafers, depositing oxide through Atomic Layer Deposition (ALD), and using Physical Vapor Deposition (PVD) for metal deposition. Additionally, we will pattern photoresist through lithography processes and gather data for SPC through probing and profilometry.

Ultimately, we aim to establish an M-I-M capacitor fabrication workflow at Birck's cleanroom while enhancing semiconductor manufacturing through SPC. By systematically analyzing process conditions, equipment performance, and cleanroom stability, we seek to control within-wafer and batch variations, ensuring consistency and reliability in capacitor production.

Keywords:

Nanofabrication; Capacitor; Birck; VIP; Statistical Process Control

Mentor(s):

Zhihong Chen (Purdue University)

Other Acknowledgement(s):
Richard D Harlan (Purdue University); Ronald K Reger (Purdue University); Noah F Opondo (Purdue University); Joon Hyeong Park (Purdue University); Neil R Dilley (Purdue University); Angshuman Deka (Purdue University); Feichi Huang (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1279

Presentation Time: Session 2: 10:30-11:30am

Leveraging ChatGPT for Qualitative Data Analysis: A Case Study on Data Management Practices among Computer Vision Scholars

STEM

Authors(s):

Zonghan Lei† (Science|JMHC|Graduate); Zachary John Heskett* (Science|JMHC); Vikram Oddiraju* (Science|JMHC)

Abstract:

Qualitative data analysis plays a crucial role in deriving meaningful insights from research data. However, conventional software tools like NVivo present challenges such as high costs and complexity (Dalkin, et al., 2021). This abstract advocates for integrating ChatGPT, an AI technology, into qualitative data analysis workflows to overcome these challenges. Focusing on the data management practices of Computer Vision professors, the study investigates how ChatGPT enhances human analysis by streamlining processes and uncovering hidden patterns within datasets. Structured interviews were conducted with six participants from research institutions (R1). The transcripts underwent manual scrutiny to identify recurring themes and patterns. Subsequently, the results were compared with ChatGPT analysis to evaluate its efficacy in qualitative data analysis. The findings illustrate the effectiveness of ChatGPT in augmenting traditional qualitative data analysis methods. By leveraging AI capabilities, ChatGPT facilitates a more efficient and comprehensive analysis, enabling researchers to uncover nuanced insights that may have been overlooked through manual analysis alone. This case study contributes to the ongoing discourse on AI's role in research, demonstrating how ChatGPT can enhance qualitative data analysis and drive advancements in academic research methodologies. The study also revealed certain limitations of AI as an analysis tool, such as potential inaccuracies, biases, and as well as ethical concerns. Therefore, while AI aids in analysis, manual intervention remains crucial to ensure accuracy and comprehensiveness in research methodologies.?

Keywords:

Research Data Management; AI; Computer Vision; Qualitative Data Analysis; ChatGPT

Mentor(s):

Wei Zakharov (Purdue University)

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Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1280

Presentation Time: Session 2: 10:30-11:30am

Reliability for High-Temperature Solders Alloys with Microalloying

STEM

Authors(s):

Colton Pierce Lennen† (Engineering)

Abstract:

Solder alloys provide good mechanical and electronic connections for circuit boards. In recent decades, researchers have been turning their attention to lead-free solder alloys for advanced packaging applications. In this project, the high-temperature solder (HTS) alloys refer to Sn-Ag-Cu (SAC) alloys, for example, SAC305 (Sn-3wt%Ag-0.5wt%Cu) and Innolot (Sn-3.8wt%Ag-0.7wt%Cu-3wt%Bi-1.4wt%Sb-0.15wt%Ni). The study investigates the effects of microalloying on the microstructure, thermal properties, and mechanical properties of these alloys, as well as their deformation mechanisms. The ultimate goal is to understand how different alloying elements impact solder reliability and, consequently, the reliability of the overall system.

Keywords:

Solder; Material Science; Mechanical Behavior; Creep Resistance; Reliability

Mentor(s):

Lijia Xie (Engineering); John E Blendell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1281

Presentation Time: Session 2: 10:30-11:30am

Mobile App Loyalty Program - A Case Study of Greyhouse Coffee

Business Case Study

Authors(s):

Kylie Michelle Levine† (DSB); Skylar Marie Heckman† (DSB); Olivia Kylie Troy† (DSB); Varsha Raj† (DSB|JMHC)

Abstract:

This research aims to identify a viable target market for Greyhouse Coffee in West Lafayette and assess consumer perceptions regarding the introduction of a Mobile App Loyalty Program. By leveraging both surveys and focus groups, we seek to gather insights into consumers' engagement with loyalty programs, their behavioral patterns, and the key metrics influencing participation.

Preliminary findings will integrate qualitative and quantitative data, offering an in-depth understanding of consumer sentiment toward the proposed loyalty program. Additionally, a comparative analysis of past consumer engagement with similar programs offered by competitors will provide further context for evaluating the potential success of Greyhouse Coffee's initiative. The findings from this study will offer strategic implications for enhancing customer retention and engagement through digital loyalty solutions in the local specialty coffee market.

Keywords:

Case Study; Loyalty Program; Mobile App; Marketing Analysis

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1282

Presentation Time: Session 2: 10:30-11:30am

Analyzing Research Experience for Undergraduates

STEM

Authors(s):

Emily Ran Li† (Science|JMHC)

Abstract:

The Research Experience for Undergraduates (REU) program aims to broaden participation in STEM, particularly in engineering, by providing students with hands-on research experiences. By exposing underrepresented students to advanced methodologies, fostering professional development, and creating an inclusive research environment, REUs enhance diversity in STEM fields.

Funded by organizations like the National Science Foundation (NSF), REUs immerse students in faculty-mentored research, strengthening technical expertise and increasing confidence in applying engineering principles. These experiences deepen students' understanding of research while cultivating a sense of belonging in engineering disciplines.

This analysis utilized qualitative thematic analysis in NVivo to assess focus group reflections. Participants discussed skill development, research engagement, and career aspirations, offering insight into the program's academic and professional impact.

While the REU effectively supported student growth, logistical challenges such as inadequate housing, unclear transportation, and delays in setting up institutional credentials created obstacles. Participants also suggested modifications to the weekly written reflections to improve engagement. However, the program was overwhelmingly positive, helping students refine career goals, enhance research skills, and solidify their commitment to engineering.

To maximize impact, REU project coordinators should consider implementing best practices identified in this analysis. Addressing logistical concerns and refining reflection activities can further enhance student experiences, ensuring REU programs at other universities continue to foster diversity, inclusion, and professional development in engineering research.

Keywords:

[no keywords provided]

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Lisa B Bosman (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1283

Presentation Time: Session 2: 10:30-11:30am

The Role of AKT and Skeletal Muscle in The Maintenance Of Neuromuscular Junction Plasticity

STEM

Authors(s):

Nathan Roger Lin† (HHS); Annabella Mei Lau† (HHS); Amanda Lynn Spanier‡ (HHS)

Abstract:

Skeletal muscle is vital for movement, posture, and metabolic regulation. The neuromuscular junction (NMJ) facilitates communication between motor neurons and muscle fibers, playing a critical role in muscle function. The integrity of the NMJ is crucial for precise neuromuscular transmission, ensuring efficient muscle contraction and overall mobility. Disruptions in NMJ maintenance can lead to muscle weakness and degeneration, which are prominent features of age-related muscle disorders such as sarcopenia. At the core of NMJ function is the stability and organization of nicotine's acetylcholine receptors (nAChR) at postsynaptic sites.

Despite decades of research, the molecular driver that regulates nAChR stability and NMJ homeostasis remain elusive.

The insulin signaling pathway, mediated by the AKT protein, is integral to skeletal muscle metabolism. This pathway regulates key processes such as glucose uptake and protein synthesis, which are essential for maintaining muscle mass and function (Jaiswal et al. 2022). Dysregulation of the insulin signaling pathway, especially through impaired AKT activation, can lead to metabolic disorders and muscle atrophy. In skeletal muscle, proper insulin signaling ensures muscle growth, repair, and overall metabolic health (Jaiswal et al., 2022). While studies in lower organism suggest a role of AKT in NMJ maintenance, its function in regulating nAChR stability in mammals remain controversial. This study seeks to address critical knowledge gap in NMJ biology by elucidating the role of AKT signaling in nAChR stability.

Our results revealed that loss of AKT activity in skeletal muscle results in disintegration of Agrin mediated nAChR stability. We aim to further investigate the molecular mechanism underlying AKT mediated nAChR stability.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Skeletal Muscle; Acetylcholine Receptor; Neuromuscular Junction; AKT

Mentor(s):
Natasha Jaiswal (Purdue University)

Other Acknowledgement(s):
Pengjun Zhang (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1284

Presentation Time: Session 2: 10:30-11:30am

Large language model (LLM) for surgical training and the evaluations of LLM performance

STEM

Authors(s):

Che Liu† (Engineering); Aqib Muhammad Abdullah† (Engineering|JMHC)

Abstract:

This study was conducted to assess the current and future role of large language models (LLMS) in the surgical process, including surgical education and simulations for students. The study was conducted through thorough exploration via PRIMSA of existing literature on various LLM application, design, and assessment in surgical simulation and education, including the PubMed, Cochrane Library, Scopus, IEEE Xplore, and Google Scholar databases followed by a screening to remove unrelated articles. The review revealed that LLMs can potentially transform many areas of surgery, benefiting students, educators, and practitioners alike. Their ability to summarize vast amounts of data in digestible amounts and generate many simulated situations for students shows their potential as a tool for education. Despite this, LLMs in their current state have many issues that limit their usefulness. For example, LLM responses often do not include credible sources. Limitations in training data can result in biased answers with regards to race, gender, and other factors. “Hallucinations” of false data are another issue; LLM-generated material must be thoroughly fact-checked before real usage. Although these are major issues that decrease trustworthiness in LLMs as tools for surgery and surgical education, the potential they hold to transform many aspects of surgery should continue to be researched.

Keywords:

LLM; Human Factors; Surgical Education; Surgery; AI

Mentor(s):

Denny Yu (Purdue University); Peiran Liu (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1285

Presentation Time: Session 2: 10:30-11:30am

Exploring Natural Enemies of Coffee Leaf Rust

STEM

Authors(s):

Lindsey Nicole Lorenz† (Agriculture)

Abstract:

Coffee Leaf Rust (CLR) is the most important disease of coffee and has caused devastating epidemics in all regions that produce coffee. A better understanding of natural enemies (hyperparasites) of this rust could have significant impact on effective disease management. Limited data exist concerning the range or identity of natural hyperparasites of Hemileia vastatrix (the causal agent of CLR). The Arthur Fungarium (PUR) at Purdue University contains hundreds of specimens of CLR gathered from most coffee growing regions of the world. In an effort to identify new potential hyperparasites of CLR and to determine their range, we are screening this material for the presence of co-collected hyperparasites by visual inspection under a dissecting scope. When a potential hyperparasite is found, it is photographed and a small sample is collected for DNA extraction and sequencing for identification. We hypothesize that novel hyperparasites will be identified from these CLR samples. Our work will provide the first dataset of the global hyperparasites of CLR and may lead to the development of more effective control strategies for this disease.

Keywords:

Hemileia vastatrix; Coffea arabica; Hyperparasite; Mycoparasite

Mentor(s):

Terry Jarianna Torres Cruz (Purdue University); Mary Aime (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1286

Presentation Time: Session 2: 10:30-11:30am

Using IoT and Edge Computing to Ensure Saftey in the Bechtel Innovation Center

STEM

Authors(s):

Jason Dumaual Lyst† (Engineering); Namit Shailesh Joshi† (Polytechnic); Jayaditya Borah† (Engineering); Abhiraj Singh Jaswal† (Engineering)

Abstract:

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The Bechtel Innovation Center is one of Purdue's greatest assets because of the many manufacturing tools it offers students. However, this can also be a potential invitation to safety and environmental hazards. Therefore, this team's goal is to prototype and implement a network of sensors and microcontrollers to be dispersed around the manufacturing center to collect data and ensure safety. Ultimately, this should be a system that one could check remotely, and can also use machine learning to automatically alert anybody of a potential problem long before it does any harm.

The methodology involves connecting SEN55 air quality sensors to ESP32 nodes via I2C. From there, the nodes will connect to a central root node wirelessly via ESPNOW, a very low-power wireless communication protocol from ESPRESSIF Systems. Finally, the root node will connect to an Orange Pi server via UART, and the Orange Pi can be accessed remotely through HTTPS(S). The team is expecting to have working prototypes and preliminary data by spring break. From there, we intend to manufacture our final designs into PCBs, as well as enable over-the-air updates. This will ensure a continuously running and robust system that can be trusted by the Bechtel Center, as well as provide next semester's students of the team with a system that is easy to build upon.

Keywords:

IoT; Manufacturing; Edge Computing

Mentor(s):

Jaeeun Kim (Engineering); Matthew A Swabey (Purdue University)

Other Acknowledgement(s):

Andrea Marie Tener (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1287

Presentation Time: Session 2: 10:30-11:30am

Utilizing the Modified Gaussian Model to analyze the abundance and locations of pyroxenes on the lunar surface

STEM

Authors(s):

Matthew Robert Scheer† (Polytechnic); Kamden Elliott Maddox‡ (Science); Jessica Marie Cyr‡ (Science); Arunima Saha‡ (Science)

Abstract:

The Apollo samples have given us a detailed understanding of a few select regions of the lunar surface, however remote sensing data can provide a global view of the lunar composition. Currently, the Indian Space Research Organization's Chandrayaan-2 mission is orbiting the Moon and will eventually provide global coverage. The spectrometer aboard this mission, the Imaging Infrared Spectrometer (IIRS) can provide valuable insight into the surface composition of the Moon, which will contribute to our understanding of the history of lunar volcanism. A single observation by this spectrometer contains over a million individual pixels with a spatial resolution of 80 meters per pixel. In this work, we analyze a total area of ~12,000 m^2 within a single one of these observations. We use two approaches to measure the 2 ?m pyroxene absorption feature at each pixel: measuring the band parameters (band depth, band width, and band area), and the Modified Gaussian Model (MGM). This second approach uses multiple Gaussians to distinguish different compositions within the same absorption band. We will analyze and map the variability of the abundance and locations of pyroxene on the lunar surface. The results from this work can be compared to previous results from other orbiting spectrometers, such as the Moon Mineralogy Mapper.

Keywords:

Moon; Pyroxene; Spectroscopy

Mentor(s):

Kris Laferriere (Science)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1288

Presentation Time: Session 2: 10:30-11:30am

Power Integrity Analysis for Post-Layout VLSI Design

STEM

Authors(s):

Leo Pearson Malachowski† (Engineering|JMHC); Pei-Chi Liu† (Engineering)

Abstract:

Power integrity is a critical challenge in modern VLSI design, ensuring that power distribution networks deliver stable voltages across an integrated circuit. As technology nodes shrink and power densities increase, voltage fluctuations, such as voltage spikes and drops, can significantly impact performance and reliability. This project, conducted through the System-on-Chip Extension Technology (SoCET) research lab, aims to assess and optimize power integrity in a post-layout VLSI design using Cadence Voltus.

The project focuses on analyzing both static and dynamic power integrity for the AFTx07 design, a taped-out chip under evaluation. The first phase involves understanding the Voltus command sets and manually developing an analysis flow tailored to the AFTx07. Once validated, reports will be generated to assess whether the design meets voltage drop constraints. Based on the findings, refinements and optimizations will be suggested to improve power delivery efficiency. The ultimate goal is to ensure that power integrity requirements are met while enhancing the overall efficiency of the design.

By providing deeper insights into power integrity analysis and optimization, this project will contribute to the development of more robust and power-efficient VLSI designs in future semiconductor technologies produced by the lab group.

Keywords:

Power Integrity; Semiconductor Research; System-on-Chip Technologies

Mentor(s):

Timothy Francis Hein (Engineering); Ajith Kumar Raja (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1289

Presentation Time: Session 2: 10:30-11:30am

Additive Manufacturing of 3D-Printed mBTT Shunt Phantoms for Hemodynamic Analysis of Shunt Parameters

STEM

Authors(s):

Kara Rochelle McCrindle† (Engineering); Jennifer Heather Quercioli† (Engineering)

Abstract:

Single ventricle (SV) heart defects, affecting over 4,000 newborns annually, result from the underdevelopment of one pumping chamber during gestation, necessitating staged surgical interventions like the Norwood procedure. This initial surgery, performed within the first week of life, uses a shunt to replace the ductus arteriosus, ensuring blood flow to the lungs and body. However, complications such as stenosis and shunt thrombosis persist due to altered hemodynamics. While computational fluid dynamics (CFD) studies have explored shunt parameters, physical models remain understudied. This research focuses on developing a fabrication process to create modified Blalock-Taussig-Thomas (mBTT) shunt phantoms that replicate physiologically relevant geometries and flow conditions. The process involves transitioning from computer-aided design (CAD) models to physical phantoms using 3D printing and molding techniques. The resulting models include subclavian and pulmonary artery segments anastomosed to the mBTT shunt, with varying diameters and lengths of the shunt. The flow loop is designed using pulsatile flow to mimic systolic and diastolic flow and accounts for the pressure gradient across the shunt by pressurizing one side of the flow loop. These phantoms enable flow data collection using noninvasive testing, such as particle image velocimetry (PIV) and 4D magnetic resonance imaging (MRI), bridging the gap between computational and physical modeling. This methodology provides a holistic approach for hemodynamic analysis and supports clinical decision-making for shunt diameter selection in SV patients.

Keywords:

Single Ventricle Heart; mBTT Shunt; Phantom Model; Hemodynamics

Mentor(s):

Brett A Meyers (Purdue University); Pavlos Vlachos (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1290

Presentation Time: Session 2: 10:30-11:30am

CRC Accelerator for the AFTx07 System on Chip

STEM

Authors(s):

Aidan Michael McDonough† (Engineering); Daeun Kim† (Engineering); Eshan Mathur† (Engineering); Puthimet Kitjaruwankul† (Engineering); Dhruv Roopchand Khatri* (Engineering)

Abstract:

Cyclic Redundancy Check (CRC) is a widely used error detection algorithm that protects digital data against accidental changes. In contrast to traditional software-based CRC computation, which can be computationally intensive, hardware-accelerated approaches can significantly improve processing speed and efficiency. Hence, this project focuses on the design and implementation of a CRC accelerator for the AFTx07 System on Chip (SoC). In the initial phase, we aim to develop a minimal CRC accelerator using a shift-and-XOR method that processes one bit per clock cycle, establishing baseline functionality for error detection. In the subsequent phase, we will optimize the design by developing a lookup table approach. This method will compute four bits per cycle by leveraging precomputed values stored in software, selected based on the input data and the chosen polynomial, thereby reducing computation time considerably. To validate the functionality and performance of our design, comprehensive testbenches will be employed, and the accelerator's outputs will be compared against known standard outputs. This project will explore efficient error detection in digital systems, with the optimized lookup table approach offering a promising solution for improved data integrity in the AFTx07 SoC.

Keywords:

SoCET; Digital Design; Hardware Acceleration; System Verilog; CRC

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1291

Presentation Time: Session 2: 10:30-11:30am

Predicting Bracket Outcomes: Using Predictive Analytics to Understand how Customer School Affinity Effects Decision Making Bias

Business Case Study

Authors(s):

William V. Mehra† (DSB); Thomas Daniel Holland† (DSB); Nathan Andrew Summers† (DSB); Ethan Arthur Haeberle† (DSB); Mahek Gupta† (DSB)

Abstract:

Our goal through this project is to key in on the nuanced ways which NCAA bracket customers are disproportionately influenced by their ties to particular schools. By integrating external demographic and historical data, we aim to identify biases in the bracket selection process and evaluate how these biases affect prediction accuracy. This initiative will allow us to practically apply predictive modeling techniques and better understand behavioral biases in a decision making context. Our analysis began with comprehensive data cleaning, removing irrelevant columns and transforming data to ensure it was easily interpretable by the models. Subsequently the methods we adopted include a gradient Boosting Model and Random Forest Regressor. After testing a variety of models, it was clear these two had the highest accuracy score and were the easiest to manipulate semantically. Gradient Boosting, specifically XGBoost, was prioritized due to its strong performance and interpretability. Cross-validation, early stopping, and feature scaling were implemented to enhance accuracy and prevent overfitting. As we test features, we anticipate finding a strong correlation between customer DMA code and school DMA code especially if the customers are younger, they will certainly be more attached to the university which they reside closest to. Through filtering by the creation date of accounts we can track which customers are more likely to be young and identify clusters of individuals who are making decisions based upon school. With the findings we discover through our predictive analysis we intend to be able to drive business decisions such as advertising and sales with the NCAA having a better direction as to where customer loyalties lie.

Keywords:

Machine Learning; Basketball; Predictive Analytics; Statistics; Python

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1292

Presentation Time: Session 2: 10:30-11:30am

The Effect of Solar Radiation Pressure and Solar Activity Cycles on the Orbital Precession of Satellites

STEM

Authors(s):

Conner M Winchester† (Engineering); Sloan Bennett McDonald† (Engineering); Krish Samir Mehta‡ (Engineering); Evan Clark Paull‡ (Engineering|JMHC); Apoorva Bahl‡ (Engineering); Kaushik G Vudathu‡ (Engineering)

Abstract:

The solar radiation pressure (SRP) and its activity cycles perturb the orbital precession of satellites, which can lead to inaccuracies in exact satellite state knowledge. The PSP ASA Satellite Tracking Project aims to compare theoretical predictions with observed behaviors of CubeSat orbits to better support predictions of solar-induced perturbations, using the last-measured state telemetry data of various satellites from outsourced catalogs, along with their geometric characteristics. The two-line-element (TLE) telemetry data acquired is used to quantify the states of these satellites at the time of measurement. This state data is then propagated into a predicted ‘standard perturbation’ orbit, which accounts for J2 and atmospheric drag, excluding SRP. Similarly, this TLE data is also integrated into an orbital propagator accounting for SRP for comparison. Then, at later times, TLE data is taken from the same satellite catalogs of the same satellites. The states at these new observed times are directly compared to the predicted states of the satellites at the same points in time using both the standard perturbation model and the SRP model. By comparing the observed data with the standard perturbation model, the effect of SRP on the satellites is quantitatively described, allowing for a more accurate model to be created. Thus, the effect of SRP on satellite precession is quantified, which enables improved precision in predicting the effect of SRP on satellite precession.

Keywords:

[no keywords provided]

Mentor(s):

Kenshiro Oguri (Purdue University); Paulo Ramirez (Engineering); Travis James Hastreiter (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1293

Presentation Time: Session 2: 10:30-11:30am

Enhancing ECElabs.io: Porting the Logic Gate Diagram Page to Vue for Improved Usability and FPGA Integration

STEM

Authors(s):

Heran Leonardo Mei† (Science)

Abstract:

This research aims to enhance the features and performance of ECElabs.io, an online digital design platform based on Field Programmable Gate Arrays (FPGAs). Specifically, this project focuses on porting the logic gate diagram page in ECElabs.io from its original implementation in the current website to a new version built using modern web development frameworks. This transition aims to improve the user experience by enhancing the interface, optimizing performance, and making the system more intuitive. The diagram page allows users to design and visualize digital logic circuits while also providing a key feature: translating these diagrams into Verilog and SystemVerilog for FPGA implementation. By leveraging a modern framework, the updated system will hope to offer a cleaner design, smoother interactions, and a more efficient workflow for students studying Electrical and Computer Engineering at Purdue University. This upgrade ensures that ECElabs.io remains a valuable tool for digital logic design, making circuit creation and translation more accessible and effective for students learning about FPGA development.

Keywords:

[no keywords provided]

Mentor(s):

Noah Mitchell Rediker (Engineering); Junfei Li (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1294

Presentation Time: Session 2: 10:30-11:30am

Carbon fiber reinforced composite beam designing and testing for SAMPE bridge contest

STEM

Authors(s):

Stan Melkumian† (Polytechnic); Edward Yum Kim† (Polytechnic); Alex Zhihang Ye† (Polytechnic|JMHC)

Abstract:

This study focuses on designing and testing carbon fiber bridges in four categories: I-beam, square beam, open design, and sandwich beam. To assess the performance of these bridges, three-point flexural tests will be performed following ASTM standard D7264. The data collected from these tests, such as load capacity and deflection behavior, will provide critical insights into the mechanical properties and failure modes of the bridges. This experimental data will then be used to build and refine simulation models in modeling software, allowing for accurate predictions of how the bridges perform under similar loading conditions. By incorporating real-world testing data into the simulations, the models will better reflect the actual behavior of the materials and structures. This process of integrating physical testing with computer simulations not only improves the reliability of the models but also enhances the understanding of the performance of composite bridges. Ultimately, this approach contributes to advancements in material engineering by providing a more robust foundation for predicting the behavior of carbon fiber structures, which could lead to optimized designs and more efficient use of composite materials in various applications.

Keywords:

Carbon Fiber; Bridge Design; Flexural Testing; Materials Engineering; Manufacturing Processes

Mentor(s):

Garam Kim (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1295

Presentation Time: Session 2: 10:30-11:30am

Hypersonic Vehicle Design Analysis Using CBAero: System Interactions and Design of Experiments

STEM

Authors(s):

Abigail Sarah Mizzi† (Engineering|JMHC)

Abstract:

There is a growing need for hypersonic technology in civilian and defense applications. However, many unique challenges occur during the design of hypersonic vehicles due to the complexity of integrating aerodynamic and thermal analysis. This challenge is prominent in the preliminary design analysis which can be very computationally expensive. To lower computational cost, software like CBAero is being used for analysis due to the lower computational expense. However, CBAero is a lower fidelity model compared to high-fidelity computational fluid dynamics (CFD) models. This project aims to investigate the CBAero analysis of hypersonic systems to understand multidisciplinary design and optimization limitations. The X-30 National Aerospace Plane (NASP) will be used due to the large amount of literature providing data to compare with CBAero. The analysis is conducted through modeling a variety of different geometries of a hypersonic vehicle using CBAero and building a variety of different system interaction diagrams. The study includes generating a Design of Experiments to explore a simple design space and analyze performance data. The work culminates in the development of a surrogate model based on the completed experimental design matrix. The results analyze the comparison of the surrogate model data with the current analysis of the NASP X-30 literature to understand the limitations and constraints of the software to support further hypersonic vehicle design in the future.

Keywords:

Hypersonic; Aerospace; Engineering

Mentor(s):

Daniel A Delaurentis (Purdue University); Waterloo Tsutsui (Purdue University); Derek George Carpenter (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1296

Presentation Time: Session 2: 10:30-11:30am

Water-table response to rainfall in the alluvial aquifer of the Funeral Formation in Death Valley National Park, CA.

STEM

Authors(s):

Leah Nicole Montgomery† (Science)

Abstract:

A hydrogeological connection between springs discharging in Ash Meadows National Wildlife Refuge (AM-NWR) and Furnace Creek, Death Valley National Park (FC-DVNP) is the subject of ongoing debate. One conceptual model suggests that groundwater discharge from FC-DVNP springs is supported by regional, interbasin groundwater flow that also supports AM-NWR springs. A second conceptual model suggests that groundwater discharge from FC-DVNP springs is supported by local mountain-front and mountain-block recharge with additional recharge from intermittent streams. Sneha and Frisbee (2021) tested these conceptual models using a suite of isotopic tracers and found for support for a modified interbasin groundwater flow model that also includes components of local recharge from high-intensity rain events. We tested the modified interbasin groundwater flow model by performing a cross-correlation between high-intensity rain events and changes in depth to water in the alluvial aquifer in the Funeral Formation. A correlation between the rainfall and water table would indicate that recharge has occurred, supporting the modified interbasin groundwater model. We isolated the data around three of the highest intensity rain events and selected a period of 3 months after the event. A python code was used to perform a cross-correlation and determine if the correlation was significant ($p > 0.2$). Significant cross correlations were found at lags ranging between 25 and 40 days for two of the rain events. The third event lacked a strong correlation pointing to differences in antecedent conditions in the alluvium. This study provides additional support for the modified interbasin groundwater flow model.

Keywords:

Groundwater Recharge; Alluvial Aquifer; Interbasin Groundwater Flow; Cross-Correlation; Desert Springs

Mentor(s):

Marty D Frisbee (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1297

Presentation Time: Session 2: 10:30-11:30am

The Role of Air Cargo in Global E-Commerce

STEM

Authors(s):

Kamanda K Mosongo† (Polytechnic|JMHC)

Abstract:

Air freight is critical in meeting customer expectations for fast, reliable, and efficient delivery, making it essential to global supply chains. Additionally, producers rely on the expertise and infrastructure of significant cargo companies to transport their products to consumers. This research aims to illuminate air cargo's tactics with the following key questions:

1. How has the growth of e-commerce influenced the safety policies, procedures, and operational logistics of air cargo services?
2. What are the key challenges in air cargo operations driven by e-commerce growth?

This study will investigate the operational safety aspect the air cargo industry successfully incorporates into its planning processes. Sources such as financial statements, newsroom releases, and prior governmental filings related to operational logistics will be used to collect data for the study. Furthermore, information will primarily come from FedEx, UPS, and DHL's websites. Combining this data with insights from IATA on air freight trends, the research will also explore the challenges and successes of air cargo service providers in maintaining logistics efficiency and capacity building in a time of ever-increasing e-commerce.

The findings will identify how air freight companies have changed or altered their general safety policies, practices, and procedures to accommodate increased e-commerce. From these findings, researchers can base conclusions on the changes in safety operational methods, the effectiveness of these changes, and the development of efforts to integrate proper planning practices into the air cargo industry to expand global e-commerce.

Keywords:

Air Cargo; E-Commerce; Safety; Operations; Freight

Mentor(s):

Caroline Kathure Marete (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1298

Presentation Time: Session 2: 10:30-11:30am

The Development of a Thermostat Environmental Emulator With humidification and Dehumidification Capabilities.

STEM

Authors(s):

Seyed Kiarash Mossalaei† (Engineering); Gregory OHanian† (Engineering); Lexing Xu‡ (Engineering); Zaki Akhter Husain‡ (Engineering); Conner Walter MacDonald‡ (Engineering)

Abstract:

The growing global demand for space conditioning of residential and commercial buildings plays a central role in global energy consumption. As a result, the deployment of more efficient heat pumps is critical in reducing energy demands. However, the current standards used to rate this equipment employ steady-state tests where controllers are overridden. As a result, they fail to capture representative performance and don't properly incentivize manufacturers to improve their controls. In response, load-based testing has recently been developed through Purdue activities that captures the dynamic performance of heat pumps with their integrated controls. In load-based testing, psychometric chambers are utilized to emulate building loads at varying outdoor conditions, resulting in dynamic changes in indoor temperature and humidity in response to feedback control of the test unit. During the load-based testing, thermostats are an essential part of the equipment's response to the varying conditions which are highly sensitive to temperature, humidity and airflow distribution. The repeatability and reproducibility of test conditions surrounding the thermostat are critical to the testing methodologies. Thus, thermostat environment emulators have been developed to provide emulated dry-bulb temperature and air velocity at the thermostat. However, the current equipment does not emulate humidity conditions that would be important for test units that incorporate humidistats and humidity control. In this work, the addition of humidification and dehumidification capabilities within an existing thermostat environmental emulator are developed.

Keywords:

Thermostat; Load-Based Testing; Emulator; Heat Pumps; Rating Standard

Mentor(s):

James Braun (Purdue University); Do Hyeon Kim (Engineering); Jie Cai (Purdue University); William Travis Horton (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1299

Presentation Time: Session 2: 10:30-11:30am

African rust fungi (Basidiomycota, Pucciniales) in the Purdue University Arthur Fungarium include an unrecognized resource for the study of Ugandan plant pathology.

STEM

Authors(s):

Caitlyn G Mount† (Agriculture); Morgan Marie Klein† (Agriculture); Sidney Miriam Bunch‡ (Agriculture); Bryan Reyes‡ (Science)

Abstract:

Founded in 1882, the Purdue University Arthur Fungarium (PUR) holds nearly 125,000 rust (Basidiomycota, Pucciniales) specimens from around the globe, making it the most biodiverse rust collection available, and efforts to improve accessibility to these specimens have been ongoing. The Purdue University Herbaria partnered with the University of Kansas in 2022 to develop a digital repository for African plant specimens. Undergraduate students and NSF Research Experiences for Undergraduates (REU) participants have digitized more than 1,600 plant hosts of rust fungi in the PUR, though the rust fungi themselves have thus far been unreported. Here we present the genera, species counts, and collection counts for African Pucciniales in the PUR. Specimens from the Republic of Uganda represent the second-largest collection from one African country in the PUR. Of 279 Ugandan rust specimens, 235 of them, including 31 type specimens, originated from collections by Clifford Gerald Hansford from 1923 to 1948. The PUR collection of Hansford specimens surpasses his contributions to rust holdings in the U.S. National Fungus Collections (164 specimens) and the Kew Mycology Collection (54 specimens), emphasizing the importance of the PUR in the study of African plant pathology. By making these data more widely available, this initiative will facilitate future studies on African rust fungi and their plant hosts. Additionally, REU-supported students that have received hands-on training in herbarium curation, data management, and specimen preservation are currently developing a manuscript based on these findings, which will be submitted to the Proceedings of the Indiana Academy of Science.

Keywords:

Rust Fungi; Arthur Fungarium; Plant Pathology; Uganda; Africa

Mentor(s):

David Rabern Simmons (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Mary Aime (Purdue University)

Poster Presentation Abstract Number: 1300

Presentation Time: Session 2: 10:30-11:30am

Developing an SH-SY5Y model to observe mitochondrial respiratory changes for toxicological studies

STEM

Authors(s):

Joliene Ruth Munson† (HHS|JMHC); Navnoor Kaur Mutti* (HHS|JMHC)

Abstract:

SH-SY5Y human neuroblastoma cells are an inexpensive and increasingly popular model for in vitro neuron culture. However, little is known about their metabolic behavior under galactose conditions, even though galactose is a key glucose alternative utilized by neurons in vivo. This study aimed to investigate how carbohydrate availability influences mitochondrial respiration in SH-SY5Y cells to improve the translational value of this in vitro neuron model for use in toxicological studies. In our experiments, glucose was replaced in the culture media with various combinations of glucose and galactose with cell survival, growth, and morphology monitored via brightfield microscopy as outcome measures. Additionally, the JC-1 mitochondrial dye was used to assess changes in respiration. The results of this study indicated that SH-SY5Y cells do not survive when galactose is the sole carbohydrate source; the highest tolerable concentration of galactose was found to be 14mM when combined with 3mM glucose. However, JC-1 staining did not show conclusive evidence that galactose altered mitochondrial respiration. The addition of retinoic acid (RA), which temporarily induces SH-SY5Y differentiation into a more neuronal phenotype, appeared to decrease cell viability in the group treated with 14mM galactose and 3mM glucose. These results underscore the need for further evaluation of SH-SY5Y galactose metabolism, especially during differentiation, as this is a critical period of investigation for many toxicological studies which involve mitochondrial respiration.

Keywords:

SH-SY5Y; Glycolysis; Galactose Metabolism; JC-1 Dye

Mentor(s):

Ribhav Mishra (Purdue University); Aaron B Bowman (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1301

Presentation Time: Session 2: 10:30-11:30am

FPGA Area Optimization

STEM

Authors(s):

Thomas Munson† (Engineering|JMHC); Kyle Zhen-Han Wang† (Engineering); Jake Robert Zegger† (Engineering|JMHC); Daniel EnYi Yang† (Engineering)

Abstract:

The purpose of this project is to design and integrate custom muxes in an FPGA to reduce its area. FPGAs, Field Programmable Gate Arrays, are reprogrammable chips that can be used for testing chip designs, or in production if a custom chip is not economical. The main tradeoffs of FPGAs is that they are larger and slower than custom chips despite being more economical for smaller batches. FPGAs' size is known for being mostly limited by their internal logic, which is very repetitive and contains many large multiplexers, commonly referred to as muxes. A reduction to the mux size would increase the logic density of the FPGA because the FPGA architecture is quite repetitive and there are a large number of muxes. Such an increase in logic density could allow for an increase in the amount of logic that could be fit on an FPGA or make it smaller and therefore cheaper with the same amount of logic. In general muxes are used to choose between some number of inputs. The large muxes in our architecture were made of small, area inefficient 2-to-1 muxes. We have designed larger, more area efficient, 4-to-1, 8-to-1, 16-to-1 and 32-to-1 muxes by removing redundant transistors and changing their architecture. For each type of mux we have designed 4 slightly different architectures of mux. Our current results indicate that the larger input muxes may be faster, smaller on average, and more power efficient.

Keywords:

FPGA; Standard Cell Design

Mentor(s):

Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1302

Presentation Time: Session 2: 10:30-11:30am

An Analysis of a Hall Effect Thruster through the Undergraduate Lens

STEM

Authors(s):

Rowan Hewitt Murphy† (Science); Robert Maxwell Neitzke† (Engineering); Urvi Kochhar† (Engineering); Fabian Noyola‡ (Science); Niousha Pajouyan‡ (Engineering); Aaron Roth‡ (Engineering); Christopher Robert Stemporzewski‡ (Engineering); Madeline G Taylor‡ (Science); Bailey Marie Jones‡ (Engineering); Lucas ChangWon Shannon‡ (Engineering); Ethan Julian Ramon‡ (Engineering|JMHC)

Abstract:

A Hall Effect Thruster (HET) is an electric propulsion system that ionizes and accelerates noble gases to generate thrust. This study attempts to compare simulated Hall Thruster performance to experimental results, specifically regarding thrust, specific impulse (ISP), discharge current, and magnetic flux density at different discharge channel depths. This will assist in describing unexpected operating conditions and flaws in performance modeling. Magnetic flux density was measured via a Langmuir probe and compared to simulated values achieved via finite element analysis, in order to explore the limitations of digitally-generated simulations in accurately representing Hall Thruster performance. Additionally, discharge current was measured via an oscilloscope to investigate breathing mode oscillations within the thruster. Model validation will improve the approximation of performance for future electric propulsion designs, eliminating the need for costly trial and error. This organization's successes promise to foster campus interest in alternative propulsion technologies that have the potential to conserve fuel and reduce the cost of extraplanetary endeavors.

Keywords:

Aerospace; Propulsion; Electric Propulsion; Hall Effect; Solenoid

Mentor(s):

Alexey Shashurin (Purdue University)

Other Acknowledgement(s):

Nicholas Vytautas Babusis (Engineering)

Poster Presentation Abstract Number: 1303

Presentation Time: Session 2: 10:30-11:30am

Predicting March Madness Bracket: The Influence of School Affinity

Business Case Study

Authors(s):

Viet Vu Hoang Ngo† (DSB); Rachel Kalyn Spear‡ (DSB); Anishka Pateriya‡ (DSB); Marcus Victor Page‡ (DSB); Sana M Khambati‡ (DSB)

Abstract:

The goal is to predict how school affinity and historical trends influence March Madness bracket choices, focusing on how fan engagement and school spirits impact decision-making patterns. The motivation lies in the increasing significance of predictive analytics in collegiate sports, where understanding customer behavior can enhance event management, marketing strategies, and audience engagement.

With the datasets provided by the NCAA, our team split and selected predictors for the training and test datasets. Key variables of interest include customer IDs, latitude and longitude, postal/area codes, and the IDs of the respective winners of each region. After cleaning and eliminating missing values from the data, the team focuses on the use of multinomial logistic regression and gradient boosting to develop the predictive model. R and Python are used to facilitate the process.

The anticipated contribution of the analysis would suggest that strong school affinity, measured through fan engagement, correlates with bracket preferences favoring schools with a rich basketball history and consistent performance. The model's performance will be evaluated through Accuracy method, ROC curve, and Area Under Curve (AUC).

The findings will improve the understanding of customer psychology, raise awareness, and offer recommendations for sports entities to enhance marketing strategies, optimize resource allocation, foster deeper fan connections, and maintain its consistent growth. It demonstrates the power of predictive analytics in transforming and advancing collegiate sports management and decision-making processes.

Keywords:

Predictive Analytics; Fan Engagement; Bracket Choices; School Affinity; Collegiate Sports

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1305

Presentation Time: Session 2: 10:30-11:30am

Predicting Fan Engagement: A Similarity Test Enhancing Future Bracketology

Business Case Study

Authors(s):

Lynden Tate Oliver† (DSB); Aubrey Zak‡ (DSB); James Graeme Tolland‡ (DSB); Charles Andrew Dempewolf‡ (DSB); Maanav Narasimha Kyabarsi‡ (DSB)

Abstract:

[Abstract Redacted]

Keywords:

Clustering; Marketing; Bracketology; Location Bias; Visualization

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1306

Presentation Time: Session 2: 10:30-11:30am

KiharaLab EMSuite Server: Advanced Tools for Cryo-EM Structure Modeling and Validation

STEM

Authors(s):

Joon Hong Park† (Science); Pranav Punuru‡ (Science)

Abstract:

Cryo-elecctron microscopy (cryo-EM) is a recent experimental method for determining molecular structures, providing critical insights into their functions and mechanisms. However, accurate interpretation of these maps requires sophisticated computational tools to model accurate atomic structures. The EMSuite Server, available at https://em.kiharalab.org, incorporates advanced algorithms developed at Kihara Lab, providing researchers with an efficient and user-friendly solution for processing cryo-EM data. This presentation highlights the server's key functionalities, new algorithm DMcloud, and a brief idea of the upcoming algorithm DAQFinder for RNA/DNA. It demonstrates how server's algorithms can be effectively utilized to generate accurate structural models with multiple examples. By leveraging these tools, researchers can generate high-quality structural models that enhance the understanding of molecular functions and mechanisms.

Keywords:

Cryo-EM; Computational Biology; Web Server; Protein Structure Modeling; Deep Learning

Mentor(s):

Daisuke Kihara (Purdue University)

Other Acknowledgement(s):

Javad Baghirov (Purdue University); Xiao Wang (Purdue University); Genki Terashi (Purdue University); Han Zhu (Science); Yuki Kagaya (Purdue University); Shu Li (Science); Kai Ling (Science)

Poster Presentation Abstract Number: 1307

Presentation Time: Session 2: 10:30-11:30am

Reinforcement Learning-Driven Real-Time Pricing for Sustainable EV Charging

STEM

Authors(s):

Jihyo Park† (Engineering); Zephan Jacob Thomas† (Science); Shounak Mukherjee† (Engineering|JMHC); Thilak Babu† (Engineering); Hyunsang Cho‡ (Engineering)

Abstract:

With the rapid adoption of electric vehicles (EVs), optimizing traffic flow and developing robust charging infrastructure are increasingly vital. Our recent work has focused on applying reinforcement learning (RL) methods to real-time electricity pricing using the CAISO (California Independent System Operator) dataset. By integrating Bayesian analysis in SAS Viya, Deep Q-Networks (DQN), and Proximal Policy Optimization (PPO), we established a strong theoretical foundation in probabilistic forecasting and RL algorithm mechanics.

Our approach centers on defining an appropriate RL environment. The state space includes market prices, demand levels, generation mix, and system constraints, while the action space encompasses pricing decisions. The reward function is carefully designed to balance revenue maximization and grid load minimization, incorporating parameters ?1\lambda_1?1? and ?2\lambda_2??2? for pricing variables. Preliminary experiments using baseline RL models (e.g., DQN and CartPole) have demonstrated promising results, informed by continuous feedback from faculty and iterative refinements.

Looking ahead, we aim to finalize the reward function, conduct more extensive simulations on the CAISO dataset, and leverage open-source frameworks such as OpenAI Gym for implementing DQN and PPO. We will also refine our models for real-time pricing operations, thereby contributing to a more efficient and sustainable EV charging ecosystem.

Keywords:

Electric Vehicle Charging; Machine Learning; Reinforcement Learning; Real-Time Pricing Optimization; Demand Forecasting

Mentor(s):

Sivaranjani Seetharaman (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1308

Presentation Time: Session 2: 10:30-11:30am

Machine Learning Driven Analysis of Duchenne Muscular Dystrophy Cardiac MRI Data

STEM

Authors(s):

Katherine Xiaoxing Pesetski† (Engineering|JMHC); Alan Yue* (Science)

Abstract:

Duchenne muscular dystrophy (DMD) affects approximately 1 in 5,000 male births worldwide, with an estimated 250,000 individuals in the United States experiencing some form of muscular dystrophy. Our research team is determined to better understand the affliction of DMD through data analysis in an attempt to create a machine learning predictive model based on specific vitals. Cardiac MRI data from over 80 patients with DMD provided by our partner lab at Vanderbilt was analyzed using Python to identify key vitals correlating to high mortality rates. Through visualizations of the data and classification modeling, a machine learning algorithm was developed aimed at predicting mortality risk based on specific cardiac features. The findings indicate that the five primary vitals in determining deaths and assessing DMD prognosis were the left ventricular systolic function (LVEF), left ventricular end-diastolic volume (LVED), left ventricular end-systolic volume (LVES), left ventricular strain (LV strain), and myocardial fibrosis and scarring detected using late gadolinium enhancement (LGE). These insights on the five primary cardiac features may aid in improving early diagnosis and treatment strategies for DMD and related muscular dystrophies.

Keywords:

Cardiac Data; Muscular Dystrophy; Machine Learning

Mentor(s):

Guang Lin (Purdue University); Madison Ann Sullivan (Science)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1309

Presentation Time: Session 2: 10:30-11:30am

Perspectives towards DMPA-SC (Depo) self-administration among Black women

Social Science

Authors(s):

Alana Powell† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

Reproductive Justice; DMPA; Black Women; Contraceptive

Mentor(s):

Kathryn Jean LaRoche (Purdue University); Randolph Duane Hubach (Purdue University)

Other Acknowledgement(s):

Fatimah Bisola Lawal (HHS)

Poster Presentation Abstract Number: 1310

Presentation Time: Session 2: 10:30-11:30am

Hyaluronic Acid Hydrogels for Biomedical Applications

STEM

Authors(s):

Shreya Prakash† (Engineering)

Abstract:

Hydrogels are water-soluble and biocompatible polymers that are able to mimic natural tissue environments, making them immensely useful as synthetic extracellular matrices in tissue engineering applications. In this research project, hyaluronic acid hydrogels are fabricated using a photosensitive thiol-ene reaction. To make bulk hydrogels, norbornene-modified hyaluronic acid (norHA), a photoinitiator (LAP), and a di-thiol crosslinker (DTT), are dissolved in buffered saline (PBS), before being exposed to 320-390 nm UV light. The UV light activates the LAP in the precursor solution and initiates the thiol-ene reaction between the norbornene groups in the norHA and the thiol groups in the DTT. This polymerization process, called crosslinking, is determined by the polymer and crosslinker concentration and allows for the modification of hydrogel mechanical properties. By adjusting the polymer and crosslinker concentrations within the precursor solution, this research project aims to analyze how different factors influence a bulk hydrogel's mechanical properties, such as Young's modulus, swelling, and structural integrity. The final presentation will present how varied conditions affect bulk hydrogels, with the goal of understanding how to optimize hydrogel formulas for tissue engineering and regenerative medicine.

Keywords:

Hydrogels; Cross-Linking; Bulk Gels; UV Polymerization

Mentor(s):

Taimoor Hasan Qazi (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1311

Presentation Time: Session 2: 10:30-11:30am

Simultaneous Use of a Lab-Realistic Virtual Teaching Experiment Alongside an In-Person Experiment Improves Students' Academic Performance and Enjoyment of the Lab Experience.

STEM

Authors(s):

Olivia Marie Raab† (Science); Noelle Marie Voglewede* (Science)

Abstract:

We created a lab-realistic Beer's Law virtual teaching experiment which replicates, step-by-step, an in-person lab experiment and also generates data that incorporates both systematic and random error. This results in individually unique data sets that replicate results collected in-person and are suitable for full analysis. We had students use our lab-realistic virtual teaching experiment alongside the in-person lab, in real-time, and compared the students' academic performance to those of students who did not use the virtual lab. Students' perceptions of learning gains were also assessed. We found that use of the lab-realistic virtual teaching experiment improved students' academic performance by 3.1% on their post-lab reports. Students were surveyed after using the virtual lab and 60% of the students felt that the simulation was enjoyable and helped them better understand the lab content and procedures. These results suggest that the use of lab-realistic virtual teaching experiments alongside in-person labs improves students' learning experience and comprehension.

Keywords:

General Chemistry Experiment; Virtual Lab; Lab-Realistic Virtual Lab

Mentor(s):

Jonathan C Rienstra-Kiracofe (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1312

Presentation Time: Session 2: 10:30-11:30am

Design and Analysis of Flapping-Wing Unmanned Aerial Vehicle (FWAV) Modular Wing Testbed

STEM

Authors(s):

Milan Edward Rahmani† (Engineering); Sota Yanagisawa‡ (Engineering)

Abstract:

Flapping-wing aerial vehicles (FWAVs) inspired by birds have been researched for their potential to improve maneuvering capability and endurance over traditional fixed-wing aircraft. Moreover, alternate between flapping and gliding to conserve energy, while only flapping when neccesary. Previous studies have focused very little on experimental results on wing design and flapping-gliding (FG) transition. As a result, wing geometries and configurations for flapping flight have primarily been designed around biomimicry or pre-existing designs. This study introduces an open-source modular testbed designed for rapid experimentation with FWAV wings. The flapping mechanism of the testbed utilizes a four-bar linkage system to actuate the wings. Hall effect sensors are integrated to detect and fix the position of the wings to achieve FG transition. The testbed is demonstrated in the wind tunnel and used to evaluate varying wing planform designs. As a proof-of-concept, the trailing edge sweep angle is adjusted, and its effects on aerodynamic forces are analyzed. Lift, drag, and flapping frequency data are collected from the wind tunnel and an onboard computer is used to calculate power consumption and efficiency of different wing planform configurations. The proposed testbed design and experimental methodology seek to contribute to the development of future FWAV designs.

Keywords:

Flapping Wing Aerial Vehicle; Modular; Planform Efficiency; Mechanism Design

Mentor(s):

Abhijnan Dikshit (Engineering); Pavankumar Channabasa Koratikere (Engineering); Leifur Thor Leifsson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1313

Presentation Time: Session 2: 10:30-11:30am

Fantasy Disclosures in Bad Parent and Peer Groomer Chats

STEM

Authors(s):

Reeya Ramasamy† (Polytechnic)

Abstract:

According to a study published in the Journal of the American Medical Association Network Open, one in six US children experience online sexual abuse. With a growing number of cases, the concept of harmful sexual behavior is becoming more prevalent. Harmful sexual behavior (HSB) is considered any sexual actions that are outside of what is safe for a young person's stage of development. HSB contributes to the growing number and level of aggression and violence of peer-to-peer grooming cases. Research suggests aggression and glorification of rape can be tied to the prevalence of rape and aggressive sex that is shown in media. This case study compares the differences in fantasy enactment and negotiation in offender-to-offender communication in both minor peer-to-peer grooming and adult online sexual grooming scenarios, which has yet to be studied. By covering two cases, this case study analyzes the differences in fantasy enactment and self-disclosure themes between adult offenders and peer-to-peer groomers to gain a deeper understanding of these dynamics in offender-to-offender chats involving child sexual abuse. This study has been recently completed showing insightful differences between the two grooming groups. By understanding these dynamics, researchers and law enforcement can develop more effective intervention and prevention strategies tailored to the specific communication patterns and motivations of different offender groups. With more than 33% of sexual offenses against children being committed by other children, it’s important to further understand the fantasy enactment and discussions that take place in peer-to-peer grooming to reduce this statistic.

Keywords:

Peer-to-Peer Grooming; Online Sexual Abuse; Case Study; Online Sexual Grooming; Cyber Crime

Mentor(s):

Tatiana Ringenberg (Purdue University); Kathryn Seigfried-Spellar (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1314

Presentation Time: Session 2: 10:30-11:30am

Raspberry Pi Robotic Arm Image Recognition

STEM

Authors(s):

Brian Ross Ramos† (Polytechnic); Brandon Maxwell Yee† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Steven R Dunlop (Purdue University); Stewart F Bauserman (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1315

Presentation Time: Session 2: 10:30-11:30am

Benchmarking and Analyzing Machine Learning Workloads for Hardware Optimization

STEM

Authors(s):

Soham Rattan† (Engineering)

Abstract:

Machine learning (ML) models are becoming increasingly complex, requiring efficient hardware implementations to achieve optimal performance. This project focuses on identifying and benchmarking key ML workloads, including matrix multiplications, activation functions, and backpropagation, to guide hardware design decisions. By reproducing and analyzing state-of-the-art ML models from research papers, such as transformers for language modeling and image generation, we aim to evaluate their computational demands and performance metrics. Additionally, we will implement and refine models and analyze loss functions to better understand their behavior during training. The insights gained from this work will inform the development of hardware architectures tailored to accelerate ML workloads, ultimately improving efficiency and scalability for future applications.

Keywords:

[no keywords provided]

Mentor(s):

Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1316

Presentation Time: Session 2: 10:30-11:30am

SoCET HAPS

STEM

Authors(s):

Alexander Repikov† (Engineering|JMHC)

Abstract:

Making a design in silicon is a long and expensive process that, once completed, cannot be changed. Any bug found after production could ruin the entire batch. The solution to this is to do extensive verification, but fully simulating large and complex designs can be slow and resource consuming. One solution to this is to use an FPGA (field programmable gate array), a device which can be reprogrammed to emulate any digital design. Using the Synopsys HAPS-100 system, consisting of several large FPGAs, we aim to verify and benchmark designs created by other members of the Purdue SoCET team, including the AFTx07 CPU, by simulating them. This will allow for an easier debugging and verification process, both speeding up development and preventing unfixable bugs.

Keywords:

SoCET; HAPS; Synopsys; Semiconductor

Mentor(s):

Timothy Francis Hein (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1317

Presentation Time: Session 2: 10:30-11:30am

Exploring the Disaggregation of Serum Amyloid A1 Fibrils Isolated from Animals

STEM

Authors(s):

Hannah Irma Reyes Charles† (Agriculture|JMHC); Natalie Grace Horgan* (Pharmacy|JMHC); Anabela Djurovic-topalovic* (Pharmacy|JMHC)

Abstract:

Amyloidosis is a group of diseases caused by the extracellular, insoluble accumulation of fibrils in a ?-plated sheet manner often resulting from chronic inflammatory disorders in birds and mammals. The accumulation of serum amyloid A1 (SAA1) fibrils leads to amyloidosis. SAA1 is a 122-amino acid protein produced by the liver that, once mature, becomes a 104-amino acid protein. In chronic inflammatory conditions, persistent high levels of SAA1 can lead to its cleavage and deposition as amyloid A (AA) fibrils, contributing to secondary amyloidosis (AA amyloidosis). Long term effects of AA amyloidosis may result in tissue damage and organ dysfunction. Our study explores the effects of Epigallocatechin-3-gallate (EGCG) in disaggregating SAA1 fibrils isolated from chicken liver, cow liver, and cat spleen. EGCG is a green tea polyphenolic flavonoid that has antioxidant and anti-inflammatory properties. To analyze the effects of this compound on SAA1 fibrils, dynamic light scattering (DLS) and transmission electron microscopy (TEM) were used. SAA1 fibrils from different animal species were treated with DMSO (vehicle, control; 1%) and EGCG (400 µM). EGCG effectively disaggregated SAA1 fibrils and reduced fibril size. These results were confirmed by the diminishing of intensity of the 10^(3-4) nm peaks regarding fibril sizes by DLS. Moreover, TEM images of SAA1 fibrils were digitally measured, resulting in a general decrease in area and change in appearance of SAA1 fibrils exposed to EGCG. The present study suggests that EGCG could be efficient in the treatment of inflammatory diseases and potentially other conditions rooting from the disaggregation of amyloid fibrils.

Keywords:

Amyloid A (AA); AA Amyloidosis; Epigallocatechin-3-Gallate (EGCG); Serum Amyloid A1 (SAA1); Disaggregation

Mentor(s):

Jessica Sonia Fortin (Purdue University)

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Other Acknowledgement(s):
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Poster Presentation Abstract Number: 1318

Presentation Time: Session 2: 10:30-11:30am

Tobacco Perceptions and Abstinence Intentions Among Caribbean Adolescents: Through the Lens of the Health Belief Model

Social Science

Authors(s):

Ava Grace Reynolds† (Exploratory Studies|Other)

Abstract:

Tobacco use is a major global health threat, linked to several negative health outcomes including death. Unfortunately, tobacco use among Caribbean adolescents 13 to 15 years (11.3%) surpasses global averages (10.3%) and requires public health intervention. Since health beliefs are strongly linked to health behaviors, we sought to explore tobacco-related perceptions among Caribbean adolescents. We utilized 2016 – 2020 Global Youth Tobacco Survey data from four Caribbean countries: Antigua and Barbuda, St. Lucia, St. Vincent, and Cuba. We limited our analytic sample to non-smoking adolescents (N=6932; 47.2% male, 76.5% 13-15 years). Guided by the Health Belief Model (HBM), we assessed adolescents' perceptions of tobacco use. Using chi-square and t-tests, we also examined the relationship between tobacco perceptions and the intention to abstain from tobacco in the next year. Analyses were performed using STATA (Version 18). Few adolescents (9.2%; 95%CI=7.8-10.9) believed that tobacco use would be enjoyable (perceived barrier), and most (88.2%; 95%CI=85.2-90.6) believed that it is harmful (perceived severity). The perceived benefit of anti-tobacco campaigns (M=0.86; SE=0.01) and tobacco abstinence (M=0.43; SE=0.02) ranged from 0 (not beneficial) to 1(beneficial). Perceived benefits of abstinence (t=6.65, p<0.001) and anti-tobacco campaigns (t=4.65, p<0.001) were associated with higher intention to abstain. Perceived barriers were associated with a lower intention to abstain (?2=321.86, p<0.001). Perceived severity was not associated with tobacco use intentions. As signatories of the WHO Framework Convention on Tobacco Control (FCTC), all four countries should strengthen anti-tobacco policies and programs to positively influence perceptions about tobacco.

Keywords:

Adolescents; Caribbean; Tobacco; Health Belief Model; Public Health

Mentor(s):

Shandey Derisa Malcolm (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Rita Ogechi Chukwu (HHS); Qingchun Jin (HHS); Maryam Hadi (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1319

Presentation Time: Session 2: 10:30-11:30am

Customizing Grid Collimators with 3D printing for Optimized Spatially Fractionated Radiotherapy

STEM

Authors(s):

Justina Joy Riffell† (Science); Anna Polkowski† (Science|JMHC)

Abstract:

Spatially fractionated radiotherapy (SFRT) delivers radiation dose heterogeneously to create spatial regions of high and low dose within a tumor, using a grid collimator. Although the precise biological response to SFRT is unclear, research suggests benefits such as reduced tissue toxicity, immune activation, and increased immunogenic cell death. Despite these advantages, its clinical use is limited due to this uncertainty, primarily being used alongside traditional treatment for large, bulky, or radioresistant tumors or palliative care. Our research aims to optimize a preclinical SFRT grid collimator design using 3D printing to better understand the design constraints and their effect on SFRT response. 3D printing allows rapid, cost-effective customization of our collimator grids. Using Fusion 360 for design and UltiMaker Cura as a slicer, we print our grids using PLA filament and fill them with 1-mm tungsten bearings or granulated tungsten to form our collimator. These grids are designed for use in the XRAD-320 small animal irradiator. We will characterize each design with film and measure parameters such as peak-valley ratio and percent area irradiated. This work will contribute to the optimization of grid design and its role in SFRT response, which will aid in preclinical studies to understand SFRT at a biological level.

Keywords:

Spatially Fractionated Radiotherapy; 3D Printing; Tumor; Collimator

Mentor(s):

Matthew Louis Scarpelli (Purdue University)

Other Acknowledgement(s):

MacKenzie Rachelle Coon (HHS); Justin Bernard Geise (HHS)

Poster Presentation Abstract Number: 1320

Presentation Time: Session 2: 10:30-11:30am

Fast and Accurate Estimates: Leveraging Digital Technologies for Construction Estimating

STEM

Authors(s):

Samuel Carter Rolley† (Polytechnic)

Abstract:

Commercial Real Estate (CRE) in the U.S. is projected to grow at 7.6% annually over the next 10 years. This anticipated growth presents abundant economic opportunities to the construction industry. While slated for major growth, the construction industry is built on antiquated systems that may inhibit its ability to capture the future surplus. Construction companies across the nation are pushing to revise their internal processes to adapt to the modern technological landscape and turn projects over faster. Of the construction processes due for an overhaul, none are more suitable than cost estimating. Cost estimating is an intensive phase of construction projects that defines the pace and quality of all subsequent project phases. Estimating processes are comprised of redundant tasks that are carried out by highly skilled project engineers and managers. A precise and timely estimate can reduce risk for all contracts within the project scope. Many nuances prevent universal estimating solutions, but a simple framework can be tailored to the unique needs of construction enterprises across the spectrum of real estate development. By leveraging AI task automation, machine learning models, and enterprise data management, cost estimating can quickly and accurately generate proposals. Technology-supported cost estimating can yield savings, reduce project timelines, and increase client confidence. For construction companies seeking to expand into the future of Commercial Real Estate growth, this research analyzes modern estimating tools and their industry application.

Keywords:

Commercial Real Estate; Construction; Cost Estimating; Machine Learning; Digital Automation

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1321

Presentation Time: Session 2: 10:30-11:30am

Customer Segmentation and Market Expansion Strategies: A Case Study for Flora Candle Co.

Business Case Study

Authors(s):

Jessica Ruiz Cortez† (DSB); Autumn Marie Scott† (DSB); Savannah K Scheele† (DSB); Nicholas Bradley Brown† (DSB)

Abstract:

[Abstract Redacted]

Keywords:

Target Market Identification; Consumer Behavior Analysis; Customer Segmentation; Retail Marketing; Brand Positioning

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1322

Presentation Time: Session 2: 10:30-11:30am

The Hardships of the "Brightest": An Investigation Into the Unhealthy Relationship Between High-Ability Students and Academics

Social Science

Authors(s):

Emma Krista JiaFu Runyan† (Education|Liberal Arts|JMHC); Jimena Avalos-Hernandez* (HHS|JMHC)

Abstract:

The concept of "high-ability" and "honors" has been implemented into a student's schooling system since as early as elementary school. Students are often divided and identified by their ability to connect, provide responses that prompt engagement, display an innate curiosity, and have self-motivating qualities. Many students spend their entire academic career in these programs with the intention of providing quality work that displays their full abilities and makes it clear that their potential is limitless. While the concept of high-ability courses and programs is a necessary differentiation for students to provide meaningful opportunities and courses of study for advanced learners, the problems begin with their self-concept and relationship with academics. The relationship between high-ability students, mental health, and grades is complicated and oftentimes reveals an unhealthy attitude. This study aims to understand the mental health of high-ability students, determine factors that increase stress within honors programs, and to investigate pedagogical techniques that provide solutions. Effective solutions are based on the ability to maintain needed challenging work but can create more positive and healthy learning environments. The study contains a summary of previous research conducted on high-ability identification, pedagogical scaffolding implemented in high-ability classrooms, and psychological studies over student mental health and effects of certain academic environments. Current Purdue Honors students are also surveyed over their experiences and Honors college faculty are interviewed to understand the most recent climate of high-ability programs and identify personal challenges and potential solutions.

Keywords:

High-Ability Education; Mental Health; Honors Program; Education; Pedagogy

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):

Linda E Haynes (Purdue University); Daniel A Guberman (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1323

Presentation Time: Session 2: 10:30-11:30am

Analysis of Temperature Sensitive Mutants

STEM

Authors(s):

Olivia Nicole Safranek† (Science); Ruoqin Rachel Yang† (Science)

Abstract:

Temperature-sensitive mutations are genetic alterations that inactivate proteins at one temperature but do not abolish the function of the proteins at another temperature. According to the prevailing hypothesis, mutations that cause temperature-sensitivity are single amino acid substitutions that alter the stability of the affected proteins such that they unfold at certain temperatures but retain normal structure at other temperatures. Our experiments are aimed at testing this hypothesis.

We obtained from Dr. J. Roth (UC Davis) a derivative of Salmonella enterica serovar Typhimurium LT2 that carries the hisD6585 mutation, which renders the product of the gene, histidinol dehydrogenase, temperature-sensitive, so that the mutant cannot synthesize histidine at 42oC but is able do so at 30oC. We amplified the mutant gene with PCR and determined its DNA sequence. We found that mutant carried a single transition of a G:C base pair to A:T at nucleotide position 479, resulting in the predicted change of cysteine to tyrosine at amino acid 160. The residue at this position is in the predicted Rossmann fold, which is a wide-spread motif that is part of the NAD+ binding sites of dehydrogenases. Thus, the temperature-sensitivity of the hisD6585 mutant may be due to weakened binding of NAD+ to the enzyme at 42oC. In the future, we plan to determine the sequences of other temperature-sensitive hisD mutants to gain insights into the scope of amino acid alterations that cause temperature-sensitivity.

Keywords:

Salmonella enterica serovar Typhimurium LT2; Temperature Sensitive; Histidine; PCR; Mutation

Mentor(s):

Laszlo Csonka (Purdue University); Nicholas Noinaj (Purdue University)

Other Acknowledgement(s):

Lan-Ying Lee (Purdue University)

Poster Presentation Abstract Number: 1324

Presentation Time: Session 2: 10:30-11:30am

Post-Synthetic Phosphorus Modification for Enhanced Hydrothermal Stability of Acid MFI Zeolites

STEM

Authors(s):

Aakash Sanjay† (Engineering)

Abstract:

Post-synthetic phosphorus modification with phosphoric acid has been widely used to improve the hydrothermal sites stability of acid MFI zeolites, a property crucial for their role in catalytic processes. The stability is hypothesized to result from interactions between phosphorus and tetrahedral Al that host acid H? sites, increasing resistance to dealumination. This suggests a potential site preference for phosphorus titration, but the specific active site properties for phosphorus structures remain unclear. In this paper, we investigate the site-dependent requirements for phosphorus stabilization by using MFI zeolites synthesized with varied active site properties, such as differences in site proximity and location within intersection or channel environments. Our preliminary X-ray diffraction analyses reveal structural changes due to phosphorus modification that depend on varied synthesis conditions of the zeolite. X-ray diffraction tools will be used to more clearly understand the nature of phosphorus-Al interactions in zeolite frameworks. By clarifying the structural factors that govern phosphorus stabilization, this paper aims to enable the improvement in design of MFI crystals with enhanced hydrothermal stability, which has many potential industrial applications.

Keywords:

Zeolites; Hydrothermal Stability; MFI Site Distribution; Phosphorus Modification; Site Engineering

Mentor(s):

Bereket Tassew Bekele (Engineering)

Other Acknowledgement(s):

Rajamani P Gounder (Purdue University)

Poster Presentation Abstract Number: 1325

Presentation Time: Session 2: 10:30-11:30am

Human-Centered Policy Frameworks for Autonomous Agent Technologies

STEM

Authors(s):

Ramani Satishkumar† (Science|JMHC)

Abstract:

As autonomous agent (AA) technologies continue to expand across numerous application spaces and become increasingly present in daily life, it is essential to consider design and regulation frameworks that ensure AAs equitable integration into society. This research aims to understand the policies that industry members, academics, and people in the policy making space consider as required for successful, human-centered implementation of AA technologies.

To address our research aims, data was collected from two different participatory design workshops involving academics, industry members, and people in the policy-making space. The first workshop type supported participants in integrating equitable design into technology design and implementation, while the second empowered employees around AA development. Both workshops involved participants designing policies for AA technologies (e.g. robots, chatbots, drones), which is the focus of this research's analysis. A thematic analysis identified key policy and design themes to guide future policy and assess how participants approach autonomous agent policy.

Preliminary results suggest that participants want technology policy to focus on topics such as job security, trust, transparency, and accountability as it relates to autonomous agent technologies. Further analysis will explore whether these themes are consistent across both workshop types to identify overlapping areas of importance. These results will inform AA policy areas for future investigation.

This research can help broaden knowledge of the social implications of autonomous technologies and pave the way for comprehensive policy frameworks.

Keywords:

Human Robot Interaction; Human Computer Interaction; Autonomous Agents; Technology Policy

Mentor(s):
Anastasia Kouvaras Ostrowski (Purdue University); Cynthia Breazeal (Massachusetts Institute of Technology)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1326

Presentation Time: Session 2: 10:30-11:30am

A systematic study on the effect of different carbon precursors for the synthesis of MAX and two-dimensional MXenes

STEM

Authors(s):

Christian Paul Hardy Scott† (Engineering|JMHC)

Abstract:

MXenes are a growing family of two-dimensional (2D) transition metal carbides, nitrides, which contribute to diverse applications in the field of energy, electronics, photonics, and biomedicine. These unique properties of MXene are paralleled by their relative complexity with various synthesis parameters, like the purity of the MAX phase, that impact their quality. In this systematic study, mono-transition metal (stoichiometric and optimized Ti3AlC2) and double-transition metal (Mo2TiAlC2 and Mo2Ti2AlC3) MAX grains were studied by varying the carbon precursor source (petroleum coke and graphite). The synthesized MAX phases were characterized using scanning electron microscopy (SEM), X-ray diffraction (XRD), and energy-dispersive X-ray spectroscopy (EDS) to evaluate morphology, grain size, crystal structure, and elemental composition. Further, we synthesized the MXenes (Ti3C2Tx, Mo2TiC2Tx, and Mo2Ti2C3Tx) using a top-down wet chemical etching approach. The effect of different carbon precursors on the synthesis and quality of the resulting Ti3C2Tx, Mo2TiC2Tx, and Mo2Ti2C3Tx MXenes were evaluated based on flake size, synthesis yield, electrical conductivity, and colloidal stability. The use of graphite in the synthesis increases the purity of the MAX phase which positively impacts the MXene quality and synthesis yield. For example, the synthesis yield of the Mo2TiC2Tx MXene was doubled when graphite was used.. This study improves the fundamental understanding of how different carbon precursors affect the synthesis of parent MAX phases and resulting 2D MXenes.

Keywords:

MAX phase; Two-Dimensional; MXenes; Sintering

Mentor(s):

Babak Anasori (Purdue University); Anupma Thakur (Purdue University); Nithin Chandran Balachandran Sajitha (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1327

Presentation Time: Session 2: 10:30-11:30am

Adaptive Accompaniment for Musical Compositions

STEM

Authors(s):

Ranav Sethi† (Science); Peter Edvardsson† (Science); Seung Hyun Choi† (Science); Ashwin Kazuki Thampi† (Engineering); Nathan Zhou† (Science); Sean Xiaoyang Su† (Engineering|JMHC); Si Ci Chou‡ (Engineering)

Abstract:

Musicians frequently perform in ensembles, where coordination and adaptability extend beyond the scope of solo performances. However, logistical challenges such as scheduling conflicts and geographic separation can hinder group practice. To address this, we are developing Companion, an artificial intelligence system that simulates ensemble performance, allowing musicians to practice in a dynamic and interactive environment even when their collaborators are absent.

Companion's app interface provides real-time accompaniment by synchronizing with a musician's performance through dynamic time-warping, ensuring flexible alignment with expressive playing. It synthesizes notes individually according to the estimated position in the piece, dynamically adjusting playback to accommodate tempo variations, pauses, and rubato. Additionally, voice commands allow users to pause, stop, or restart playback seamlessly.

This semester, we are advancing Companion's evaluation framework, re-evaluating the score-following mechanism and developing an intuitive and user-centric frontend. Future developments aim to extend Companion's capabilities to support improvisation and multiple musicians, broadening its applications in music rehearsals and education.

Keywords:

Signal Processing; Score Following; Dynamic Time-Warping; Real-Time Synchronization; Musical Accompaniment

Mentor(s):

Yeon Ji Yun (Purdue University); Yung-Hsiang Lu (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1328

Presentation Time: Session 2: 10:30-11:30am

fRaud: An R-Shiny Application To Identify Financial Transaction Fraud

Business Case Study

Authors(s):

Himanshu Niraj Sethia† (DSB); Marissa Shuluo Urbanek† (DSB); Bao Chau Chau Nguyen† (DSB); Allison Spahn† (DSB)

Abstract:

This study assesses the impact of various financial metrics in predicting transaction fraud. Exploring various features and predictive modes, we develop a model that helps financial institutions identify key metrics that capture inconsistencies that could help prevent transaction fraud. This motivation for this research is that with advancements in technology, the probability of fraudulent activity increases, which can have significant financial impact to firms and society. Providing decision makers data-supported recommendations with a front-end interface to detect and understand fraud, can improve firm efficiency in this area, as well as create opportunities to discuss strategies to mitigate such risks in the future. Our interface was developed using R-shiny which helps analysts easily put their analytics in the hands of decision-makers. Users can easily experiment with other models without constraining human capital resource needs or technical skills. We demonstrate where our cross-validated binary classification model performs well and scenarios where continued research is needed.

Keywords:

Transaction Fraud; Predictive Modeling; Financial Metrics; Risk Mitigation

Mentor(s):

Matthew Lanham (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1329

Presentation Time: Session 2: 10:30-11:30am

The Impact of DEI Abolition on University Cultural Centers and International Student Inclusion

Humanities

Authors(s):

Amogh Meenakshi Shadangi† (Engineering); Manas Umangkumar Doshi† (Engineering); Yu-Chun Chou† (DSB); Jui-Tung Lee† (HHS)

Abstract:

The purpose of this study is to investigate the effects of the Abolition of DEI from universities due to recent federal actions under the Trump administration and how the University cultural centers respond to these policies that signaled that schools supporting Diversity, Equity, and Inclusion (DEI) initiatives could risk losing funding if they continued these DEI programs". Furthermore, the research will address the following questions: What is the correlation between DEI and opportunities for International students and how would institutions and their cultural centers adapt to this act as it directly affects the international students' sense of inclusion and access to essential resources. This study examines how campus cultural centers have responded to these policy changes and their subsequent impact on international students. A convergent parallel mixed method was employed. Quantitative data was gathered from an online survey of approximately total of 50 international and national students, measuring their perceptions of cultural center support, experiences with campus integration, and satisfaction with resource availability. In parallel, qualitative insights were obtained through interviews with the cultural center members to uncover the future plans of the cultural centers. This research has some limitations as it may not have a very wide body of students which may not represent the experiences of other international students studying other institutions. The long-term impacts of DEI policy changes on international student enrollment and academic achievement should be explored in future studies as it is only a recent act. Expanding the study to include multiple universities will enhance the findings.

Keywords:

Diversity, Equity, and Inclusion (DEI); Cultural Centers; Federal Policy Changes; Institutional Adaptation

Mentor(s):

Haiyan Li (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1330

Presentation Time: Session 2: 10:30-11:30am

Topology Distorted Amorphous Metal-Organic Framework For PFAS Removal in Water

STEM

Authors(s):

Netra Ashish Shah† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Per- and Polyfluoroalkyl Substances (PFAS); Forever Chemicals; Sorption; Water Remediation

Mentor(s):

Sathish Rajendran (Purdue University); David Warsinger (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1331

Presentation Time: Session 2: 10:30-11:30am

Molecular CSI: An Integrated Workflow Using AI-Driven Structural Modeling and Domain Microanalysis for Hypothetical Protein Annotation

STEM

Authors(s):

Ranen Kaiser Shakir† (Agriculture|Engineering); Eric Tate Vasser† (Agriculture|Engineering); Lauren Elizabeth Bhat† (Agriculture|Engineering); Isaac Brennan Schantz† (Agriculture|Engineering)

Abstract:

Current genome analysis technologies have allowed for the prediction of many gene functions. However, these methods do not identify all genes and their function, resulting in hypothetical proteins with unknown roles. This project establishes a workflow involving the investigation of prediction software, 3D structure visualization, and sequence homology to characterize hypothetical protein functions. Protein prediction software, Alphafold 3, was used to generate a 3D molecular structure for hypothetical protein sequences from arthrobacteriophage Skitty. Then, Alphafold files were imported into Mol* 3D Viewer to display the molecular structure, allowing for microanalysis, which ultimately determined protein homology. BLAST was also used to identify protein homology by comparing sequences to other proteins with known functions. Applying the same process to known protein functions to authenticate the methods for this workflow produced the same results from DNA Master. The established workflow determined the functions of six hypothetical proteins from arthrobacteriophage Skitty. Two additional genes of known function were examined utilizing the function determination workflow to verify accuracy. The known gene function was found to be consistent with the hypothesized protein function in both cases. This process maintains a strong ability to procedurally identify functions of hypothetical proteins. The determination of this workflow will allow for bacteriophage genome sequencing to achieve a higher level of detail, increasing phage understanding and allowing more straightforward and faster selection for phage therapy.

Keywords:

Hypothetical Protein; 3D Structure; Sequence Homology; Genome Analysis; Bacteriophage

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Kari L Clase (Purdue University); Julia Ann Simler (Agriculture)

Other Acknowledgement(s):
Marcelo Inaki I Guerrero Montalvan (Agriculture); Opeyemi Samuel Oduniyi (Agriculture)

Poster Presentation Abstract Number: 1332

Presentation Time: Session 2: 10:30-11:30am

Simulating a Quantum Walk as Hawking Radiation

STEM

Authors(s):

Likith Reddy Singam† (Engineering); Jack Harrison Reynolds† (Science); Hermes Heng-yu Fu† (Science|Graduate); Millan Shah Kumar† (Science); Tyler Mitchell† (Science); Lucas Michael Rulo‡ (Science); Yana Manishkumar Shah‡ (Science)

Abstract:

In the classical view, nothing can escape from a black hole, not even light. In the quantum view, however, quantum tunneling enables the escape of particles from black holes as Hawking radiation. Direct observation of Hawking radiation is almost impossible, so several works have been done to simulate Hawking radiation with computers. We will be using quantum simulations to better simulate Hawking radiation. This is because quantum simulations provide an unparalleled tool for studying quantum systems by directly leveraging quantum mechanics, making them far more scalable and efficient than classical approaches. Following the article “Quantum simulation of Hawking radiation and curved spacetime with a superconducting on-chip black hole”, this research aims to recreate a simulation of an event horizon on an IBM processor environment. We will be constructing a quantum computing simulation of Hawking radiation by producing a particle-antiparticle pair within a simulated event horizon to measure how they tunnel out. The particle-antiparticle pair will be initialized into a quantum walk using stochastic evolution to simulate the extreme behavior around a black hole. We aim to enable future improvements to discover physics phenomena around black holes with the simulation structure.

Keywords:

Quantum Simulation; Quantum Computing; Astrophysics; Black Holes

Mentor(s):

Robin Carpenter (Science); Danny Milisavljevic (Purdue University); Andreas Jung (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1333

Presentation Time: Session 2: 10:30-11:30am

Scripting generation of System on Chip

STEM

Authors(s):

Neal Sai Singh† (Engineering); Robert Yida Zhang† (Engineering|JMHC); Trent Michael Seaman‡ (Engineering); Daniel Wang‡ (Engineering)

Abstract:

The process of generating top-level code for System-on-Chip (SoC) designs is often time-consuming and prone to human error due to the complexity of component configurations and interconnections. To address this, the Purdue SoCET Research Team is developing an automated Python-based script that simplifies and accelerates the generation of top-level code for SoCs. This tool utilizes a flexible configuration YAML file format, to represent hierarchical data structures such as buses, peripherals, memory, and cores. By allowing users to define system components, including bus managers, the script generates parameterized Verilog code, ensuring consistent and maintainable top-level design. Additionally, the script is designed to accommodate various bus architectures and peripheral configurations, significantly reducing the manual effort required for complex SoC integrations. This project is in progress, and we are actively refining the configuration schema and developing parsers to translate hierarchical data into Verilog. Future iterations will explore the possibility of integrating a graphical user interface to simplify the user input. This automated solution enhances productivity and accuracy in SoC development, paving the way for more efficient design workflows.

Keywords:

[no keywords provided]

Mentor(s):

Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1334

Presentation Time: Session 2: 10:30-11:30am

GPU Architectural Optimisations for Differentially Private Stochastic Gradient Descent

STEM

Authors(s):

Rudraneel Sinha† (Science|JMHC); Danielle C Ejiogu† (Science|JMHC)

Abstract:

Ensuring privacy in machine learning is critical, especially with the commercialization of trained models. Differential Privacy (DP) is the standard for protecting individual data, but applying it to Stochastic Gradient Descent (SGD) introduces significant performance overheads—often 2x to 30x slower. Existing solutions, such as JAX and Opacus, attempt to mitigate this, but further optimization is necessary.

Current hardware approaches focus on dedicated accelerators, but GPUs remain the primary platform for large-scale neural network training. This research investigates optimizing DP-SGD operations at the GPU architectural level to enhance performance. Key DP-related computations—gradient clipping, noise addition, and aggregation—are major bottlenecks. Our goal is to identify optimizations in NVIDIA CUDA-enabled GPUs to accelerate these steps.

Using profiling tools like Nsight Systems/Compute, this work analyzes Opacus' performance, modifies CUDA C++ kernels for clipping and noise addition, and explores custom PTX and SASS-level optimizations. This work aims to design GPU instructions that integrate DP-SGD steps directly, reducing overhead, using the GPU simulator framework Accel-Sim.

Additionally, this work analyzes ways to restructure the underlying automatic differentiation engine of PyTorch to enable greater parallelism at a lower level since current implementations suffer from unnecessary Python function call overheads.

Keywords:

Differential Privacy; Machine Learning; GPU; Opacus; PyTorch

Mentor(s):

Kazem Taram (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1335

Presentation Time: Session 2: 10:30-11:30am

Free Speech Across Borders? Analysis of International Legal Documents

Humanities

Authors(s):

Charlize Alexis Sinko† (Polytechnic)

Abstract:

Changes to speech laws impact people on a global scale online and offline. In this project, I explore the ways in which speech laws have changed in the past three years. Empirically, I compile laws and regulations around the world from 2022 to 2024 using the Freedom on the Net index, adding to an original Platform Regulation Database constructed by the International Politics and Responsible Tech (iPART) lab at Purdue. I focus on the United States, Singapore, and Iran to draw cross-country comparisons on the changes in the legal framing of free speech. I find that while speech laws are evolving in response to political, technical, and social pressures, the approaches vary across countries. The United States has an ongoing debate on balancing free speech with the need to stop misinformation, leading to new regulations on accountability online. Singapore has introduced stricter laws that control speech online under the guise of combatting misinformation. Iran has used speech laws to increase censorship and surveillance of online spaces. This project provides a broader understanding of governmental approaches to free speech, while enabling civil society actors to see the global legal arena in a concise dataset.

Keywords:

Freedom of Speech; Regulations; Digital Governance; Censorship

Mentor(s):

Swati Srivastava (Purdue University); Alexander Thomas Wilhelm (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1336

Presentation Time: Session 2: 10:30-11:30am

Synthesis, structural and protein binding analysis of differently substituted Ru(II)-hydrazine complexes

STEM

Authors(s):

Milica Slavkovic† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Ruthenium(II) Complexes; Protein Binding; Serum albumins (HSA and BSA); Anti-Cancer Drug Design; Thermodynamic Analysis

Mentor(s):

Michael Humes Borkowski (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1337

Presentation Time: Session 2: 10:30-11:30am

Optimizing Pre-Trained Model Selection for Resource-Constrained Applications

STEM

Authors(s):

Lawrence Folsom Smith† (Engineering); Hyeonwoo Heo† (Engineering); Christopher Xu† (Science); Minh Binh Tran† (Science); Kyle John Massie‡ (Engineering)

Abstract:

The emergence of Pre-Trained Models (PTMs) has revolutionized various domains by offering ready-to-use models that eliminate the need for resource-intensive training from scratch. Model zoos, a collection of PTMs such as Hugging Face, often contain hundreds to thousands of PTMs. Selecting the most appropriate PTM for a specific task poses significant challenges due to the vast number of available models, the complexity of functions, and the resources needed to ensure the best model is used. Last semester, we explored the limitations of current PTM selection methods, which often involve exhaustive evaluations followed by fine-tuning the models. We focus on improving upon a successful method: Model Spider. We have identified the constraints of large models and show that hardware-conscious solutions to PTM selection are necessary for future research directions.

Keywords:

Pre-Trained Models; Model Zoo; Model Spider; Hardware

Mentor(s):

James C Davis (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1338

Presentation Time: Session 2: 10:30-11:30am

Resource Allocation Challenges In Athletic Training Programs

Creative

Authors(s):

Kinsley Brianne Smoot† (HHS)

Abstract:

This research investigates the resource allocation challenges faced by athletic training programs, including those at Purdue University, as they balance the demands of injury prevention and rehabilitation. With increasing concerns over athlete health and performance, athletic training programs are tasked with finding an adequate distribution of resources to address the prevention of injuries and rehabilitation following injuries. This study examines the key factors influencing these decisions, including budget limitations, evolving injury trends, technological advancements, and the growing complexity of sports medicine. Through interviews with athletic trainers, program administrators, and case studies, the research explores how these programs prioritize their resources and the impact of these choices on athlete health outcomes and the overall success of athletic programs. The findings will provide insights into strategies for optimizing resource allocation to enhance both injury prevention efforts and rehabilitation effectiveness, offering guidance for athletic departments navigating this critical crossroads.

Keywords:

[no keywords provided]

Mentor(s):

Catherine Jean Shukle (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1339

Presentation Time: Session 2: 10:30-11:30am

Decoding the Future: The Impact of Generative AI on Coding Education and the Programming Job Market

Social Science

Authors(s):

Elliott Jameson Soderberg† (DSB)

Abstract:

This study examines the economic impact of Generative AI, specifically ChatGPT, on human talent investment in software coding skills. Using two years of Google Trends data, we analyze the effects of ChatGPT's introduction in November 2022 on major code learning platforms by assessing changes in search volume. Our findings reveal a significant decrease in search volume for these platforms following ChatGPT's launch, indicating reduced demand for traditional coding education. However, platforms with strong brand equity—measured by their popularity in search volume prior to ChatGPT's release—showed a smaller decline, highlighting the role of brand strength in mitigating negative impacts. These insights suggest that the advent of Generative AI could reshape digital education by influencing platform dynamics and potentially altering the trajectory of human capital development in tech-related fields.

Keywords:

Generative AI; Human Talent; Digital Education; Brand Equity

Mentor(s):

Wooyong Jo (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1340

Presentation Time: Session 2: 10:30-11:30am

How NPCs Navigate Crowded Spaces in Different Weather Conditions

STEM

Authors(s):

Justin Song† (Engineering); Sabrina Louise Gray† (Engineering); Reed Ellis Baker† (Engineering); Akash Amalarasan‡ (Engineering)

Abstract:

This project explores how AI-driven non-playable characters (NPCs) react to various weather conditions while navigating crowded environments. The goal is to simulate realistic NPC behavior by examining how factors such as rain, wind, and temperature changes influence their decisions, comfort levels, and interactions. Just as people react differently to changing weather, NPCs will make individualized choices based on their perception and personality traits. Using Unreal Engine, NPCs will assess their surroundings through the Environmental Query System (EQS) to detect weather exposure, shelter availability, and crowd density. Behavior trees will help determine their response, such as whether to find cover, continue walking despite discomfort, or take an alternative path. Some NPCs may prioritize shelter from rain or wind, while others may avoid crowded areas even if it means staying exposed to harsh weather conditions. This system aims to enhance the realism of AI-driven simulations by integrating weather-based factors into NPC decision making. These improvements can be applied in game development where dynamic NPC behaviors improve immersion, as well as urban simulations where AI-driven crowd models help predict pedestrian flow under different weather conditions. Understanding how NPCs react to environmental changes can also support safer and more efficient public space designs by replicating how people move and seek comfort in real-world settings.

Keywords:

Environmental Query System (EQS); Non-Player Characters (NPCs); Unreal Engine; Artificial Intelligence

Mentor(s):

David Michael Barbarash (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1341

Presentation Time: Session 2: 10:30-11:30am

Quantifying hydrogeological processes in the stratified-drift aquifer system of the Iroquois Till Plain using heat, geochemistry, and stable isotopes as tracers in the Ross Biological Reserve, Tippeca

STEM

Authors(s):

Canada Connor Speier† (Science); timothy Hartzer† (Science); Thomas Barstow Lambert† (Science); Destin Javai Gentillon‡ (Science|JMHC); Diana Lucia Pinto Montes‡

Abstract:

The aquifers of Tippecanoe County, IN are poorly studied, yet these aquifers are critical for baseflow generation, aquatic ecology of surface-water systems, agricultural irrigation, groundwater for private and municipal wells, and water for industry. The primary aquifer systems of Tippecanoe County include: 1) water-bearing sand and gravel units (S&G) found in the stratified drift on the Iroquois Till Plain (north of the Wabash River) and Tipton Till Plain (south of the Wabash River), 2) glacial outwash alluvial aquifers found along the river corridor and sometimes extending into the adjacent Till Plain, and 3) regional groundwater hosted in the underlying carbonate bedrock where present. Here, we quantify the hydrogeological processes of S&G units in the stratified-drift aquifer system at the Ross Biological Reserve (RBR) using heat, geochemistry, and stable isotopes. Groundwater temperature was continuously monitored in seeps emerging from the upper, middle, and lower S&G units and compared to ambient air temperature. The upper seep shows very little seasonal variability in temperature and counterintuitively, the stable isotope data suggest a mixture of recharge from summer and fall precipitation. The middle and lower seeps show slightly more seasonal variability and stable isotope data indicate that they are supported by recharge occurring from fall to spring. These data suggest that the middle and lower S&G are distinct from the upper S&G, yet this seems unlikely since recharge must travel through the upper strata unless the confining clay layers are spatially discontinuous. These seeps also appear to be ecologically important requiring further investigation.

Keywords:

Hydrogeology; Stratified-Drift Aquifer Systems; Heat Analysis; Geochemistry; Stable Isotopes

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):

Marty D Frisbee (Purdue University); Srilani Wickramasinghe Wickramasi Mudiyanselage (Interdisciplinary & Special Programs)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1342

Presentation Time: Session 2: 10:30-11:30am

Organoid-based study of free fatty acid-induced lipid accumulation and growth dynamics in MAFLD

STEM

Authors(s):

Nora Mariam Sukkar† (Engineering)

Abstract:

Metabolic dysfunction-associated fatty liver disease (MAFLD) is a leading cause of chronic liver dysfunction, characterized by excessive hepatic lipid accumulation, inflammation, and progressive fibrosis. Despite extensive research on lipid toxicity and hepatocellular injury, the molecular and cellular mechanisms governing MAFLD progression remain poorly understood. Liver organoids, self-assembled three-dimensional culture systems derived from stem/progenitor cells, provide an in vitro platform to model liver pathophysiology and test therapeutic interventions in a controlled environment. In this study, we utilize liver organoids to investigate the impact of free fatty acid (FFA) exposure on lipid accumulation and organoid growth. Liver organoids were treated with defined oleic acid to palmitic acid ratios, mimicking the lipid composition associated with MAFLD pathogenesis. Fluorescence imaging and Nile Red staining confirmed a dose-dependent increase in intracellular lipid accumulation, with significant lipid droplet formation observed at a higher FFA concentrations. Morphometric analysis revealed an increase in organoid size, which may be indicative of hepatocellular ballooning, a key histopathological hallmark of MAFLD. However, whether this enlargement results from lipid-induced hypertrophy or enhanced proliferation remains unclear. Future work will focus on elucidating the contributions of hypertrophy versus proliferation through single-cell transcriptomic profiling and cell cycle analyses. Additionally, lipidomics and metabolic profiling will be employed to assess changes in lipid composition and stress pathways in response to FFA exposure. By refining organoid-based liver models with advanced bioengineering and functional assays, this study aims to bridge the gap between in vitro liver models and clinically relevant MAFLD research.

Keywords:

MAFLD; Liver Organoids; Lipid Accumulation; Free Fatty Acids; Hepatocellular Injury

Mentor(s):

Sunghee Park (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Jiafei Zhu (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1343

Presentation Time: Session 2: 10:30-11:30am

Efficient and Cost-Effective Enzyme Deposition onto Tissues for Mass Spectrometry Imaging using a Mini-Humidifier

STEM

Authors(s):

Erik Robert Sveen† (Science)

Abstract:

Mass spectrometry imaging (MSI) is a powerful technique for studying the spatial localization of N-linked glycans in biological tissues, which are important biomarkers for various diseases. The analysis of N-linked glycans requires enzymatic release from proteins by applying an enzyme onto tissue sections. However, current instrumentation for enzyme deposition is not readily accessible to laboratories that employ ambient ionization MSI methods, which do not require any special sample pretreatment. In this study, we present a cost-effective and accessible approach for enzyme application onto tissues that eliminates the need for any specialized instrumentation. Specifically, we employed a mini-humidifier to deposit peptide N-glycosidase F (PNGase F) onto mouse brain tissue sections for MSI of N-linked glycans. To enhance detection, we combined this approach with chemical derivatization, utilizing hydrazide reagents to increase the hydrophobicity of N-linked glycans. Collectively, these developments provided a substantial improvement in MSI analysis of N-linked glycans using nanospray desorption electrospray ionization (nano-DESI). Our results demonstrate that the mini-humidifer provides a cost-effective and efficient solution for PNGase F deposition, enabling N-linked glycans analysis by MSI. Moreover, this approach can be readily adapted for the application of to other enzymes, broadening its potential utility in MSI.

Keywords:

Mass Spectrometry; Biological Imagining; Electrospray Ionization; N-Glycans; Glycoproteomics

Mentor(s):

Alyssa Marie Moore (Science); Miranda Renee Weigand (Purdue University); Julia Laskin (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1344

Presentation Time: Session 2: 10:30-11:30am

HPV Vaccine Recommendations: Influencing Change Through Information Provision at No-Cost Vaccine Clinics

Social Science

Authors(s):

Emma Swanson† (HHS); Evan Graham Coblentz‡ (Agriculture|JMHC); Rhea Chintan Shah‡ (Science); Avery Grace Brubaker* (HHS); Caroline Rhea Packee* (Science)

Abstract:

Background: Human papillomavirus (HPV) is the most common sexually transmitted infection among ages 15-24 years. However, many individuals remain unvaccinated against HPV. Recommendations from friends and family have been shown to improve vaccine uptake.

Objective: To assess and examine characteristics associated with changes in the likelihood of recommending the HPV vaccine following the provision of vaccine-related information.

Methods: We recruited participants at two no-cost vaccine clinics on a university campus in September and October 2024 (N=556; age range=18 – 75 years, 59.5% female). Through a one-time, voluntary online survey, we asked participants how likely they were to recommend the HPV vaccine to a family or friend on a scale from 1-5. We repeated this question after sharing a list of HPV vaccine-preventable diseases. Analyses included a dependent t-test to determine if there was a change in mean pre and post recommendation scores. We also conducted bivariate (chi-square and independent t-tests) and multivariable (logistic regression) analyses to examine factors associated with a positive change versus no/negative change. All analyses were conducted using IBM SPSS Statistics (Version 29).

Results: The average post (x?=4.21; SD=.95) recommendation score was significantly higher than the pre (x?=3.87; SD=1.031) recommendation score (t=-11.37; p<0.001). Multivariable logistic regression revealed that a positive change in recommendation score was significantly associated with younger age (aOR=.98, p=.017) and lower vaccine confidence (aOR=.50, p < .001).

Conclusion: Future education interventions should target younger individuals with lower vaccine confidence, as they were more likely to improve their recommendation score after the provision of relevant information.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
HPV; Vaccination; Recommendation; Prevention

Mentor(s):
Shandey Derisa Malcolm (Purdue University); Samantha L. Ky (HHS); Monica Kasting (Purdue University)

Other Acknowledgement(s):
Trexie M Rudd (Purdue University); Abigale Louise Fritsch (Purdue University)

Poster Presentation Abstract Number: 1345

Presentation Time: Session 2: 10:30-11:30am

The Relationship Between Social Support and Perceived Stress Among Breastfeeding Mothers in the United States: A Cross-Sectional Study

STEM

Authors(s):

Tricia Isabel Sy† (HHS)

Abstract:

Background: Social support and perceived stress play a critical role in breastfeeding outcomes.

Objective: To investigate the associations between the maternal individuals' perceived stress, their level of social support, and the incidence of breastfeeding their infants in the postpartum. Theoretical Framework: Social Support Theory.

Methods: A cross-sectional observational study was conducted using an online survey. Subjects who were 18 years or older, fluent in English, and was currently breastfeeding or has breastfed in the last 12 months were eligible to participate. Participants were recruited through flyers. The Perceived Stress Scale (PSS) was used to evaluate maternal stress, and the Multidimensional Scale of Perceived Social Support (MSPSS) was used to measure social support. Demographics, medical and breastfeeding practices were self-reported.

Results: A sample of 99 participants completed the survey. Most of the participants were 22-39 years old. 67.5% of the participants were White, 23.4% were African-American, and 9.1% identified as another race. More than 56.4% have a bachelor's, graduate, or professional degree. Through the MSPSS, the mean score for significant others is 5.84?1.53, family is 5.30?1.49, friends are 5.20?1.69 and the total mean score was 5.45?1.33. Using the PSS, the mean total score is 27.61?6.32. There is a weak positive correlation between the MSPSS and PSS scores, (r = .49, P= .0001). More than 77% were exclusively breastfeeding and around 16% were partially breastfeeding.

Conclusion: PSS scores were high amongst participants. As MSPSS increases and PSS decreases, the incidence of breastfeeding increases. Strategies to promote social support and decrease stress among breastfeeding mothers are needed.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Breastfeeding Outcomes; Perinatal; Postpartum; Social Support; Stress

Mentor(s):
Azza H Ahmed (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1346

Presentation Time: Session 2: 10:30-11:30am

Supply Chain Optimization Using Quantum and Hybrid Machine Learning

STEM

Authors(s):

Myron Milad Tadros† (Engineering)

Abstract:

A critical challenge in supply chain optimization is minimizing reserved stock while reliably meeting both current and future demands. Accurate forecasting for demand enables companies, from small businesses to large conglomerates, to reduce operational costs and enhance customer satisfaction. Classical algorithms often struggle with real-world complexities, either overshooting or undershooting the required demand. Traditional machine learning techniques also encounter difficulties when dealing with imbalanced datasets and complex relationships. In contrast, quantum machine learning, by reducing model parameters and discovering subtle interdependencies, offers a promising alternative. This research will develop and apply quantum and hybrid classical-quantum machine learning algorithms to improve demand prediction accuracy. We will benchmark these innovative approaches against existing classical methods to assess their performance and potential impact on inventory management in supply chains.

Keywords:

Supply Chain Optimization; Quantum Machine Learning; Hybrid Machine Learning

Mentor(s):

Andreas Jung (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1347

Presentation Time: Session 2: 10:30-11:30am

Deep Learning for Asset Mispricing in High-Frequency Trading: A Fat-Tailed Approach

STEM

Authors(s):

Sarthak Tandon† (Engineering)

Abstract:

We develop a deep learning-based strategy to detect and exploit mispriced asset bubbles in high-frequency trading (HFT) markets. By modeling option prices using a displaced constant elasticity of variance (CEV) process with a fat-tailed component, our approach captures extreme market movements that drive pricing inefficiencies. Leveraging neural networks, we identify systematic overpricing and underpricing, allowing for an arbitrage strategy that buys undervalued assets and sells overvalued ones. The incorporation of fat-tailed uncertainty enhances bubble detection, improves trade execution, and enables the strategy to adapt to rapid fluctuations in volatile HFT environments, maximizing profit opportunities from transient mispricings.

Keywords:

Quant Finance; Deep Learning; Fintech; Algorithmic Trading

Mentor(s):

Kiseop Lee (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1348

Presentation Time: Session 2: 10:30-11:30am

Recycled Plastic Tree Tube Project

STEM

Authors(s):

Christopher Dawkin Tanjutco† (Engineering); Jesse Basham† (Polytechnic); Jackson Thomas St Myer† (Polytechnic); John G Burrell† (Polytechnic); Spencer Russell Fiddler‡ (Polytechnic); Adan Rosales‡ (Polytechnic)

Abstract:

The aim of this project is to revitalize recycled plastic waste into long-lasting, eco-friendly tree tubes to help smaller trees across Purdue University's campus and the West Lafayette community grow into healthy, mature trees. The project adheres to a structured, four-phase manufacturing process: collecting, shredding, extruding, drilling. The team first collects high-density polyethylene (HDPE) containers from campus and the community. Then, the collected material is shredded using a Precious Plastic shredder into pellet-sized pieces. The shredded material is then put through a Precious Plastic extruder, transforming the shredded material into plastic tubes. Once out of the mold and cooled, holes, measuring 3/8-inch in diameter, are drilled into the top one-foot section of the tubes to provide airflow.

This project is ongoing and concludes by the end of the semester. The following has been completed: CAD design of a spider dye as the extrusion mold, collection of material, and casted parts of the mold. Design iterations have been made to the manufacturing of the extrusion mold. The dimensions were shortened to cut back on material expenditures and increase the efficiency of machining. Furthermore, the first attempt of manufacturing the mold resulted in casted parts.

Currently, the team is working on machining large pieces of aluminum to finish the extrusion mold, developing methods for rapid cooling of the tubes post-extrusion, and communicating with organizations within the university and community to promote the project, join in on the collection efforts, and find an event to place the tree tubes around new trees.

Keywords:

Extrusion; Casting; Plastic; Trees; Manufacturing

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Devon Julia Pessler (Purdue University); Paul B McPherson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1349

Presentation Time: Session 2: 10:30-11:30am

Participatory Design of Autonomous Agents' Role and Personality in the Workplace

STEM

Authors(s):

Mikaela Sandra Thompson† (Polytechnic); Lucy Gunther‡ (Carnegie Mellon University)

Abstract:

Autonomous agents (AAs) are increasingly implemented into the workplace in recent years, introducing human-agent interactions in industry settings. The incorporation of AAs in work environments will allow for new forms of collaboration among employees and AAs, creating a unique space to explore the design of agent personalities and roles. Limited research exists around incorporating employees in the design of AAs' roles and personalities, especially in the context of the workplace. Hence, this research uses a collaborative design approach to empower employees in the process of designing AAs for their workplace. We present findings from a collaborative design workshop completed with designers, engineers, and workers in non-engineering or non-designer roles. In the workshop, participants created a storyboard of AA interactions and agent personality diagrams (building from the Big 5 Personality and Insights Discovery tools). Results from a deductive and inductive analysis of worker's storyboards demonstrate that the form of the AA may influence worker's perceptions of the agent's role and characteristics. Different embodiments revealed varying levels of agent autonomy, interactions, social cues, and even gender. In addition, participants' design of AA personalities displayed themes such as personification of human traits, contradicting personality trait combinations, and metaphors in agent personalities. We also present pre- and post- survey data, revealing worker's expectations and comfort levels with working with autonomous agents in the near future. Future work will further focus on the inclusion and empowerment of employees in AA design and implementation processes in the workplace.

Keywords:

Personality; Role; Autonomous Agent; Participatory Design; Workplace

Mentor(s):

Anastasia Kouvaras Ostrowski (Purdue University); Cynthia Breazeal (Massachusetts Institute of Technology)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1350

Presentation Time: Session 2: 10:30-11:30am

Cosmic Clutter

Humanities

Authors(s):

Keely Shea Vanhorenbeck† (HHS)

Abstract:

In this exploratory research project, I analyze ongoing efforts to dispose large pieces of space debris. This preliminary research topic concerns numerous countries and scientists, as they have disagreed on how to clean up space debris along with who is in charge of cleaning up the debris. To investigate this issue, I have conducted an exploratory literature review that looks over how fatal situation space debris is and how it could affect space travel and satellites through theories such as the Kessler Syndrome, as well as looking at the different solutions scientists have come up with to solve this big problem. This research highlights the importance of active space removal (ADR) as well as the fatality of the situation. Ultimately, the research will aim to help students better understand the concept of space debris and the effects that come along with it.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1351
Presentation Time: Session 2: 10:30-11:30am

C-To-Rust: Standardized Dataset Creation

STEM

Authors(s):

Gaurav Vermani† (Engineering); Ryan Alexander Kubinski† (Engineering); Tzu Chieh Yi† (Engineering)

Abstract:

The strongly and statically typed programming language, Rust, focuses on memory safety and low-level control and incorporates features from functional programming languages. Due to its unique combination of features, it is seen as a safer alternative to C, fueling an interest in migrating legacy codebases from C to Rust. This demand has led to the development of C-to-Rust transpilers, such as the C2Rust project, that attempt to convert C syntax to Rust while maintaining the source code semantics. However, such existing tools have an inadvertent drawback: they preserve certain unsafe practices of C, denoting them with the "unsafe" keyword to circumvent the Rust compiler's safety checks, potentially compromising the language's memory-safety guarantees.

This research focuses on developing a dataset of C programs annotated with function types and pointer distinctions, such as differentiating between static arrays, dynamic arrays, and string representations. By systematically labeling key features of C code, we aim to provide a structured resource that facilitates better analysis of how various programming constructs impact memory safety, and potential Rust migration efforts. Our work will serve as a ground truth for evaluating current C-To-Rust transpilers, thus enabling future research to assess how different constructs and function types influence code safety and correctness.

Keywords:

C; Rust

Mentor(s):

Aravind Machiry (Purdue University); Shashank Sharma (Engineering); Ayushi Sharma (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1352

Presentation Time: Session 2: 10:30-11:30am

Traffic Light Detection for Autonomous Vehicles

STEM

Authors(s):

Jai Balaji Viswanath† (Engineering); Zian Pan† (Engineering)

Abstract:

Reliable traffic light detection is crucial for the safe operation of autonomous vehicles, ensuring compliance with traffic regulations. This study introduces a traffic light detection application that processes user-uploaded images through an integrated platform. The proposed algorithm first converts each image into a matrix representation in the HSV color space to enhance color differentiation. It then applies binarization to extract red, yellow, and green regions, followed by circle detection to identify potential traffic lights. By analyzing the coordinates and pixel intensities of detected circles, the algorithm determines the presence and state of traffic signals. Annotated images with detected traffic lights are then transmitted to the server and displayed to users through the application interface. This approach improves the accuracy and robustness of traffic signal recognition under various environmental conditions, offering a scalable solution for real-time autonomous navigation.

Keywords:

Image Processing; App Development

Mentor(s):

Fengqing Zhu (Purdue University); Soudabeh Taghian Dinani (Purdue University); Carla Zoltowski (Purdue University); Edward J Delp (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1353

Presentation Time: Session 2: 10:30-11:30am

The Computational Implications of Lambda Calculus

STEM

Authors(s):

Vedant Vrattikoppa† (Science)

Abstract:

Lambda Calculus, often referred to as the simplest programming language, is the formal system of logic and computation introduced by Alonzo Church in the 1930's. It's an extremely powerful concept, being able to represent any computation that can be encoded on a Turing machine, or essentially any modern computer. Furthermore, it can represent a wide variety of mathematical proofs, providing a brilliant bridge between mathematical logic and computer science.

In this project, I will delve into the semantics and mechanisms underlying this mysterious mathematical formalism, and explore the fascinating computational results that it implies. I will look at the basic rules of Lambda Calculus, reduction phenomena, combinator calculi, isomorphisms to Boolean logic, mathematical proofs & arithmetic, and Lambda Calculus embeddings of popular programming constructs. To perform this last objective, I will use the purely functional programming language Haskell, because of its highly abstract & powerful features, to draw parallels between it and Lambda Calculus "code". Finally, in culmination of this research, I will have created a Lambda Calculus interpreter.

My motivation for this project is to understand the bare bones of computation, free of the fluff found in many modern programming languages. Doing this will help build an extremely strong intuition of computational processes, and ultimately make me a better programmer.

Keywords:

Lambda Calculus; Haskell; Combinators; Logic; Computation

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1354

Presentation Time: Session 2: 10:30-11:30am

Consumer Decision-Making and Market Expansion Strategies: A Fowler Theater Business Case Study

Business Case Study

Authors(s):

Paul Christian Walter† (DSB); Elijah Lewis Claeys† (DSB); Noah Michael Clayman† (DSB); Trent A Osborn† (DSB); Tyler Ryan Green‡ (DSB)

Abstract:

This case study examines the Fowler Theater in Fowler, Indiana, with the objective of analyzing its target market and identifying strategies to enhance or expand its audience base. By employing a combination of qualitative and quantitative research methods, this study explores consumer willingness on various factors influencing decision-making related to theater attendance.

Data will be gathered from Fowler Theater's internal sources and student participants to evaluate behavioral patterns, preferences, and the psychology behind decision-making. Through this analysis, we seek to understand what influences consumer choices and how these insights can be leveraged to attract new demographics. Additionally, the study will examine potential positioning techniques to strengthen the theater's market presence.

The expected findings will provide a deeper understanding of the behaviors and attitudes of Fowler Theater's target audience, as well as actionable recommendations for refining marketing strategies. This research contributes to broader discussions on consumer psychology and decision-making, offering valuable insights for both local entertainment businesses and the field of consumer behavior studies.

Keywords:

Market Segmentation; Target Market Analysis; Behavioral Insights; Market Positioning

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1355

Presentation Time: Session 2: 10:30-11:30am

AI Tool Selection Among University Students: Preferences and Influencing Factors

Social Science

Authors(s):

Chandhopama Thidas Bandara Wanasinghe† (Science); Zhonghang Du† (Science)

Abstract:

"With the growing abundance of AI tools, how do American university students select AI tools for academic support, and what factors drive their preferences?"

The growing abundance of artificial intelligence (AI) tools, such as DeepSeek and ChatGPT, offers university students diverse options for academic support. However, little research has examined how students choose among these tools and the factors influencing their decisions. This study examines how students at a large STEM-focused public university select AI tools and the factors shaping their decisions.

Using a mixed-methods approach, we surveyed 50 students across disciplines, incorporating Likert-scale and open-ended questions, and conducted structured interviews with 12 for contextual analysis and factor validation. The Analytic Hierarchy Process (AHP) methodology offers a structured framework for ranking key decision factors, including usability, functionality, cost, institutional support, and peer recommendations.

We compare five widely used AI tools: DeepSeek, ChatGPT, Grok, Claude, and Gemini. Results highlight usability and functionality as top priorities, with cost and institutional support also playing significant roles. The cultural value of individualism and competition strongly influences student preferences, as they seek AI tools that enhance efficiency and competitiveness in academic tasks. This reflects a broader trend in American education, where students prioritize autonomy in learning and market-based improvement of AI companies.

Findings provide insights for universities to guide AI adoption and for developers to align tools with student needs. A key limitation is the study's focus on one institution, suggesting future research on broader trends. These insights support improved AI integration in higher education.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
AI Tool Selection; University Students; Decision Factors; Usability and Functionality; Individualism and Competition

Mentor(s):
Haiyan Li (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1356

Presentation Time: Session 2: 10:30-11:30am

Utilization of Various Nanofillers for Increasing Membrane-Based Dehumidification Efficiency

STEM

Authors(s):

Lily Avery Waterman† (Engineering); Ishan Gopu Nair‡ (Engineering)

Abstract:

Conventional air-conditioning systems require air to be cooled to below dew point temperature to remove water through condensation. This energy expending process is costly for both wallets and the planet. Membrane-based dehumidification is a promising energy-efficient alternative as it can remove water vapor directly from the air without going through any phase change. Specifically, passive membrane-based dehumidification (PMD) is very energy-efficient as it does not require any active components like vacuum pumps or compressors. However, for PMD to efficiently dehumidify air, which is driven by water vapor partial pressure, it requires a membrane with low thermal conductivity. For that reason, the nanofillers reduced graphene oxide (rGO) and graphene aerogel (GA) where grafted in polyvinyl difluoride (PVDF) matrix to create composite membranes with a high water vapor permeability and low thermal conductivity through casting and phase immersion method. Membranes were fabricated with rGO concentrations ranging from 0% to 1.5% and GA concentrations of 1% to 10%. An active layer of PEBAX and graphene oxide was added to one side of the membrane to further increase water vapor permeability. The membranes were subjected to characterizations, including thermal conductivity, water vapor permeability, morphology and porosity to better understand how membrane composition impacted dehumidification performance. Then, the most promising membranes were tested in a novel PMD system to determine the latent effectiveness for the various concentrations of nanofillers. Future studies will explore membrane configurations other than a counter-flow flat-plate arrangement and other thermally insulative nanofillers to further increase the efficiency of the PMD system.

Keywords:

Dehumidification; Membrane; Thermal Conductivity; HVAC

Mentor(s):

Md Ashiqur Rahman (Engineering); David Warsinger (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1357

Presentation Time: Session 2: 10:30-11:30am

Phonological Memory Profiles of Children with Speech and Language Disorders

STEM

Authors(s):

Bailey Marie Whitlock† (HHS|JMHC); Taya Christine George† (HHS)

Abstract:

Rationale: We investigated performance on a nonword repetition task to better understand the shared and specific processing weaknesses of children with speech sound disorder (SSD), with and without developmental language disorder (DLD).

Methods: Fifty-four preschool-aged monolingual English-speaking children completed a battery of speech and language tests, including the Syllable Repetition Task (SRT). Children were classified in one of three groups: typical speech and language (TD); SSD-only; SSD+DLD. We analyzed performance on the SRT by group, examining error quantity and type. In addition, we investigated whether children who produce atypical speech errors have more difficulties repeating longer nonwords than children who produce typical errors.

Conclusions: Children with SSD+DLD had the most difficulty repeating longer nonwords and produced vowel errors on the SRT. Children with SSD who produce atypical speech errors also had more difficulty repeating longer nonwords.

Implications: Clinicians and researchers can consider implementing nonword repetition tasks into assessment batteries for children with speech and language disorders.

Keywords:

Children; Speech Sound Disorders; Language Disorders

Mentor(s):

Francoise Brosseau-Lapre (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1358

Presentation Time: Session 2: 10:30-11:30am

Clean and Efficient Hybrid Propulsion System for Drones

STEM

Authors(s):

Thomas B Wooldridge† (Engineering); Ishaan Breinig‡ (Engineering)

Abstract:

Data collection in remote areas of ocean airspace has been significantly enabled by advances in drone technology, and improvement of flight times for modern-day battery-powered drones can greatly benefit flight campaigns. Current lithium-ion batteries used in drones have low energy densities (around 0.25 kWh/kg corresponding to an average flight time of one hour or less), when compared with hydrogen fuel cells, which have an energy density of around 40 kWh/kg and average flight times of 5-10 hours. The dramatically higher energy density makes hydrogen-based solutions attractive for drone operations, but hydrogen-refueling places other constraints on drone operations. The objective of this research is to provide a proof-of-concept for a completely autonomous hydrogen fuel cell powered drone docking and refueling station in remote parts of the ocean. The docking station will consist of a water pump which pumps sea water into a reverse osmosis water filter that then leads into an electrolysis stack that produces clean hydrogen. Next, the hydrogen will enter a high-volume low-pressure tank that stores the hydrogen in preparation to be boosted to higher pressures. After the hydrogen has been compressed, it will be directly inserted into the onboard hydrogen tank on the drone when the drone docks for refueling. Before assembling into a single unit, preliminary experiments are conducted to check the performance and quality of each component, particularly in terms of power requirements, component size and efficiency, and other important design parameters for remote operations. The preliminary experiments are used to calculate the actual working pressure and hydrogen flow rates, as well as to test any potential problems that may arise. Performance metrics, such as hydrogen production per cycle, energy efficiency, and noise are quantified based on the integration of the components. This demonstration work will estimate values for the metrics and areas of improvement for the next design iteration. The overall goal of the project is to transfer the proof-of-concept design to an actual autonomous environment.

Keywords:
Clean Hydrogen; Docking Station; Ocean Data Collection; Fuel Cell Drone; Forever Flying Drone

Mentor(s):
Holman Lau (Engineering); Li Qiao (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1359

Presentation Time: Session 2: 10:30-11:30am

Optimized Air-Entrained Structures in Underwater Noise Mitigation for Offshore Wind Energy

STEM

Authors(s):

Shaocheng Wu† (Engineering)

Abstract:

Pile-driving noise poses significant risks to marine life, with existing noise mitigation systems (NMS) struggling to attenuate low-frequency noise. As monopiles increase in size, the resulting low-frequency noise intensifies, while the scalability of NMS introduces fabrication and deployment challenges. This research investigates an optimized PDMS-Air Entrained Structure as a compact and effective alternative.

Building on previous research work utilizing plastic grid sheets, we designed an array of waveguides incorporating air-entrained solids to create soft boundaries, preventing low-frequency sound propagation. To enhance performance and practicality, we introduced PDMS-based structures and characterized their effectiveness using COMSOL simulations. Simulation results indicated that in the 100-1000 Hz range, the PDMS structure achieved up to 70 dB noise reduction, significantly surpassing the plastic model's maximum 15 dB reduction for identical waveguide dimensions (5 cm × 5 cm × 10 cm).

These findings demonstrate the superior acoustic attenuation capabilities of PDMS-based structures while addressing fabrication and deployment constraints. Future work will focus on experimental validation with lab-scale testing to further assess the system's efficacy in real-world conditions.

Keywords:

Metamaterials; Noise Control; Acoustics; Vibration

Mentor(s):

Junfei Li (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1360

Presentation Time: Session 2: 10:30-11:30am

Predicting Failures in Manufacturing Machinery Using AI-Based Models: Case Study of Air Compressor Health Monitoring

STEM

Authors(s):

Andrew Yuchao Wu† (Engineering); Chen Jyh Wong* (Polytechnic); Eunjae Yu* (Science)

Abstract:

Air compressors serve as the lifeblood of manufacturing shop floor, providing the essential pneumatic power required for various operations. Their reliability is critical to maintaining seamless production process, yet unexpected failures can lead to costly downtime and reduced efficiency. This study explores the application of AI (Artificial Intelligence) models that predict potential failures in an air compressor. The ongoing research utilizes data collected from an IIoT (Industrial IoT) based vibration sensor attached to an air compressor owned by TDS (Terra Drive Systems), a Purdue industry partner. The sensor gathers a variety of descriptive statistics, including crest, temperature, impact, fatigue, and friction, detailing the machine's performance and activity. The data was then exported from the sensor for processing, condensing, and aggregation for analysis. The primary objective is to identify patterns that signify potential failures within the machine and use these insights to develop a predictive model. The model would be capable of analyzing real-time data to predict the likelihood of failure, allowing for early detections of failures and allowing for preemptive measures to be taken. Developing and applying this model in an edge computer aims to predict potential failure in real-time and remotely so that the company minimizes downtime and improves the operational efficiency of the compressor. The anticipated outcomes could provide valuable insights into industrial applications, innovating maintenance practices and solutions in the manufacturing sector.

Keywords:

[no keywords provided]

Mentor(s):

Eunseob Kim (Purdue University); Jaeeun Kim (Engineering); Ali Shakouri (Purdue University); Martin Byung-Guk Jun (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1361

Presentation Time: Session 2: 10:30-11:30am

Design and Analysis of Flapping-Wing Unammned Aerial Vehicle (FWAV) Modular Wing Testbed

STEM

Authors(s):

Sota Yanagisawa† (Engineering); Milan Edward Rahmani‡ (Engineering)

Abstract:

Flapping-wing aerial vehicles (FWAVs) inspired by birds have been researched for their potential to improve maneuvering capability and endurance over traditional fixed-wing aircraft. Moreover, birds often glide to save energy and flap their wings only when necessary, effectively transitioning between flapping and gliding. However, previous studies have given limited attention to experimental results on wing design and flapping-gliding (FG) transition. Consequently, wing geometry and configuration for flapping have mainly been inspired by biomimicry or existing designs. As such, this study aims to develop an open-source modular testbed for rapid experimentation of FWAV wings. The flapping mechanism of the testbed utilizes a four-bar linkage system to actuate the wings. Hall effect sensors are used to detect and lock the position of the wings to achieve FG transition. The testbed is demonstrated in the wind tunnel and used to analyze different wing planform designs. As a proof-of-concept, the trailing edge sweep angle is varied, and its effects on aerodynamic forces are examined. Lift, drag, and flapping frequency data collected from the wind tunnel and an onboard computer is used to calculate power consumption and efficiency of different wing planform designs. The proposed testbed design and experimental procedure seek to support future WAV designs.

Keywords:

Flapping Wing; Avian-Inspired Aircraft; Mechanism Design; Wing Kinematics; Robotics

Mentor(s):

Abhijnan Dikshit (Engineering); Pavankumar Channabasa Koratikere (Engineering); Leifur Thor Leifsson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1362

Presentation Time: Session 2: 10:30-11:30am

Obtaining VGA Video Output via AFTx07 FPGA Emulation

STEM

Authors(s):

Eileen Yoon† (Engineering); Seongbin Lee† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

VGA; Video Processing; Digital Design

Mentor(s):

Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1363

Presentation Time: Session 2: 10:30-11:30am

Communication's Role in Facilitating University Student Access to Mental Health Resources: How Communication Can Help Save Lives

Social Science

Authors(s):

Ashley Young† (Engineering|JMHC)

Abstract:

Mental health resource discussions are increasingly saturating everyday communication, especially at universities, which struggle to give comprehensive and curated information about mental health resources for students. This project seeks to determine the ways Purdue University can better provide students with timely, accurate, and accessible communications about mental health resources. Robust data is being collected on the current practices of Big 10 schools, including their communication methods, their resources offered, their resource utilization by students, and their student suicide rate. Data will be measured and analyzed at each step of the following communication model: the message, the perception of the message, and the actions of the receiver. The data collected will be broad in scope to reflect a variety of stakeholder perspectives, including but not limited to official university reports, student interviews, university news outlets, and social media. Benchmarking will be performed to arrive at best practices to suggest future communication methods for Purdue to utilize to increase resource accessibility and, most importantly, decrease student suicide deaths.

Keywords:

Mental Health; Communication Model

Mentor(s):

Melissa Kay DeFrench (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1364

Presentation Time: Session 2: 10:30-11:30am

Smart CNC Machine Tool Monitoring using Industrial IoT and Artificial Intelligence: MTConnect Data Integration and Forecasting Conductivity for Predictive Maintenance

STEM

Authors(s):

Eunjae Yu† (Science); Chen Jyh Wong† (Polytechnic); Andrew Yuchao Wu* (Engineering)

Abstract:

Industrial Internet of Things (IIoT) and Artificial Intelligence (AI) are increasingly vital for smart manufacturing, particularly for Small and Medium-sized Enterprises (SMEs) where efficient predictive maintenance can significantly reduce costs. In collaboration with Terra Drive Systems, this study integrates Computer Numerical Control (CNC) machine tool controller data with IIoT sensors to establish a real-time data pipeline for remote monitoring and AI applications. The MTConnect was utilized for integrating CNC controller data and sensors equipped with IO-Link protocol. A key focus in this research is forecasting machining coolant conductivity level which is critical for tool performance and machine longevity. Traditionally, operators manually analyze conductivity using separate software to determine coolant replacement schedule, which leads to inefficiencies in maintenance scheduling. By leveraging the integrated real-time MTConnect data pipeline, this study develops predictive models to estimate coolant conductivity to provide proactive approach to maintenance. Preliminary results indicate that statistical and machine learning models effectively capture the relationship between coolant degradation and conductivity variations. These findings demonstrate that AI-driven forecasting can enhance maintenance scheduling, minimizing unplanned downtime and improving overall operational efficiency. This research highlights the potential of data-driven methodologies in optimizing predictive maintenance strategies for CNC machine tool operations.

Keywords:

Industrial IoT; Machine Monitoring; Artificial Intelligence; MTConnect

Mentor(s):

Eunseob Kim (Purdue University); Ali Shakouri (Purdue University); Martin Byung-Guk Jun (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1365

Presentation Time: Session 2: 10:30-11:30am

Understanding Student Experiences in REU Programs at a Large Midwestern R1 University University

STEM

Authors(s):

Bayan Yunis† (Liberal Arts|JMHC)

Abstract:

The U.S. National Science Foundation's Research Experiences for Undergraduates (REU) program provides students from around the world with the opportunity to engage in cutting-edge research across the United States. The National Science Foundation supports students in the program through financial support in the form of stipends and in many cases support for housing, meals, and travel. At a large Midwestern R1 University, REU participants gain hands-on experience in various research fields, primarily within STEM disciplines. This program allows students to develop practical skills, apply theoretical knowledge, and prepare for future careers in research and industry.

This study examines the experiences of students who participated in the university's REU program. Through a series of interviews, the participants' motivations for applying, their experiences working under faculty mentors, and their time conducting research in university labs were analyzed. In addition to technical training, the study explored qualitative aspects of the program, including mentorship, diversity, and interpersonal interactions among participants. By identifying common themes in students' experiences, the university can assess the program's impact and effectiveness. Understanding what students find most valuable will help the university continue fostering a supportive and enriching environment while also addressing areas for improvement.

Keywords:

REU; Student Experiences

Mentor(s):

Lisa B Bosman (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1366

Presentation Time: Session 2: 10:30-11:30am

Understanding Engagement and Ministry Improvement in a Local Church Community

Business Case Study

Authors(s):

Avery Marie Ragon† (DSB); Neng Bi Zhang† (DSB); Robert Pedro Chambers† (DSB); Andee Michelle Elenbaum† (DSB); Isabel Opal Davis‡ (DSB)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1367

Presentation Time: Session 2: 10:30-11:30am

Enhancing Tumor Cell Therapy: Development of Bispecific Small Molecule Ligands Targeting Tumor Cells and Cancer-Associated Fibroblasts

STEM

Authors(s):

Nathan Enlong Zhang† (Science|JMHC)

Abstract:

Chimeric Antigen Receptor (CAR)-T cell therapy has revolutionized cancer treatment, yet its efficacy in solid tumors remains limited due to immunosuppressive tumor microenvironments. This research aims to enhance CAR-T therapy by developing bispecific small molecule ligands that selectively target both tumor cells and cancer-associated fibroblasts. Specifically, we synthesize ligands incorporating PSMA617, which binds prostate-specific membrane antigen (PSMA) overexpressed in prostate cancer, and FAP, targeting fibroblast activation protein in tumor stromal cells. These ligands are conjugated with fluorescein to enable CAR-T cell recognition and tumor destruction. The project involves organic synthesis, purification using advanced chromatographic techniques, and in vitro and in vivo evaluation of ligand binding, stability, and therapeutic impact. By disrupting the tumor microenvironment and reducing immune suppression, this approach has the potential to improve CAR-T therapy efficacy for solid tumors. If successful, this strategy could be expanded to other cancers, broadening the impact of immunotherapy.

Keywords:

Car-T Cell Therapy; Tumor Microenvironment; Prostate-Specific Membrane Antigen (PSMA); Fibroblast Activation Protein (FAP); Targeted Cancer Therapy

Mentor(s):

Sudarsan Reddy Kasireddy (Purdue University); Philip S Low (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1369

Presentation Time: Session 2: 10:30-11:30am

Sustainable Concrete Utilizing Supplementary Cementitious Materials

STEM

Authors(s):

Shelby Allen† (United States Military Academy West Point); Thomas Vellenga† (United States Military Academy West Point)

Abstract:

The origins of this project were to develop a novel mix design with multiple supplementary cementitious materials (SCMs) that behave similarly to traditional Portland cement concrete (PCC). However, initial mix designs resulted in problematic fresh-state concrete, poor workability, and unpredictable water demand. This observation led to an updated research goal to quantify the change in water demand based on the SCM replacement in the mix design to shed light on the individual and combined effects of these materials. To ensure consistent results, all mixes were prepared using the same aggregates and mixing/curing process; however, each mix was created to achieve a target slump of 4 inches. A control mix and five experimental mixes for each SCM—with varying percentages of glass pozzolan and silica fume—were produced and evaluated for water demand, compressive strength, tensile strength, and electrical resistivity. Early results showed similar resistivity and compressive strength across the mixes; however, as curing progressed, the glass pozzolan mixes maintained comparable compressive strength, the silica fume mixes exhibited higher strength, and every SCM mix demonstrated greater resistivity than the control beyond 28 days. These findings suggest that the experimental mixes hold promise as sustainable concrete alternatives, offering high strength, enhanced durability, and comparable or even reduced water demand. Future research will focus on developing empirical formulas to further define the relationship between concrete characteristics and SCM replacement percentages, and will eventually expand to include other SCMs, such as agricultural waste or other waste products.

Keywords:

Sustainable; SCM; Alternative; Slump; Water Demand

Mentor(s):

Andrew Banko (United States Military Academy West Point)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1370

Presentation Time: Session 2: 10:30-11:30am

Autonomous Particle-Filter Path Generation

STEM

Authors(s):

Michael Berlingieri† (United States Military Academy West Point)

Abstract:

The purpose of this research is to develop an autonomous path-planning algorithm for efficiently detecting minefields and plotting a safe route through them, optimizing landmine reconnaissance efficiency. Traditional "lawn mower" search patterns, which systematically sweep an area in straight lines, are inadequate for rapid and adaptable mine detection, as they require more time to achieve satisfactory coverage. The proposed method employs a particle filter, where randomly generated particles represent potential mine locations. Each particle is assigned a weight based on the probability of a mine's presence at that location. As a simulated aerial agent navigates the minefield, particles within its field of view (FOV) shrink according to a probabilistic detection model, while those outside the FOV grow, producing evolving estimates of the targets' probability density. The simulated search agent can then use this target belief distribution to intelligently adapt its path, steering toward the highest-weighted particle within an adjustable search radius. This radius expands or contracts based on local probability density, allowing for a more efficient and adaptive search strategy. To ensure the generated flight path is viable, the algorithm incorporates exponential smoothing to simulate flight physics. Flight path generation occurs in a simulated environment, where users define latitude and longitude coordinates for the search domain and specify no-fly zones. This study hypothesizes that an adaptive search radius improves search efficiency by dynamically adjusting based on environmental feedback. Results indicate that the adaptive search radius algorithm reaches the search threshold more efficiently, covering 95% of the minefield in less time compared to traditional methods. This research has significant implications for military reconnaissance, search-and-rescue operations, and autonomous navigation in hazardous environments. Efficient search algorithms enhance operational safety and intelligence gathering, reducing risks in mine-infested or hostile territories. Currently, this work is being applied to ongoing projects where the path-generation algorithm will autonomously guide drones. Future efforts will focus on refining the model for real-world drone implementation and integrating sensor data and machine learning to enhance adaptive decision-making.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Drone Path Generation; Autonomous; Particle-Filter

Mentor(s):
Josiah Steckenrider (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1371

Presentation Time: Session 2: 10:30-11:30am

CGM Data: Distilling and Interpreting Glycemic Trajectories

STEM

Authors(s):

Ethan Collins† (United States Military Academy West Point)

Abstract:

Continuous Glucose Monitors (CGM) are a revolutionary wearable sensor that collects frequent (every 5-15 minutes) measurements of glucose concentrations for a period of 10-14 days. Initially used to monitor patients with type 1 or type 2 diabetes, CGM is now also used in precision nutrition studies. In fact, the NIH funded Nutrition for Precision Health (NPH) study is collecting CGM data in over 8000 participants generating one of the largest CGM databases in existence. Despite the availability of CGM data for analysis, the complexity behind preprocessing data into meaningful metrics is complex and challenging. While there are numerous online calculators that preprocess CGM data, often the calculations are not transparent and to date, no single calculator can batch process or allow for upload of multiple patient files at once. Moreover, some CGM metrics do not have clearly defined formulation even within publications. In our study, we have worked through detailed explanations of popular existing CGM metrics including the metrics in the Ambulatory Glucose Profile by the International Consensus on Use of Continuous Glucose Monitoring. A user-friendly app designed to batch process data from any CGM device was developed to output all metrics and key visualizations leading to immediate human interpretations of the data. The study and app will allow non-quantitative investigators to analyze CGM data and ultimately standardize the field.

Keywords:

Precision Nutrition; Diabetes Technology; Personalized Medicine; Clinical Data Processing; Glycemic Variability

Mentor(s):

Andrew Banko (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1372

Presentation Time: Session 2: 10:30-11:30am

Fresh Whole Blood Transfusion in Austere Environments

STEM

Authors(s):

Drew Homan† (United States Military Academy West Point)

Abstract:

This research study focuses on analyzing modes of failure through intravenous (IV) tubing of fresh whole blood (FWB) transfusion kits used by the military in cold regions to expand the operating envelope to environments where servicemembers were previously untreatable. The two modes of failure investigated are heat loss which can result in unhealthy fluid administration temperatures for patients and pressure head loss which can result in insufficient flowrate for emergent fluid delivery to patients. During experiments, fluid temperature is controlled at the inlet of the IV tubing while the resulting outlet fluid temperatures and volumetric flow rates are measured. Data for IV tubing heat loss and pressure head loss analysis is collected in an environmental chamber. The temperature within the environmental chamber is systematically reduced by 3°C from the first collection starting at 20°C to a final collection at -39°C. Heat loss analysis reveals that 40.9 ± 3.4 W of heat loss occurs even when the ambient temperature is 20 °C. As the environment temperature reaches -39°C, the heat loss through the IV tubing increases to 168 ± 17.4 W. This research study quantifies the amount of heat loss through the IV tubing during austere blood transfusions and uses mathematical models to propose mitigation methods such as utilizing thermal insulation around the IV tubing and reducing the length of the tubing. Current work is directed at pressure head loss analysis with initial mathematical models indicating increased IV tubing diameter and fluid filter redesign as methods to reduce pressure head losses.

Keywords:

Blood Transfusion; Fresh Whole Blood; IV Tubing; Heat Loss; Pressure Head Loss

Mentor(s):

Emine Foust (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1373

Presentation Time: Session 2: 10:30-11:30am

Operational Modal Analysis of the Bear Mountain Bridge

STEM

Authors(s):

Gautam Namjoshi† (United States Military Academy West Point); Philip Williams† (United States Military Academy West Point); Ethan Espinosa† (United States Military Academy West Point)

Abstract:

This project focuses on the dynamic monitoring of The Bear Mountain Bridge, a historic suspension bridge in the lower Hudson Valley. A sensor network of eight uniaxial accelerometers was installed across the bridge's suspended span to measure its operational vibrations and determine modal properties. Three system identification methods are used to analyze the acceleration data to estimate modal properties of the bridge, namely vertical and torsional modal frequencies and mode shapes. Implementing three analytical methods—AFDD, ERA-NExT, and SSI— for the same data allows for cross-validation of the results. Overall, thirteen model frequencies below 2.5 Hz were identified as modal frequencies, six of which were cross-validated by all analytical approaches. This research provided the first known experimental estimates of the modal properties of this bridge.

Keywords:

System Identification; Modal Properties; Structural Health Monitoring; Sensor Network; Bridge

Mentor(s):

Thomas Matarazzo (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1400

Presentation Time: Session 3: 12:00-1:00pm

Financial Conspiracy Theories and Their Influence on Social Media

STEM

Authors(s):

Phoebe Isadora Abbruzzese† (Science)

Abstract:

Financial conspiracy theories claim hidden forces or groups cause events that will have a significant impact on individuals' financial well-being. For example, the NESARA/GESARA (National Economic Security and Recovery Act/Global Economic Security and Reformation Act) conspiracy promotes the idea that there will be a sudden reset of the economy that will bring radical changes like the elimination of all debts and compound interest. While these conspiracy narratives may seem harmless, some social media channels promote these ideas and financially exploit followers by encouraging them to invest in or buy products related to these conspiracies. To better understand how financial conspiracies can negatively impact followers, we will survey the financial conspiracy environment on social media by using network analysis. This analysis, using natural language processing, will distinguish between these conspiracy channels and the greater social network. Then, we will use this information to uncover how these conspiracy theorists monetize their social media presence. We hypothesize that conspiracy theorists foster engagement by using more paranoid and urgent language, making emotional appeals that are more persuasive than other types of communication. The findings from this study will inform future research on how conspiracy channels operate and prey on vulnerable social media users.

Keywords:

Financial Conspiracy Theories; Network Analysis; Natural Language Processing

Mentor(s):

Courtney Allen Falk (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1401

Presentation Time: Session 3: 12:00-1:00pm

Development of a Benchmarking Tool Utilizing Computer Vision for Generative Models

STEM

Authors(s):

Rishit Agrawal† (Science); Agrim Sharma† (Science); Bingyi Liu† (Science)

Abstract:

Text-to-image generative models have seen a rapid increase in advancement in recent years, with diffusion models and GAN's producing increasingly realistic and diverse outputs. However, the rise of these models creates challenges for researchers and professionals who seek optimal solutions for resource-constrained environments such as embedded systems. This project introduces a comprehensive benchmarking platform that evaluates generative models across multiple dimensions. The framework measures accuracy using object detection algorithms using Real-Time Detectron Transformer (RT_DETR), style classification with Vision Transformers, and semantic consistency with the text prompt and generated output via Contrastive Language-Image Pretraining (CLIP). We assess the quality of metrics such as fidelity utilizing CLIP with Maximum Mean Discrepancy (CMMD) and diversity assessment through LPIPS and Structural Similarity Index Measures (SSIM). Our work evaluates performance measures by tracking execution time and resource utilization across differing computing environments such as Purdue's Gilbreth Computing Cluster and various embedded systems like Jetson Orin. We additionally worked on fine-tuning the pre-trained OpenCLIP model on a synthetic dataset consisting of text-based prompts and multi-model generation. By providing standardized, customizable evaluation metrics, our research enables informed decision-making for both scientists and industry professionals to accommodate the growing share of generative models. Our findings suggest that there is no single model that single-handedly excels in all metrics which indicates how important it is to build evaluation frameworks based on task-specific applications.

Keywords:

Benchmarking Tools; Generative Models; Contrastive Language-Image Pretraining; Structural Similarity Index Measures

Mentor(s):

Yung-Hsiang Lu (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1402

Presentation Time: Session 3: 12:00-1:00pm

MINERAL DIVERSITY AND IMPACT MELTS IN CRATER CENTRAL PEAKS ON MARS

STEM

Authors(s):

Chandler Albright† (Science)

Abstract:

Impact melts on Mars provide a window into the planet's astrobiological potential by trapping organic matter and associated hydrothermal systems. Central peaks in impact craters, often minimally affected by later deposits, expose signatures ideal for studying these melts. We analyze spectral data from the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) onboard the Mars Reconnaissance Orbiter to investigate mineral diversity and impact melts in 20 crater central peaks. Spectra from regions of interest were ratioed against neutral terrains and processed by continuum removal to extract key band parameters: the 1 um band depth, band center, and the 1:2 um band area ratio. These parameters allowed classification of dominant mafic minerals into bins for low-calcium pyroxene, high-calcium pyroxene, olivine, and glass. Our analysis reveals that glassy materials appear in nine of the 20 central peaks, typically as localized patches interspersed with other minerals. In Alga crater, glass detections occur between olivine rich regions and areas dominated by low-calcium pyroxene. While the band area ratio effectively distinguishes high-calcium pyroxene from olivine, separating olivine from glass remains challenging. This study demonstrates the feasibility of remotely detecting impact melts and highlights the complexities of interpreting mixed mineral spectra. Future work will refine spectral parameters and incorporate high-resolution imaging to further make clear impact melt distributions and their role in Mars's geological evolution.

Keywords:

Crater; Impact Melt; Mars; Glass

Mentor(s):

Briony H Horgan (Purdue University)

Other Acknowledgement(s):

Athanasios Klidaras (Science)

Poster Presentation Abstract Number: 1403

Presentation Time: Session 3: 12:00-1:00pm

Predicting Consumer Purchasing Trends: A Comparative Analysis of Walmart and Target Customers in West Lafayette

Business Case Study

Authors(s):

Alexander Chase Alfele† (DSB); Lauryn J Crumbley† (DSB); Annika Anders Nelson† (DSB); Brendan Lawrence Ludwig† (DSB)

Abstract:

This project leverages advanced computational methods and AI to develop a synthetic dataset simulating the purchasing habits of Walmart and Target customers in West Lafayette, Indiana. By analyzing consumer preferences, spending patterns, and market trends, we aim to determine how key demographics—particularly college students versus non-students and differences in gender—shape shopping behaviors at these two major retailers.

Our methodology involves creating and examining a synthetic dataset infused with controlled noise to approximate real-world variability. This dataset captures essential details, including product categories (groceries, electronics, beauty, and household essentials), total spending, and demographic characteristics. We employ exploratory data analysis (EDA), visualization techniques, clustering, and predictive modeling to uncover spending trends and identify distinct customer segments.

The expectation is that our findings will indicate that Target may attract higher-income consumers and a greater proportion of college student shoppers, likely due to its proximity to campus. These insights have practical implications for retailers seeking to improve customer engagement and refine marketing strategies. More broadly, the study showcases how data-driven, AI-enhanced methodologies can inform business decision-making and strengthen consumer segmentation models across diverse market contexts.

Keywords:

Consumer Behavior; Retail Market Trends; Customer Segmentation; Purchasing Patterns; Spending Habits

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1404

Presentation Time: Session 3: 12:00-1:00pm

Analyzing Trends in Post-Pandemic Purdue Computer Science Courses Over Time

STEM

Authors(s):

Colette Gabriella Bacidore† (Science); Anika Ghosh Maji† (Science); Shamita Yedlapalli† (Science); Nandini Sachdeva† (Science); Isabela Ureche† (Exploratory Studies|Other)

Abstract:

There are limited studies analyzing the effects of Purdue University's return to in-person learning after the COVID-19 pandemic, which is known to have significantly affected students' academic performances. As a top 20 Computer Science (CS) program and one of the largest departments on campus, Purdue University CS presents a perfect opportunity to study the impacts of the pandemic on student performance. As Purdue CS students ourselves, we are interested in understanding how trends in CS class grades for different undergraduate class levels (100-level, 200-level, etc.) have changed following the pandemic. We hypothesized a slight upward trend in grades as students gradually adapted to post-pandemic in-person classes, assuming that grades would be lower in higher class levels due to greater class difficulty. We evaluated the trends across course levels over the years based on the information in our dataset, Purdue Course Grade Distribution, obtained from BoilerGrades, for classes during the Fall 2021 to Spring 2024 semesters (excluding the summer terms). For our main analysis, we weighted letter grades, ignoring pluses and minuses. We made our weighted values representative of students taking the courses for a letter grade. We found that, contrary to our hypothesis, level 400 courses had the highest average grades. Additionally, the average for any given level was not too different between Fall 2021 to Fall 2024, but there was a decent amount of fluctuation between Fall and Spring semesters. In the future, we hope to expand our analysis to other factors that may impact grades besides course level.

Keywords:

[no keywords provided]

Mentor(s):

Tiantian Qin (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1406

Presentation Time: Session 3: 12:00-1:00pm

SoCET: PCB STARS Chiplet

STEM

Authors(s):

Aniketh Bhaskar Bandi† (Engineering|JMHC); Maribel Garcia Vasquez† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Matthew A Swabey (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1407

Presentation Time: Session 3: 12:00-1:00pm

Development and Testing of a Footstep Planner Simulation Platform for Robust Quadrupedal Locomotion on Dynamic Surfaces

STEM

Authors(s):

Annalise Marie Baniecki† (Engineering|JMHC)

Abstract:

The purpose of this study is to develop a simulation platform for Unitree's Go1 to compare the performance of various footstep planners before testing the physical hardware. The background for this project is a new footstep planner (HT-LIP), which uses a hybrid, time-variant (HT) version of the linear inverted pendulum (LIP) model, which is meant to balance the robot in the presence of aperiodic surface pitching and swaying, as if we're on a boat. The project focuses on finishing the simulation platform, converting the simulation code to hardware code, designing test protocols for Unitree’s Go1, and designing hardware for experimental test harnesses on quadrupedal locomotion. This research will demonstrate how robust quadrupedal locomotion can be in real-world scenarios with different controllers. It's very applicable to search-and-rescue applications or even exploration/maintenance of dynamic environments with tilting surfaces.

Keywords:

Quadrupedal Locomotion; Robotics; Simulation

Mentor(s):

Magnus-Tryggvi Adejogun Kosoko-Thoroddsen (Engineering); Yan Gu (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1408

Presentation Time: Session 3: 12:00-1:00pm

Autonomous Docking Mechanism and Deployment System for Agricultural Robots

STEM

Authors(s):

Alexa Katherine Barron† (Engineering|JMHC)

Abstract:

As the demand for sustainable and efficient agricultural practices grows, autonomous robotic systems offer promising solutions for improving food production. However, a major challenge in deploying these systems at scale is ensuring secure transport, reliable deployment, and continuous operation in remote field environments. This research focuses on developing a secure and autonomous deployment system for agricultural robots transported by an autonomous Polaris Ranger UTV. The system is constructed using 80/20 aluminum extrusion for modularity and ease of integration. It incorporates guide rails and an adjustable locking mechanism to stabilize and secure robots during transport while enabling controlled deployment in the field. The system will be tested at Purdue's Agronomy Center for Research and Education (ACRE). Data collected from these tests will evaluate deployment reliability, stability, and overall system efficiency. Additionally, collaboration with other institutions will support the integration of an onboard charging system to extend robot operation time. This research contributes to the broader adoption of autonomous farming technologies by improving efficiency, scalability, and reliability in agricultural robotics.

Keywords:

Agriculture; Robotics; Autonomous

Mentor(s):

David J Cappelleri (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1409

Presentation Time: Session 3: 12:00-1:00pm

Sustainability Challenges of Recycled Concrete Aggregate: The Hidden Role of Target Strength in Environmental Impact

STEM

Authors(s):

Amareah Elena Bead† (Engineering|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Rui Bai (Engineering); Marina Garcia Lopez-Arias (Engineering); Maria mirian Velay Lizancos (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1410

Presentation Time: Session 3: 12:00-1:00pm

PFAS biotransformation through composting of contaminated animal carcass

STEM

Authors(s):

Ethan Robert Behrend† (Engineering)

Abstract:

Per- and polyfluoroalkyl substances (PFAS) have been a rising concern due to their heavy industrial and commercial use since the 1950s. PFAS compounds can be found in cookware, packaging, clothing, foams, and water/oil-repelling papers. A property of PFAS is its resilience in the environment. Products with PFAS have been placed in municipal and industrial waste and composting systems. The introduction of these compounds impacts the land that is treated with contaminated compost. This has been seen around the country as such compost has been used to treat forest floors and agriculture. A consequence of this application is the presence of these compounds in the vegetation and wildlife in treated areas across the ecosystem. Significant PFAS levels have been detected in higher trophic levels due to bioaccumulation which poses a higher toxicity to such organisms. This lab-scale composting study focused on understanding the biotransformation process of PFAS in the presence of an HBT mediator and laccase enzyme added to compost material. The study included 7 jars of compost with differing variables of airflow, PFAS spiking, humidity, and enzyme presence in effort to influence degradation. Degradation of PFAS was observed in the compost over the test period and in the gas collected through granular activated carbon filters. This experiment would provide insight into the PFAS degradation process during the composting of the contaminated matrix.

Keywords:

PFAS Degredation; Compost; PFOS

Mentor(s):

Youn jeong Choi (Purdue University); Linda S Lee (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1411

Presentation Time: Session 3: 12:00-1:00pm

Evaluating The United States' Vaccines

Social Science

Authors(s):

Srishti Bhatnagar† (HHS)

Abstract:

Getting vaccinated is critical to the public health of the United States; however, there is still a lot of hesitancy surrounding them. The research done for this presentation will explore and analyze whether people should get vaccinated or not, depending on the data collected, with a thorough literature review; this presentation will focus around measles as there is currently an outbreak. I will prove the effectiveness of vaccines in general and then focus in on the measles vaccine. The information researched will include the effects of previous mandates, the correlation of vaccines and outbreaks of different diseases, and the ethical and legal perspectives of vaccine regulations. This research will concern both scientific and ethical aspects of this ongoing debate of public health versus personal freedom, hoping to provide an overview of the current balance and how the statistics speak on it.

Keywords:

[no keywords provided]

Mentor(s):

Catherine Jean Shukle (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1412

Presentation Time: Session 3: 12:00-1:00pm

Optimal Fleet Strategy for Consistent Efficiency through Crisis: COVID-19 Case

STEM

Authors(s):

Layne Daniel Blocher† (Polytechnic); Serim No Cheon† (Polytechnic)

Abstract:

The first quarter of the 21st century brought many challenges to the airline industry. Airlines needed to adjust their business strategies in order to deal with these crises. One of the strategies that airlines adopted is upgauging, which refers to reshaping an airline's fleet to have an increased number of larger aircraft than they had previously. Research suggests this new strategy leads to an increase in productive efficiency. However, demand greatly declined during the COVID-19 pandemic which led to a decrease in airline load factors. Therefore, the impact of upgauging on airline efficiency during post-COVID years remains uncertain due to the fact that this strategy is only efficient when load factors remain high. We investigate the relationship between COVID-19 and upgauging on airline efficiency by utilizing data from U.S. airlines from 2010 to 2023. We employ two stages of semi parametric analysis and conduct a data envelope analysis to obtain an efficiency score. Following that, we use the truncated regression with bootstrapping method to examine the impact of COVID-19 and upgauging on airline productive efficiency. Our results reveal that small narrow body aircraft are more efficient for airlines during COVID-19 recovery years, while upgauging is more efficient for airlines in general. This suggests that airlines should maintain a diverse fleet in order to achieve a stable productive efficiency regardless of environmental volatility. Future research may focus on the percentage of the total fleet which should be composed of small, narrow body aircraft in order to optimize an airline's efficiency.

Keywords:

Airline Efficiency; Aircraft Size; Semi Parametric Analysis; COVID-19

Mentor(s):

Fecri Karanki (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1413

Presentation Time: Session 3: 12:00-1:00pm

Examining the Role of Teachers' Language Modeling in Prekindergarten Classrooms

Social Science

Authors(s):

Camila Bonta† (HHS|JMHC)

Abstract:

This study investigates whether the quality of teachers' language modeling, assessed by the Classroom Assessment Scoring System (CLASS), influences prekindergarten children's language development. CLASS evaluates teacher-child interactions, focusing on frequent conversation, open-ended questions, repetition and extension, self- and parallel talk, and advanced language use. While research supports the importance of high-quality teacher interactions, few studies specifically link CLASS language modeling scores to measurable language growth. This study hypothesized that children in classrooms with higher CLASS language modeling scores would show greater language development over the prekindergarten year, measured by receptive vocabulary assessments.

To explore this relationship, CLASS observations were conducted in 48 prekindergarten classrooms on two separate days during the 2023-2024 school year. The CLASS scores for the language modeling dimension were averaged across the two days. Direct assessments of language skills were collected with 186 children (m age = 4.46 months; 54% female) at the beginning and end of the prekindergarten school year. A multilevel regression model was used to examine associations between CLASS language modeling scores at the classroom-level and child language development at the child-level, accounting for a host of potential confounding variables (i.e., baseline language, child sex, child age, child race/ethnicity, family income, teacher experience, teacher-to-child ratio, and home literacy environment). Multiple imputation was used to account for missing data. Inconsistent with what was hypothesized, CLASS language modeling was not significantly associated with children's language development ($b = -0.32$, $SE = 0.82$, $p = 0.70$).

Keywords:

Language Modeling; Early Childhood Education

Mentor(s):

Jenn Finders (Colorado State University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1414

Presentation Time: Session 3: 12:00-1:00pm

Bias Confrontation & It's Relationship with Political Ideology

Social Science

Authors(s):

Badreddine Bouzeraa† (HHS); Emma Yue Xiao* (HHS); Samantha P Mohr* (HHS); Alexis Renee Rosenberg* (HHS); Minnah Rafay Khawaja* (HHS); Madison Nicole Collier* (HHS)

Abstract:

Past scholars have shown that confrontations of bias reduce subsequent expressions of bias. This study aims to answer the question, "Is confrontation an effective strategy in reducing prejudice or bias, regardless of political ideology?" Through this project, we will better understand how liberal and conservative ideologies impact affective reactions to confrontation, bias reduction, social costs, and desires of retaliation against confronters. At least 160 White and domestic U.S. citizens who self-identify as liberal or conservative will complete an online survey and be asked to recall an incident in which they had been confronted regarding bias in the last five years. They will then be asked to respond to measures of negative other-directed and self-directed affect, social costs, self-reported reduction of bias, and retaliation against the confronter. We will use political ideology to predict these outcomes in correlational analyses. We hypothesize that 1) participants will report reducing their bias following confrontation regardless of political ideology; 2) conservative participants will report less negative self-directed affect and greater negative other-directed affect than liberal participants; and 3) conservative participants will levy greater social costs and retaliation on their confronters than liberal participants. Our findings will inform future literature on the effects of political ideologies and confrontation and potentially establish newer and more effective confrontational techniques to reduce negative other-directed affect, social costs, and retaliation.

Keywords:

Bias Confrontation; Political Ideology; Prejudice; Social Costs; Social Psychology

Mentor(s):

Margo J Monteith (Purdue University); Madison Paige Vigdor (HHS)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1415

Presentation Time: Session 3: 12:00-1:00pm

Forever-Flying Drones: Autonomous Ocean-Based Refueling Stations for Hydrogen-Powered Drones

STEM

Authors(s):

Ishaan Breinig† (Engineering); Thomas B Wooldridge‡ (Engineering)

Abstract:

Gaseous hydrogen's low emissions and high gravimetric energy density make it an appealing energy source for drones. One of the most useful applications of drone technology is data collection and mapping. Most data-mapping drones are powered by batteries with gravimetric energy densities around 0.14-0.20 kWh/kg, correlating with flight times of no more than an hour. Hydrogen (pressurized to 700 bar) fuel cell-powered drones boast roughly 40 times the energy density of battery-powered drones, leading to much longer flight durations and greatly benefiting data collection operations, especially in remote areas like the ocean. However, hydrogen refueling poses a challenge. Because hydrogen is the smallest chemical element, it is difficult to pressurize and store safely. This research aims to produce a proof-of-concept system of an autonomous, ocean-based refueling station for hydrogen-powered drones. The system is powered by grid electricity and consists of a pump, reverse osmosis water filter, hydrogen electrolyzer, two-stage gas booster, storage tank, and a metal plate that serves as a floating base. The seawater will be pumped directly into the filter, split into gaseous hydrogen, pressurized appropriately, and stored in a tank. The drone will be refueled through an autonomous docking system with a fuel line from this tank. Each component has been tested separately before assembling into one system to ensure safe and proper operation. Parameters such as component efficiencies, mechanical vibrations, output hydrogen pressure, and mass flow rates at different points in the system will be measured to determine performance and potential improvements. Future work entails scaling up to full autonomy (including transitioning the system's power source to hydrogen fuel cells), buoyancy calibration, and testing in a marine-like environment.

Keywords:

Hydrogen; Drone; Sustainability; Autonomous Refueling; Ocean Data Collection and Mapping

Mentor(s):

Li Qiao (Purdue University); Holman Lau (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1417

Presentation Time: Session 3: 12:00-1:00pm

How Student Journalists Perceive and React to Information Challenges in the Field of Journalism

Social Science

Authors(s):

Caitlyn Yuchong Cai† (DSB); Skyler Rose Mofle† (HHS); Shree Krishna Tulasi Bavana† (DSB)

Abstract:

This qualitative study investigates how student journalists perceive and react to information challenges in the field of journalism and how they believe the field can respond to these challenges. Using a semi-structured interview approach, the SPIRaL research team conducted thirteen 30-60 minute interviews with student journalists working for student newspapers in the Big Ten Academic Alliance. The team employed thematic analysis to iteratively code the transcripts and identify themes. Initial findings suggest student journalists perceived challenges, including 1) balancing journalistic integrity and practical challenges, 2) negotiating a relationship with their audience, and 3) navigating the university's influence on their ability to collect information. Student journalists address these information challenges by placing an emphasis on balanced reporting (making sure all sources and sides are represented), and leveraging existing guidance and support from their other student reporters, journalism mentors, and advisors in their learning environment. These initial findings suggest that in addition to training that promotes balanced reporting practices, student journalists may need specialized training to enable them to effectively navigate the dynamics and foster positive relationships between the newspaper and the university.

Keywords:

Student Journalism; Information Literacy; Higher Education

Mentor(s):

Rachel Fundator (Purdue University); Clarence Maybee (Purdue University); Margaret Elizabeth Collins (Libraries)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1418

Presentation Time: Session 3: 12:00-1:00pm

Designing Standard Cell Library using Open-Source Software

STEM

Authors(s):

Enrique Camacho† (Engineering|JMHC); Haruna Kawai† (Engineering); Chase John Grimm† (Engineering); Yilin Xu‡ (Engineering)

Abstract:

This project aims to test the viability of Open-Source EDA tools by using them to synthesize a RISC-V CPU core designed by SoCET. The project collaborates with AcuSemi and uses their AS800 process, an 800nm technology node designed for educational and demonstration purposes, to create a standard cell library. Our first steps, designing schematics for basic CMOS logic gates using XSCHEM and running SPICE simulations to confirm the functionality, have been completed. Additionally, we created layouts for each standard cell in KLayout with Design Rule Check and Layout vs. Schematic checks. IO Pads are also being tested in Xschem with ESD protection. Parameterized cells have been designed within the PCell script, supporting layout development. The standard cell library has been built using CharLib, an open-source standard cell characterizer, to generate liberty format files for use with OpenLane, an automated RTL to GDSII flow. OpenLane includes tools to complete synthesis, place & route, and verification, that are abstracted into just a single configuration file. OpenROAD, the routing placement platform, which is OpenLane's backend, is used to generate configuration files for the AS800 technology from existing standard cells and process, and to validate the functionality with two metal layers. The standard cell library is undergoing functionality tests, in which basic combinational designs are synthesized using Yosys. The developed open-source PDK and standard cell library will be formally documented and shared publicly via GitHub, helping lower the barrier to entry to chip manufacturing for universities and smaller companies.

Keywords:

Standard Cell Library; Open-Source EDA Tool; CharLib; OpenLane; AS800

Mentor(s):

Boyuan Chen (Engineering); Andrew Lee Schlabach (Purdue University); Mark Johnson (Purdue University); Sergey Zakharov (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1419

Presentation Time: Session 3: 12:00-1:00pm

Dextran encapsulation In Modified Coiled-Coil Peptide Nanotubes

STEM

Authors(s):

Wyatt Tristan Carter† (Agriculture)

Abstract:

Peptide biomaterials are an emerging technology that has applications in regenerative medicine. Peptides self-assemble into various structures at the microscale and nanoscale level, including spheres, tubes, and disks. In one example, the trimeric coiled-coil peptide TriNL undergoes hierarchical assembly to form nanotubes with an extensive interior cavity. This cavity incorporates fluorescein labeled anionic dextrans via ionic interactions with the growing nanotubes. Due to the level of cationic amino acids within the TriNL sequence, only negatively charged cargo has been incorporated within the nanotube to date. The aim of this research is to modify the sequence of TriNL to replace specific amino acids to improve the scope of encapsulated cargo.

In this work, two modified TriNL peptides were designed, TriNL-K3Q and TriNL-K28Q. The modified peptides have replaced positively charged lysine (K) with neutral glutamine (Q) at the 3rd position for K3Q and 28th position for K28Q. Both peptides were prepared using solid phase peptide synthesis, purified using RP HPLC and characterized using MALDI-TOF MS. Scanning electron microscopy was used to investigate the modified peptide structures. TriNL-K3Q was observed forming rods ranging in size from 500 nm to 3 ?m. TriNL-K28Q was observed assembling into structures about 20 ?m long. TriNL-K28Q was tested with anionic, neutral, and cationic dextran and was found to encapsulate anionic and cationic dextran using confocal microscopy. Further testing will be done on determining the charge of TriNL-K28Q.

The development of peptide nanotubes capable of carrying therapeutic biopolymers may have many applications in drug delivery and storage.

Keywords:

Peptide; Biomaterials; Nanotube

Mentor(s):

Jean A Chmielewski (Purdue University); Anna Pavlishchuk (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1420

Presentation Time: Session 3: 12:00-1:00pm

Synthetic Biology Laboratory: Construction of a Methylsalycylate Biosensor

STEM

Authors(s):

Yamna Belen Chacon Perello† (Agriculture); Aidan Thomas Dibble‡ (Agriculture); Alexis Mae Carroll‡ (Agriculture); Ann Marie Uhlmansiek‡ (Agriculture); Emily Joy Reeves‡ (Agriculture); Gretchen K Minich‡ (Science|JMHC); Race Ethan Medema‡ (Agriculture|Engineering); Timothy Michael Raplee‡ (Agriculture)

Abstract:

The Food Science department at Purdue University has developed a new major entitled Microbial Biotechnology and Fermentation Science, featuring a comprehensive curriculum that integrates both lectures and a laboratory courses. The overall curriculum covers essential topics such as: the fundamentals of fermentation related to microbial metabolism, molecular interactions, basic bacterial genetics and synthetic biology. A previously developed module for the lab course to introduce numerous molecular methods in the construction of a biosensor for methylsalicylate was evaluated. The biological component consists of either the Arabidopsis thaliana or Nicotiana tabacum methyl esterase (MES) modified for bacterial expression. Previous clones were cross-streaked with an E. coli expressing the salicylate hydroxylase (nahG) and catechol-2,3-dioxygenase (nahG) exposed to methylsalycylate vapor. Positive clones showing the yellow ring cleavage products at culture intersections were subjected to plasmid isolation for further use. The genes encoding the MES will be subsequently expressed in a luminescence-based salicylate biosensor containing the NahR and associated operator/promoter fused to the luxCDABE gene cassette. The resultant MES expressing sensor will cleave the methyl group from the methylsalycylate leading to salicylate interacting with the NahR protein with the induction of bioluminescence. The sensing strain will be integrated to a photomultiplier tube to transduce the luminescence response with a digital output. The module incorporates numerous molecular methods and fundamental concepts associated with strain construction including genetic manipulation of eukaryotic genes for expression in bacteria, cloning, bioreporter development, and strain characterization.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Methyl Esterase; Bioluminescence; Photomultiplier

Mentor(s):
Bruce M Applegate (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1421

Presentation Time: Session 3: 12:00-1:00pm

TimeScale Creator Online: Web Tool for Visualization of Earth

STEM

Authors(s):

Kevin Ming Chang† (Engineering); Aditya Krishnan Sivathanu† (Engineering); Leyton Drew Bostre† (Engineering); Samyukta Balaji† (Engineering); Michael Robert Knaack† (Engineering); Jiali Shi† (Science|Graduate); Joshua Yu-Yaw Ho† (Science); Ellis Reuben Selznick† (Engineering); Paolo Gabriel Gumasing‡ (Science); Jaehyuk Lee‡ (Science); Jiaqing Li‡ (Science)

Abstract:

The TimeScale Creator is a free software tool developed and progressively enhanced through the past decade by Purdue students for researchers, educators, and industry professionals to visualize and explore Earth's geologic history. The suite contains comprehensive stratigraphic, paleontologic, climatic and geophysical datasets. While the original Java based program enabled users to plot and analyze data across various geologic time periods, its technical installation requirements and the need for regular updates posed accessibility challenges for many public users. To overcome these problems and to expand the accessibility of these tools, our team developed a web-based version of the TimeScale Creator program using TypeScript and React. This online platform retains the basic functionalities and user interfaces of the original software, enhances the user experience through an interactive browser-based environment, and eliminates the need for downloads and installations. Users can now access a vast primary database of over 20,000 global and regional events, including biological, geomagnetic, sea-level and stable isotope data. In addition, the web version offers the ability to incorporate other region-specific data packages and user-generated datasets, thereby allowing for customizable chart creation and detailed analysis. Our efforts focus on ensuring that the TimeScale Creator continues to support public engagement, education and scientific research with Earth's dynamic history.

Keywords:

Software; Geology; Vertically Integrated Projects; Data Visualization

Mentor(s):

James G Ogg (Purdue University); Aaron C Ault (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1422

Presentation Time: Session 3: 12:00-1:00pm

SLM Research for Computer Vision

STEM

Authors(s):

Alan Chi† (Engineering|JMHC)

Abstract:

Over the course of the semester, the goal of this research project was to be able to manipulate a Spatial Light Modulator to take an image and split it up into 9 different images at different brightness and use those different images to produce an HDR video through using image processing on the images. While the requirements that were set for the HDR were not fully met, the research team was capable of learning how to manipulate the SLM to produce 5 different images from a single picture using a diffraction grating as well as capturing that image on a camera.

Keywords:

Spatial Light Modulator; Computer Vision; Optics

Mentor(s):

Qi Guo (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1423

Presentation Time: Session 3: 12:00-1:00pm

Evaluating the Efficacy of Protein Arginine Methyltransferase (PRMT5) Inhibitor in Castration-Resistant Prostate Cancer (CRPC)

STEM

Authors(s):

Yoonjung Choi† (Agriculture|Engineering)

Abstract:

Prostate cancer continues to be the most common cancer in men despite advancements in early detection and treatment. Given its dependence on androgen receptor (AR) signaling for growth, androgen deprivation therapy (ADT) has been used as the standard care. Within 2-3 years of the treatment, however, 20% of ADT-treated patients develop castration-resistant prostate cancer (CRPC), a recurrent tumor that can persist at low levels of androgen. Protein arginine methyltransferase 5 (PRMT5) is positively correlated with the progression of CRPC by acting as an epigenetic regulator and reactivating AR transcription, making it an attractive target for CRPC. This project incorporates various biological assays to evaluate the efficacy of an in-lab synthesized PRMT5 inhibitor and demonstrate its potential as a therapeutic candidate for CRPC.

Keywords:

Prostate Cancer; CRPC; PRMT5; Biological Assays

Mentor(s):

Hye Seung Nam (Pharmacy); Rong Huang (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1424

Presentation Time: Session 3: 12:00-1:00pm

Powder Rheometer Model

STEM

Authors(s):

Seong Bin Choi† (Engineering)

Abstract:

Granular flow is a complex and poorly understood phenomenon with significant importance in industries that handle particulate materials such as pharmaceuticals, agricultural and food products, chemicals, and additive manufacturing powders. This work simulates a novel rheometer to relate velocity, bulk density, and stress in flowing granular materials. Granular material is sheared within an annulus created by a fixed outer cylinder and a rotating inner cylinder while the material flows downward through the annulus. The simulation predicts the torque required to rotate the inner cylinder, the mass flow rate through the device, and the particle velocity and bulk density fields. These quantities are simulated as the inner cylinder rotational speed, gap width, and particle properties are varied. The simulations are performed using the discrete element method (DEM) simulation algorithm in which the dynamics of each particle in the system are modeled. The objective of the work is to identify relationships between the applied stress and the particle velocity and bulk density fields to further development of continuum rheological models of granular materials.

Keywords:

[no keywords provided]

Mentor(s):

Carl R Wassgren (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1425

Presentation Time: Session 3: 12:00-1:00pm

Purdue Aerial Robotics Team - Competition Mechanisms

STEM

Authors(s):

Easton Ludeman Clark† (Engineering); Aidan P Pender† (Engineering); Yusif Shukurlu† (Engineering)

Abstract:

The Purdue Aerial Robotics Team is developing a small, autonomous aerial vehicle for the Student Unmanned Aerial Systems (SUAS) competition. As part of the Mechanisms subteam, we have designed a landing gear system and payload deployment mechanism to ensure the aircraft performs reliably during competition. The landing gear was engineered to manage worst-case landing scenarios, preventing deformation or collapse while minimizing the force transmitted to the fuselage. The front landing gear is constructed from an in-house aluminum plate that absorbs impact energy. At the same time, the rear landing gear incorporates a single fork design that also serves as the steering mechanism. A servo controls two wires connected to the rear wheel, allowing easy ground maneuverability. Additionally, the Mechanisms subteam designed a payload-dropping system integrated into the wings, allowing for quick and efficient assembly before competition flights. The system ensures that the payload is securely handled and delivered to the designated target, while following all competition guidelines. Lastly, mechanisms have created a payload capsule to safely and securely deliver the payload to the desired target within a safe velocity using a parachute. This semester, there has been a focus on manufacturing and testing. Mechanisms have been 3D-printed, laser cutting, and CNCing parts for each mechanism component. Also, there has been testing with the payload to ensure the payload will hit the target with little to no damage. This design approach builds on past iterations by addressing landing gear performance and payload protection issues, ensuring optimal functionality and durability.

Keywords:

UAV Development; Payload Delivery; Additive Manufacturing; Prototyping

Mentor(s):

Niall Patrick Moloney (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1426

Presentation Time: Session 3: 12:00-1:00pm

Optimization of Composite Patch Repairs for Steel Bridge Girders

STEM

Authors(s):

Doren M Cohen† (Engineering); Chang Su† (Polytechnic)

Abstract:

There are hundreds of thousands of bridges across the United States that require intense maintenance and care. Many of these bridges use steel beams and girders as a method of support and can suffer from severe corrosion over time. Typical repairs of such damage can include completely replacing damaged beams and are typically extremely intrusive and costly. Composite materials have recently gained attention in the construction industry due to their high strength and easier application. The goal of this project is to use composite materials and the properties of fiber orientation to create composite patch repairs that would severely decrease the cost and time it takes to repair damaged steel bridges. Tensile and shear test specimens were made using a wet epoxy layup of Glass Fiber fiber-reinforced Polymer plies, cut to conform to ASTM standards. These samples will be tested using Digital Image Correlation (DIC) to capture the deformation within the tests and determine material properties. These properties include the Tensile Chord Modulus of Elasticity, Poisson's ratio, and Shear Chord Modulus of Elasticity. With the analyzed data, the investigation can examine how the fiber orientation of composite patches on steel girders can enhance the overall repair efficacy for steel bridges. From these results, it will be determined what scale of application may be feasible with the given material and properties. This research has potential implications across the US as countless bridges every year face issues with corrosion and could save thousands of tax dollars with this new, cost-effective method of repair.

Keywords:

Glass Fiber Fiber-Reinforced Polymer; Composite; Steel Bridge Repair; Tensile; Shear

Mentor(s):

Garam Kim (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1427

Presentation Time: Session 3: 12:00-1:00pm

Investigation of a mechano-bioreactor on chemical and mechanical properties of a three-dimensional articular cartilage model

STEM

Authors(s):

Aaron Coppeta† (Engineering)

Abstract:

The purpose of this study is to characterize a mechano-bioreactor that mimics the environment chondrocytes inhabit in articular cartilage by introducing dynamic mechanical loading. A tunable mechano-bioreactor dynamically loads chondrocyte-laden hydrogels, which replicate native mechanical stresses, while seeding chondrocytes in hydrogels enhances mimicry and scalability. The three-dimensional extracellular environment of the chondrocytes will be modeled using a hydrogel composed of collagen type I with 4% agarose and stiffness matched agarose gels. Collagen type I provides integrin binding sites, while agarose provides similar viscoelasticity to the pericellular matrix. Bovine chondrocytes will be isolated and seeded at 150,000 cells per hydrogel, into 4% agarose/2 mg/mL collagen I hydrogels and agarose hydrogels, then cultured in a standard 24-well plate. These hydrogels are cyclically compressed at 1 Hz, following a cycle of 1-hour loading, 1-hour rest, and another hour of loading, repeated daily in a custom mechano-bioreactor and cultured for 1, 3, 7, 14, and 21 days. To characterize the constructs, dimethylmethylene blue (DMMB) assay will be used to measure sulfated glycosaminoglycan content. A stress relaxation test to 10% compressive strain will be conducted, and experimental data will be fit to a viscoelastic constitutive equation to estimate mechanical properties. These data will be compared to baseline (0 days) and used to determine the effects collagen I has upon loading in cyclically loaded hydrogels for mechanotransduction studies. Ultimately, these results can deepen our understanding of chondrocyte behavior in response to cyclic mechanical loading in a three-dimensional environment similar to native cartilage.

Keywords:

Chondrocyte; Agarose; Bioreactor; Hydrogel; Mechanotransduction

Mentor(s):

Deva Chan (Purdue University); Hong-Anh Alexandria Nguyen (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1428

Presentation Time: Session 3: 12:00-1:00pm

Neanderthal d15N Values are Not Exceptionally High for Hominins: A Holocene Comparison

STEM

Authors(s):

Ellie Lane Coppola† (Exploratory Studies|JMHC|Other); Mackenzie Grace Roche* (Science|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Nitrogen Isotopes; Neanderthals; Paleodiet Reconstruction; Hypercarnivory

Mentor(s):

Melanie M. Beasley (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1429

Presentation Time: Session 3: 12:00-1:00pm

Assessment of Bone Mechanical Properties via UTE-MRI Based on Measure of Bound Water

STEM

Authors(s):

Braden James Cordrey† (Engineering); Grant Andrew Belush‡ (Engineering|JMHC)

Abstract:

Various conditions contribute to an increased risk of osteoporotic fracture including aging and menopause (1, 2). The current industry standard for assessing fracture risk is measuring Bone Mineral Density (BMD) using dual-energy X-ray absorptiometry scans (DXA). However, DXA can overestimate BMD 97-100% of the time compared to computed tomography scans (CT-Scan) (5). A particularly new solution to detect bone health changes is the use of Ultra-Short Echo Time Magnetic Resonance Imaging (UTE-MRI). The UTE-MRI allows us to assess the bound water content of bone due to its ability to eliminate the time between signal excitation and acquisition (6). DXA scans are currently unable to detect collagen and water content which makes up approximately 60% of bone by volume (7). A UTE-MRI can give us information about both the water content and collagen organization of bone but struggles in terms of resolution, but a CT scan can make up for the low resolution. So, we will combine the UTE-MRI and Micro CT scans by registering the images in Matlab while focusing on the fibular tibial junction. Then we will measure bone mechanical properties through the three-point bending test (4). The UTE-MRI will allow us to calculate the bound water index in bone and we expect to find that the bone water index plays a significant role in terms of bone mechanical properties (8). The registrations produced in this project will then be used to develop more comprehensive FEA models that incorporate the bone water index to better predict mechanical deficits in bone.

Keywords:

Bone Mechanical Properties; Bound Water Content

Mentor(s):

Peter Asiwaju Olayooye (Engineering); Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1430

Presentation Time: Session 3: 12:00-1:00pm

Wildfire Impact on Air Quality: A Case Study of Isle Royale, Michigan in 2023

STEM

Authors(s):

Kerstin Ariel Cox† (Science); Parth Thakre‡ (Science|Graduate)

Abstract:

Wildfires have become more intense in recent years, driven by a combination of factors such as hotter and drier conditions. According to the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report, climate change has significantly increased these conditions, raising the global risk of wildfires. While wildfire research primarily focuses on the Western United States, the Midwest remains understudied despite rising smoke exposure and health risks. We analyzed long-term ground-based particulate matter observations from national parks across the Midwest to understand these impacts better. Early in our study, we observed significant peaks at Isle Royale, a remote location in Michigan, in June 2023, a year that witnessed extensive wildfires in Canada. Our findings indicate that wildfire-related pollutants, including organic carbon, potassium, phosphorus, and fine particulate matter, rose significantly in June 2023 compared to other recent wildfire-impacted years. Long-term trends show an overall decline in these pollutants since 1989 due to the 1990 Clean Air Act, yet recent data reveal extreme spikes, especially in the summer months, that suggest a shift in this trend. This shift in the air quality trend showcases the need for further research and more vigorous mitigation efforts.

Keywords:

Air Quality; Wildfires; Atmospheric Aerosols; Climate Change; Climate Extremes

Mentor(s):

Gouri Gouri Prabhakar (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1431

Presentation Time: Session 3: 12:00-1:00pm

Process Intensification for Synthesis and Purification of Oncology Drugs

STEM

Authors(s):

Attila Tamas Csathy† (Engineering); Fiona Jene Wehrle* (Engineering); Murat Ekin Agca* (Engineering|JMHC)

Abstract:

Continuous manufacturing is transforming pharmaceutical production, shifting from large-scale batch processing to small-scale modular systems. The COVID-19 pandemic highlighted the need for small-scale manufacturing near raw material sources (Sharma et al., 2020). Advancements in small-scale development have allowed for the integration of various unit operations like reaction, extraction, and crystallization for purification and polymorphic control, offering improved efficiency, safety, adaptability to the industry in the form of end-to-end manufacturing (Nagy et al., 2021). This work explores modular manufacturing for chemotherapy drugs with process intensification. The mini pharm setup that was developed, implemented, and demonstrated on high-value, low-demand drugs, Lomustine and Imatinib Mesylate.

Lomustine, a chemotherapy drug, affected by monopoly induced price gauging, was successfully manufactured in the mini-pharm platform through process intensification. A two-step synthesis and solvent switch distillation were utilized. Gas chromatography-mass spectrometer was used to analyze the distillation samples. Lomustine was purified via continuous combined cooling and antisolvent crystallization.

For Imatinib Mesylate, three key studies were conducted: solvent screening and solubility, precipitation reactions, and polymorphic crystallization. Solubility experiments identified a suitable solvent. Precipitation reactions produced the metastable form of Imatinib Mesylate. Polymorphic transformation experiments to isolate the stable form of the compound. Stable Imatinib Mesylate was produced via continuous cooling crystallization and verified with analytical technology tools and powder X-ray diffraction.

This study demonstrates the feasibility and advantages of small-scale modular manufacturing for Lomustine and Imatinib Mesylate, highlighting end-to-end continuous manufacturing improvements, even for hazardous

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

anti-cancer drugs. It offers valuable insights for advancing pharmaceutical manufacturing through process intensification.

Keywords:
End-to-End Drug Manufacturing; Polymorphism; Modular Manufacturing

Mentor(s):
Zoltan Nagy (Purdue University); Ilke Akturk (Engineering); Hemalatha Kilari (Purdue University)

Other Acknowledgement(s):
Giulia Murbach De Oliveira (Science)

Poster Presentation Abstract Number: 1432

Presentation Time: Session 3: 12:00-1:00pm

Measuring the Ligand Exchange Kinetics of Metal Chalcogenide Clusters

STEM

Authors(s):

Ronald Anton Cutler† (Science)

Abstract:

Metal chalcogenide clusters are assemblies composed of a metal and a group 16 chalcogen element, ranging in size from atomic to microscopic scales. These clusters have a range of applications used in energy conversion, catalysis, and semiconducting materials. Metal chalcogenide clusters bind to ligands to stabilize their structure. The choice of stabilizing ligands significantly influences the cluster's electronic structure and reactivity, making ligand selection an important step toward synthesizing clusters with desired properties. However, synthesizing these clusters with certain ligands can be challenging. An alternative approach involves ligand exchange in pre-formed clusters, where a new ligand is added into the solution and substitutes for the original ligand in the cluster. This synthesis strategy is ideally suited for clusters that are challenging to synthesize by traditional methods but requires knowledge of how the cluster will exchange the ligands. In order to better understand and utilize the ligand exchange method for synthesizing metal chalcogenide clusters, the kinetics of this process need to be investigated. In this study, we investigated this exchange process using an over-pressured system coupled with electrospray ionization mass spectrometry (ESI-MS). We examined the ligand exchange kinetics of Co6S8(PPh3)6 cluster complexes with triethylphosphine ligand (PEt3). The results of these experiments provide insights into the kinetics of the ligand exchange process, which will enhance our understanding of the properties of metal chalcogenide clusters and facilitate future applications.

Keywords:

Mass Spectrometry; Metal Chalcogenides; Reaction Kinetics; Metal Cluster Complexes

Mentor(s):

Julia Laskin (Purdue University); Bethany Ana Phillips (Science)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1433

Presentation Time: Session 3: 12:00-1:00pm

Optimization of an Origami Shaped Antenna Reflector to Maximize Uniform Coverage and Energy Containment For One-to-Many Communication

STEM

Authors(s):

Jacob Daniel† (Engineering|JMHC); Prisha Rachakonda‡ (Polytechnic); Adina Ioana Margineantu‡ (Science); Sishir Mahavadi‡ (Engineering); Tanya Vijay‡ (Engineering)

Abstract:

Many companies and governments send communication satellites to geostationary orbit to receive and transmit signals. Most of these satellites use parabolic reflector antennas best suited to one-on-one communication due to their concentrated radiation pattern. However, these reflectors are not best suited for one-to-many communications where uniform coverage over a given area is desired. An active field of research solving this problem is the development of shaped antenna reflectors which use a non-parabolic reflector to generate more complex radiation patterns using only one antenna element unlike phased array antennas which use many antenna elements. One novel design being researched is an origami-inspired reflector that can fold and expand panels like a piece of paper to obtain many different surface geometries. This study focuses on the optimization of the reflector's shape given a desired coverage area. The antenna was modeled mathematically using a radial B-Spline distortion surface added to a paraboloid surface. A multi-objective global optimizer used the B-Spline surface's control points as design variables to optimize the radiation pattern for uniform coverage and energy containment. This optimization process is expected to greatly increase signal strength and reduce power requirements compared to traditional parabolic reflectors.

Keywords:

Origami; Shaped Reflector Antenna; Uniform Coverage; Global Optimization

Mentor(s):

Ran Dai (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1434

Presentation Time: Session 3: 12:00-1:00pm

Impact of Medullary Bone on the Fracture Toughness of Egg Laying Hens' Tibias

STEM

Authors(s):

Joshua Armstrong Davis† (Engineering)

Abstract:

This study is an investigation into the fracture toughness of the leg bones from egg laying hens. The specific aim is to determine the role of medullary bone on the fracture toughness of the tibia. Previously, medullary bone was considered to not contribute to bone strength. However, no direct conclusion about the influence of medullary bone on fracture toughness has been made. This is the first known study on a measurement of the contribution of medullary bone to bone fracture toughness of egg laying hens. A long bone fracture mechanics model is employed to compute fracture toughness of the leg bones from measurements of breaking forces of leg bones with a surface notch introduced as a saw cut. First, fracture toughness of tibia bone including medullary bone is measured. Then, medullary bone is manually removed from tibias and fracture toughness is measured. Differences in fracture toughness between the two groups is then interpreted as the contribution of medullary bone to fracture toughness. This will allow a decision to be made on whether the impact of medullary bone on the fracture toughness of egg laying hens is negligible.

Keywords:

Bone; Fracture; Avian; Egg Laying

Mentor(s):

Thomas H Siegmund (Purdue University)

Other Acknowledgement(s):

Glynn Ellen Gallaway (Engineering)

Poster Presentation Abstract Number: 1435

Presentation Time: Session 3: 12:00-1:00pm

Reinforced Learning Models for Modern Production

STEM

Authors(s):

Thiago Gabriel Di Si† (Polytechnic)

Abstract:

Modern production relies heavily on robotic tool path development, which often requires time-consuming manual programming, optimization, and testing. Human error is prevalent in these positions, which may compromise industrial operations' precision and effectiveness. Attempts to automate robotic systems for improved accuracy and flexibility in dynamic manufacturing environments have been driven by the need to decrease human error and manual inefficiency. Although a number of automation approaches, such as machine learning and conventional algorithms, have been studied in the past, little is known about how reinforcement learning might be used to automate tool path development. This research aims to develop an AI-powered system that uses reinforcement learning to automate robotic tool path creation. The primary goal is to design a simulation environment capable of generating robot movements, training reinforcement learning models, and applying these models to produce adaptive robot motions that can respond to different conditions in manufacturing. It is hypothesized that this approach will improve the effectiveness and adaptability of robotic systems, enabling them to autonomously adjust their behavior based on learned experiences. Ultimately, the system aims to enhance the accuracy and productivity of industrial processes while reducing the risk of errors and human intervention.

Keywords:

Reinforced Learning; AI; Manufacturing; Robotics; Robotic Systems

Mentor(s):

Yu She (Purdue University); Jaeeun Kim (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1436

Presentation Time: Session 3: 12:00-1:00pm

The Transgender Avatar: Self-Perception in Video Game Character Creation

Humanities

Authors(s):

Emily Hannah Duong† (HHS|JMHC)

Abstract:

Transgender people often utilize video games as a way to explore themselves in a safe, low-stakes environment. Many transgender adults have used character creation in video games to experiment with gender identity and presentation (Constantine). However, little research exists that focuses specifically on the use of avatar creation features in relation to identity (Morgan et al.). In this exploratory research project, I investigate the impact of avatar customization features on transgender gamers' perception and exploration of their identities, gender and otherwise. I conducted a literature review which includes personal statements by transgender individuals that have used game avatars to reflect how they feel internally and studies conducted with transgender teenagers on their experiences with gaming and gender identity. Then, I analyzed how they used the creation features of different games, especially in games that place emphasis on customization, and the effects that these choices had. I also interviewed transgender gamers in the Splatoon 3 competitive community about their game avatars and self-discovery journeys. This research highlights the importance of video games in creating a space allowing for transgender people to create true representations of themselves and contributes to the discussion on how to build avatar customization to provide this valuable environment.

Keywords:

Transgender; Video Games; Gender Identity; Gaming

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1437

Presentation Time: Session 3: 12:00-1:00pm

Do parents

Social Science

Authors(s):

Divya Tarika Durai† (HHS); Maggie Brinn Miller† (HHS)

Abstract:

Research suggests that the frequency of parents' engagement in early math activities predicts young children's future math achievement (Daucourt et al., 2021). However, parents' negative feelings towards math, shaped by their own learning experience and math anxiety, can decrease their involvement in home math activities (Carkoglu et al., 2023; Cannon et al., 2008; O'Toole et al., 2005). We investigated how parents' negative feelings about math are associated with how often they engage in math-based activities with their preschoolers. Parents (N=577) of children aged 3-5 in the United States participated in a Prolific survey. They rated their agreement with statements about their past and general experience with math (e.g., "I never liked math in school." And "doing math makes me uneasy or nervous.") on a 5-point scale. Additionally, parents reported how often they engage in math-based activities (e.g., talk about math, play math games, and use math worksheets) with their preschoolers on a 6-point scale, with 1 representing never and 6 representing every day. We hypothesized a significant negative correlation between parents' negative feelings about math and the frequency of parent-child math interaction. Preliminary analysis supported this hypothesis ($r = -.28$, $p < .001$). Our final analysis will compare parents' feelings about math and their engagement in specific types of math-based activities with their children. The research provides insights into risk factors affecting children's early math experience and future math outcomes.

Keywords:

Math Experience; Parent-Child Interaction; Math-Based Activity; Early Childhood

Mentor(s):

Siqi Zhang (HHS); Suzanne Christine Varnell (HHS); Salvador Roberto Vazquez (Purdue University); Sarah Eason (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1438

Presentation Time: Session 3: 12:00-1:00pm

Wearable Device Design for Autonomic Dysreflexia Detection Using Skin Sympathetic Nerve Activity Collection

STEM

Authors(s):

Reed Stevens Elphingstone† (Engineering)

Abstract:

Autonomic Dysreflexia (AD) is a potentially life-threatening condition that can occur in up to 70% of people with spinal cord injuries at or above T6. AD is an overreaction of the sympathetic nervous system (SNS), which coordinates the body's fight-or-flight response. AD is caused by a stimulus below the line of injury which the body perceives as noxious, leading to dangerously high blood pressure. Patients identify AD using symptoms such as nausea, sweating, and a change in heart rate. These symptoms will continue to increase in severity until the stimulus is removed, thus detection of these episodes is critical. Skin Sympathetic Nerve Activity (SKNA) is a non-invasive method to measure the activity of the SNS on the skin using surface electrodes. The objective of this study is to develop a comfortable wearable device capable of collecting SKNA signals, used in an AD detection algorithm. SKNA is collected by filtering ECG from 500 – 1000 Hz. SKNA is a low amplitude signal, so signal-to-noise ratios (SNR) will be measured in different electrode arrangements. Five participants will perform different types of motion at different intensities and measure SNR. Based on the SNR data, we will compare arrangements to determine the ideal electrode configuration. In summary, this wearable device design will use surface electrodes to collect SKNA signals necessary to help patients proactively identify events of AD in real time.

Keywords:

Autonomic Dysreflexia; Skin Sympathetic Nerve Activity; Wearable Device; Signal-to-Noise Ratio; Surface Electrode

Mentor(s):

Molly Noelle Dye (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1439

Presentation Time: Session 3: 12:00-1:00pm

The Effects of Induced Hypothyroidism on Intestinal Morphology in Nursery Pigs

STEM

Authors(s):

Samantha Teal Fairchild† (Agriculture)

Abstract:

The hypothalamic-pituitary-thyroid/adrenal (HPTA) axis regulates basal metabolism. Disruptions like hypothyroidism can also slow metabolism, impair digestion, and affect nutrient absorption. In humans, conditions such as Hashimoto's thyroiditis and iodine deficiency-induced hypothyroid have been observed to affect metabolic function, leading to constipation and slowed growth in children. However, few previous studies have examined the physiological effects of hypothyroidism on gastrointestinal function and structure. Given the physiological similarities between pigs and humans, this study examined methimazole-induced hypothyroidism in nursery pigs as a biomedical model. We hypothesize that hypothyroidism will lead to significant morphological changes in the small intestine, including reduced villi height and increased crypt depth, indicating impaired intestinal function. A total of 27 weaned pigs (14 treated, 13 control) were used across two replicates (N=11, N=16). Pigs were acclimated for one week before receiving methimazole treatment (10 mg/kg/day) for three weeks to induce hypothyroidism. After euthanasia, intestinal samples from the ileum, jejunum, and duodenum were collected, formalin-fixed, paraffin-embedded, sectioned and stained with alcian blue and nuclear fast red. Tissue sections were imaged at 10x magnification and analyzed using a custom analysis pipeline, with statistical analyses carried out in R. Preliminary analysis indicates no significant differences in villi height or crypt depth of the ileum between treated and control pigs. Further analysis is needed to determine whether more severe hypothyroidism affects intestinal morphology. Ongoing research will enhance our understanding of hypothyroidism's impact on intestinal structure. These findings may provide insights into how thyroid dysfunction influences gut health in both pigs and humans.

Keywords:

[no keywords provided]

Mentor(s):

Jonathan Pasternak (Purdue University); Isabel Turner (Agriculture)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1440

Presentation Time: Session 3: 12:00-1:00pm

Automated Skin Layer Segmentation in Histology Images: A Comparative Analysis of Deep Learning Methods

STEM

Authors(s):

Mikyla Farnell† (Science|JMHC); Kelly Hsieh Lin† (Engineering); Somya Gupta† (Engineering|JMHC)

Abstract:

Skin layer identification offers valuable insights for various applications, including cancer diagnosis, transdermal drug delivery, and wound healing assessment. However, manually segmenting and annotating histology images is time-consuming, and there is limited research on automating the process. Therefore, this project aims to evaluate three different existing deep-learning based algorithms–Segment Anything in Medical Images (MedSAM), HistoSegNet, and Xception–for segmenting the epidermis, dermis, and subcutaneous layers in skin tissue samples. We will apply MedSAM and HistoSegNet directly to our eight porcine tissue samples, since the lack of ground truth annotations and the small sample size prevents us from fine-tuning the models. Xception will be used to extract high-level features from the tissue samples and then apply k-means clustering to group similar tissue regions. The outputs of these models will be compared to the segmentation method outlined in "Automated Layer Identification Method for Skin Tissue Histology Images," published by Biomedical Engineering Society, using Intersection over Union and the Dice Similarity Coefficient. By comparing these algorithms' accuracy and efficiency in terms of processing time, we look to ultimately identify the most effective method for automating skin layer segmentation and tissue annotations.

Keywords:

Automated Tissue Annotation; Convolutional Neural Networks (CNN); Skin Layer Segmentation; HistoSegNet; Segment Anything in Medical Images

Mentor(s):

Brett A Meyers (Purdue University); Reza Babakhani Galangashi (Engineering); Pavlos Vlachos (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1441

Presentation Time: Session 3: 12:00-1:00pm

ChainVisor: analyzing the security posture of IoT device software

STEM

Authors(s):

Daniyal Fazal† (Engineering); Parth Doshi† (Engineering); Jayden Chun-Hin Chow† (DSB|JMHC); Geuntae Kim† (Engineering|JMHC); Harmon Howse† (DSB|JMHC); Daniel Jonathon Proano† (Science)

Abstract:

As Internet of Things (IoT) devices have become increasingly prevalent, it becomes important to consider the security of the underlying technology. Our research intends to evaluate the security of various IoT devices and make clear the implications of the flaws in these systems. By analyzing the firmware, hardware, and user-facing applications of said devices, we gain a better understanding of the IoT ecosystem as a whole. The focus of ChainVisor's methodology is on identifying vulnerabilities in the IoT architecture at various levels, such as software misconfigurations, memory unsafety, and poorly implemented network protocols. This thorough analysis helps to secure existing IoT deployments and offers a framework for manufacturers to enhance future device design, reducing the risk of data breaches and unauthorized access.

Keywords:

[no keywords provided]

Mentor(s):

Santiago Torres Arias (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1442

Presentation Time: Session 3: 12:00-1:00pm

Predicting NCAA Bracket Champions with Data-Driven Insights

Business Case Study

Authors(s):

Maura K Flood† (DSB); Mackenzie Elizabeth Arnish† (DSB); Nicholas Patrick Zebell† (DSB); Haley Grace Henson† (DSB); Olivia Francis Hojnicki† (DSB)

Abstract:

Every March, millions of college basketball fans participate in the time-honored tradition of filling out NCAA Division I Basketball Championship brackets. While these brackets are often viewed as mere predictions of game outcomes, they also offer a rich source of insight into team loyalties and decision-making processes for the NCAA. This project aims to predict the semifinal winners from the East/West and South/Midwest regions, as well as the overall national champion for each bracket in the test set based on participants' demographic attributes, historical bracket behaviors, and team preferences. Understanding fan behavior and identifying influential factors behind their bracket selections offers valuable insights for the NCAA to engage fans, devise successful marketing strategies, and provide impactful data to those who sponsor the March Madness tournament.

Our methodology combines rigorous data preparation, feature engineering, and machine learning techniques. We trained and used cross-validation to compare multiple models, including logistic regression, random forest, and XGBoost, focusing on accuracy and interpretability. Key performance metrics such as accuracy, F1-score, and confusion matrices ensured a balanced assessment of model performance. The optimal model to be selected will be the one with the lowest cross validation misclassification error.

Our expected results based on an initial analysis are that factors like school loyalty, past performance, and regional trends strongly influence bracket choices. These insights can help personalize fan experiences, refine marketing strategies, and improve decision-making for the NCAA.

Keywords:

Bracket Prediction; Fan Behavior; Machine Learning; March Madness; Marketing Analytics

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1443

Presentation Time: Session 3: 12:00-1:00pm

Beyond the Bracket: Data-Driven Predictions of March Madness Selection Patterns

Business Case Study

Authors(s):

Alyssa A Forester† (DSB); Sophia Ling‡ (DSB); Isabella Chiara Lagioia‡ (DSB); Zainab Waheed‡ (DSB); Aadi Agrawal‡ (DSB)

Abstract:

This project aims to predict trends in March Madness bracket selections by analyzing fan behaviors, biases, and historical performance. The primary goal is to identify patterns such as the overvaluation of high-seeded teams, favoritism toward underdogs, and the influence of school affinity on bracket choices. Understanding these trends is valuable for businesses targeting NCAA audiences, including advertisers, streaming platforms, and merchandise retailers, by enabling more effective market segmentation and engagement strategies.

To achieve this, we utilize a dataset provided by CCAC, consisting of demographic information, bracket selections, and historical tournament outcomes. The data preparation process involves cleaning and validating entries, handling missing values, and engineering features that capture factors like historical performance, seed rankings, and affinity-based selections. Analytical methods include logistic regression to model selection probabilities, decision trees to explore influential factors, and K-Means clustering to segment fans based on bracket behavior. Model evaluation metrics such as accuracy score, F1-score, log loss, and mean squared error will be used to ensure predictive robustness.

Preliminary findings suggest that fan bias plays a significant role in bracket selection, with a tendency to favor local teams or higher seeds despite historical trends. This study's insights can inform marketing strategies, improve predictive models for sports analytics, and help businesses optimize engagement during March Madness. By leveraging predictive analytics, companies can refine targeted advertising, enhance streaming recommendations, and develop more strategic merchandising efforts, ultimately improving customer retention and revenue generation in the sports industry.

Keywords:

Bracketology; Fan Bias; Predictive Analytics; Market Segmentation; Sports Marketing

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1444

Presentation Time: Session 3: 12:00-1:00pm

Wings in Motion: Geometric Patterns of Swarming and Non-swarming Mosquitoes

STEM

Authors(s):

Rachel Fortman† (Science)

Abstract:

Flight behavior in mosquitoes varies across species based on their natural history with some engaging in complex coordinated swarming behaviors while others exhibit more solitary erratic flight patterns. These differences are likely underlined by morphological adaptations in their wings and flight stabilizers—halteres. This study aims to investigate the morphological underpinnings of these differences by analyzing the wing geometry and haltere structure across swarming and non-swarming mosquito species. We hypothesize that the wing morphology of swarming mosquitoes has been under selective pressures to facilitate coordinated, group flight, while non-swarming mosquitoes have wing structures optimized for stable, solitary flight. To test this hypothesis, we conducted comparative analyses of wing shape, size, and structural features across 10 mosquito species exhibiting both behaviors. Additionally, we investigated the role of halteres, a trait unique to flies, in stabilizing flight in both groups. We predict that swarming mosquitoes have wings with unique features that enhance maneuverability during swarm formation. In contrast, non-swarming mosquitoes are predicted to exhibit wing shapes optimized for solitary flight. This research contributes to deepening our understanding of how morphological adaptations in mosquito wings and halteres facilitate complex flying behaviors, paving the way for future investigations into mosquito flight aerodynamics and providing insights into the evolution of insect flight mechanics.

Keywords:

Halteres; Flight; Morphometrics; Aerodynamics; Behavior

Mentor(s):

Ximena Bernal (Purdue University); Richa Singh (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1445

Presentation Time: Session 3: 12:00-1:00pm

KanKan Theater Business Case Study

Business Case Study

Authors(s):

Robert Louis Fruchey† (DSB); William V. Mehra† (DSB); Henry Jack Love† (DSB); Simon Joseph Denny† (DSB)

Abstract:

This research case study examines the marketing strategies of a local theater in Indianapolis, focusing on identifying the key demographic and behavioral characteristics of its audience to increase attendance and revenue. The study analyzes the theater's current marketing efforts, including social media presence, website functionality, and customer satisfaction. Additionally, the research aims to gather primary data on customers' willingness to pay and provide pricing recommendations based on these insights. By exploring these factors, the study seeks to define target market segments and develop tailored marketing strategies to improve customer engagement and boost ticket sales. Methods include secondary data analysis using consumer segmentation tools and primary data collected through surveys conducted at screenings.

Keywords:

Pricing Strategy; Marketing Strategy; Customer Segmentation

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1447

Presentation Time: Session 3: 12:00-1:00pm

Exploration of IL-27 Gene Therapy in the Treatment of Acute Respiratory Distress Syndrome (ARDS)

STEM

Authors(s):

Viviana Galindo† (Science)

Abstract:

Acute Respiratory Distress Syndrome (ARDS) is a severe pulmonary condition marked by excessive alveolar fluid accumulation, leading to impaired gas exchange and respiratory failure. The increasing prevalence of respiratory illnesses like COVID-19, along with rising sepsis and pneumonia cases, has heightened ARDS risk. Despite its significant clinical impact, ARDS remains underrecognized, with historically high U.S. mortality rates (~20-40%).

Current treatments rely on mechanical ventilation, which provides symptomatic relief but does not address the underlying pathology. A key feature of ARDS is immune dysregulation, with elevated pro-inflammatory cytokines (IL-8, IL-1, IL-17) exacerbating disease progression.

This study explores the therapeutic potential of Interleukin-27 (IL-27), an anti-inflammatory and tissue-reparative cytokine, as an immune modulator in ARDS. We hypothesize that human adipose stromal cells (hASC) genetically modified to express IL-27 can mitigate inflammation and restore cytokine balance in the lung microenvironment. Our in vitro results show that IL-27 hASC-conditioned media downregulates pro-inflammatory cytokines in LPS-induced lung epithelial (A549, BEAS-2B) and monocyte (THP-1) cell lines.

To validate these findings, we are employing an in vivo LPS-induced ARDS model and using RNAseq-based immune modeling to assess IL-27's effects on cytokine networks. Kaplan-Meier survival analysis will evaluate IL-27 hASC's therapeutic efficacy. By integrating experimental and computational approaches, this research aims to develop novel ARDS therapies, addressing a critical unmet need.

Keywords:

Gene Therapy; ARDS; Cytokines; Immunotherapy

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
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Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1448

Presentation Time: Session 3: 12:00-1:00pm

ExamBoost: A Data-Driven Approach to Improve Student Exam Outcomes

Business Case Study

Authors(s):

Riley Clare Garrison† (DSB|JMHC); Sreeya Thirunagari† (DSB|JMHC); James Graeme Tolland† (DSB); Lucas Hunter Spence† (DSB); Destinee Walker† (DSB|JMHC)

Abstract:

This research provides a data-driven tool called ExamBoost that predicts student exam success based on controllable and uncontrollable factors, and provides guidance via optimization modeling in how changing controllable behavior could lead to the greatest incremental change in exam performance. The motivation for this research is that the authors are themselves students and would like to know how to optimally change certain controllable decisions to boost exam performance, based on our individual and unique resource constraints. Our decision support tool could help students create a data-supported strategy to optimize their performance in classes, or help their instructors best steward them toward success. Our tool was developed using R-shiny, which helps bring the the analytics and graphics capabilities of R to life for analytics professionals and their end-users.

Keywords:

Student Success; Prediction; Optimization; R-Shiny

Mentor(s):

Matthew Lanham (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1449

Presentation Time: Session 3: 12:00-1:00pm

"He's Like FBI But Not": Exploring Humor and Aggression in Vigilante Legitimacy

STEM

Authors(s):

Doetri Ghosh† (Polytechnic); Madhu Joshi‡ (Polytechnic)

Abstract:

Online financial scams are ever increasing, ranging from phishing emails to phone call impersonations. In response, a growing community of online vigilantes known as "scambaiters" have begun to confront scammers online and spread awareness about the threats they pose. Many of these individuals have become prominent online figures by sharing their work through YouTube videos or Reddit discussion posts. These individuals attract a large audience with their unique behaviors and approaches, which range from humorous pranks to damaging scammers' digital assets. While some prior research exists on general public perceptions of scambaiters, little research has delved deep into how differences in presentation of the scambait shape viewer attitudes. Our study addresses this gap by exploring how scambaits framed as either humorous or aggressive influence perceptions of legitimacy and acceptability. We conduct a content analysis of discussions on scambait-focused subreddits to explore how variations in tone affect audience reception.

Keywords:

Financial Scams; Online Vigilantes; Scambaiters; Public Perceptions

Mentor(s):

Tatiana Ringenberg (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1450

Presentation Time: Session 3: 12:00-1:00pm

An In-depth Look of Different Phase Locked Loop Topologies

STEM

Authors(s):

Thomas Allen Greer† (Engineering); Erik Kocinare† (Engineering); Chao Min Chung† (Engineering)

Abstract:

The Phase Locked Loop, more commonly known as the PLL, is one of the most important components in modern day mixed signal systems. The goal of PLLs is to match a reference clock in phase and signal, ensuring that no timing errors propagate throughout the system. The SoCET team requires a variable output PLL for the AFTx07, a RISC-V based CPU, ranging from 25-200 MHz to act as the main system clock. Some of the building blocks of the PLL include a PFD (Phase Frequency Detector), a charge pump with low pass filter, and a VCO (Voltage Controlled Oscillator). The two most critical analog blocks of the system are the charge pump and the VCO. These two blocks have countless different structures with different tradeoffs such as speed, gain, and power consumption. We observe 3 different topologies of VCOs and 2 different topologies of charge pumps after doing an extensive literature review. We simulate these different circuits in Cadence Spectre and compare the results in order to determine the best topologies for our system.

Keywords:

[no keywords provided]

Mentor(s):

Archana Dharanipragada (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1451

Presentation Time: Session 3: 12:00-1:00pm

Design, Manufacturing and Testing of Thermoplastic Composite Rivets

STEM

Authors(s):

Arda Gunduz† (Engineering); Sean Angillo Mitchell† (Polytechnic)

Abstract:

This research focuses on design, fabrication and testing of thermoplastic composite rivets, aiming to solve issues caused by conventional alloy rivets and provide an alternative solution. In modern aircraft manufacturing, carbon composites have become an essential part of our aircrafts. However while the carbon composites started creating the structures for our aircraft, the fasteners assembling these structures remained made from metals like aluminum or titanium, which were prone to galvanic corrosion, conducted electricity towards the inside of the event of a lightning strike and were weighed significantly. While adhesives are commonly used for bonding composite laminates, their structural strength is often lower than that of mechanical fasteners. Thermoplastic composite rivets offer a unique approach by combining mechanical fastening with lightweight characteristics, enhancing the bonding strength without significantly increasing the overall weight of the assembly. To search for an appropriate replacement for metal rivets, we designed and manufactured composite rivets. We tested the rivets we developed via various application types (induction and ultrasonic bonding) and combination with adhesive supporting connections. The results we gathered showed us the strength and failure characteristics of our rivet design, effects of different application types and the possibility of thermoplastic composite rivets replacing metal rivets.

Keywords:

Composites; Thermoplastic; Fastners; Design; Mechanical Properties

Mentor(s):

Garam Kim (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1452

Presentation Time: Session 3: 12:00-1:00pm

Design and Optimization of a Fully Differential Gilbert Cell Mixer for 2.4 GHz Direct Conversion Wi-Fi RF Receivers

STEM

Authors(s):

Youssef Nagah Haider† (Engineering); Abdelrahman Osama Khalid† (Engineering)

Abstract:

This project presents the design and optimization of a fully differential Gilbert Cell mixer for a direct conversion Wi-Fi RF receiver operating in the 2.4 GHz band. The mixer is a critical component in achieving high-performance signal down-conversion while maintaining low power consumption, making it suitable for energy-efficient applications such as IoT devices and mobile phones. The design targets a conversion gain of approximately 8 dB, ensuring robust signal reception and minimizing the need for additional amplification stages. Key challenges include achieving high linearity, low noise figure (NF), and effective suppression of local oscillator (LO) leakage and image frequency interference. Advanced simulation tools are employed to optimize the mixer's performance, focusing on trade-offs between gain, noise, and power consumption. The proposed design leverages the inherent advantages of the Gilbert Cell architecture, such as excellent balance and common-mode rejection, to enhance overall receiver performance. This work aims to contribute to the development of compact, low-power RF receivers for next-generation wireless communication systems, with a focus on meeting the stringent requirements of modern Wi-Fi standards.

Keywords:

Mixer; Gilbert Cell; Receiver; 2.4 GHz

Mentor(s):

Swapnil Bansal (Engineering); Archana Dharanipragada (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1453

Presentation Time: Session 3: 12:00-1:00pm

Comparative Analysis of Bioinformatic Programs for Bacteriophage Protein Structure and Function Homology

STEM

Authors(s):

Ash Hallissey† (Pharmacy); Joshua Edward Sheldon† (Agriculture); Ekagrah Kumar† (Agriculture|Engineering); Sara Thomason† (Agriculture|JMHC)

Abstract:

Various bioinformatics tools are utilized to predict the structure and function of bacteriophage genes. Programs like HHPred utilize Hidden Markov Models (HHMs) to compare protein sequences with known functions, while artificial intelligence platforms such as AlphaFold leverage the expanding protein data bank (PDB) to predict protein structures. This study aims to compare the efficacy of HHPred and AlphaFold in predicting protein function and structure using the novel phage AdaS. The research methodology involved analyzing 10 genes from AdaS into both programs: 5 highly conserved genes with known functions, and 5 low-conservation genes with unknown functions. To strengthen the evidence surrounding the accuracy of conservation among similar phage genes, five genes from Skitty, a novel Arthrobacter phage, with similar base pair sections were analyzed. Results suggest that HHPred is a useful tool for comparing less conserved proteins to a library database, however, the top result will not produce proteins identical to the input. AlphaFold is far more useful for predicting the quaternary protein structure, though it lacks the predictive feature of protein functions. Future results should explore additional protein mapping programs beyond HHPred and AlphaFold to generate more accurate data and effective protein models. This approach would contribute to a more comprehensive understanding of bacteriophage gene structure and function prediction.

Keywords:

Bacteriophage; Gene Conservation; Bioinformatics Tools; Protein Function; Quaternary Protein Structure

Mentor(s):

Kari L Clase (Purdue University); Julia Ann Simler (Agriculture); Opeyemi Samuel Oduniyi (Agriculture); Marcelo Inaki I Guerrero Montalvan (Agriculture)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1454

Presentation Time: Session 3: 12:00-1:00pm

Homeowner Well-Being and Community Livability: A Comprehensive Analysis in Lafayette, Indiana

Social Science

Authors(s):

Bridget Katherine Heindl† (Liberal Arts|JMHC); Leo Pearson Malachowski† (Engineering|JMHC); Jennifer Lilian Yang* (Engineering|JMHC); Ayden Timothy Fahey* (Science|JMHC)

Abstract:

The city of Lafayette, Indiana prioritizes affordable housing for all. Towards that end, this project focuses on improving the quality of life of Habitat for Humanity homeowners and residents in the Greater Lafayette region through partnerships with the Quality of Life Foundation (QOLF), Habitat for Humanity of Lafayette, and the Purdue John Martinson Honors College.

By integrating Veenhoven's Quality of Life framework with the QOLF Framework 2.0, a structured methodology is developed to assess partner families' experiences as they become accustomed to their new neighborhoods. By combining key aspects of livability from Veenhoven with the emphasis on connected communities from the QOLF Framework 2.0, a comprehensive lens is created to analyze overall quality of life. Surveys and interviews gather insightful information about the physical and emotional factors contributing to well-being.

These frameworks shaped our collaboration with Carla, a Habitat for Humanity homeowner, to support her sense of control by working with her to design and plant flower beds, creating an inclusive and aesthetically pleasing environment for her family.

The team's continued efforts in neighborhood revitalization focus on engaging more homeowners through surveys and interviews, providing valuable data to Habitat for Humanity to strengthen livability in the community.

Keywords:

Neighborhood Revitalization; Quality-of-Life; Affordable Housing; Community Engagement

Mentor(s):

Jason Ware (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1455

Presentation Time: Session 3: 12:00-1:00pm

Antennal Complexity in Mosquitoes: Association between Structure and Multimodal Sensory Functions

STEM

Authors(s):

Jonathan Christopher Henry† (Science); Krisha Shah‡ (New York University)

Abstract:

Mosquitoes employ diverse sensory modalities, such as hearing and olfaction, to navigate their habitat, locate mates, and detect host-emitted cues. The antennal structure of mosquitoes plays a crucial role in these sensory functions, and variations in antennal structure may be linked to species-specific ecological adaptations. In most mosquitoes, these structures exhibit sexual dimorphism, with males primarily using them for detecting mating signals, while females employ them to locate host-related cues. Despite the antennae's role in acquiring diverse sensory cues, the relationship between antennal structure and sensory cue usage across sexes and species remains elusive. We hypothesize that the variation in antennal structure across different mosquito species reflects cross-modal sensory compensation. To examine this hypothesis, we investigated the association between antennal structures associated with sound perception and those related to olfactory detection across sexes and eight mosquito species. Using light microscopy, we performed detailed morphometric analyses of the antennae, focusing on the flagella and Johnson’s organ. In addition, we studied the diversity and distribution of sensory receptors, called sensilla, which determine the mosquitoes' ability to detect chemical and acoustic cues. We predict that the antennal structure in mosquitoes is highly specialized for specific ecological functions, with the variation in antennal morphology showing biases towards sensory modalities critical for survival and reproduction. This study elucidates how antennal architecture promotes reception of both acoustic and chemical stimuli, emphasizing the antennal complexity of mosquitoes and highlighting the challenge of supporting multiple sensory modalities within a single organ.

Keywords:

Sensilla; Acoustic; Host Cues; Olfaction; Reception

Mentor(s):

Ximena Bernal (Purdue University); Richa Singh (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1456

Presentation Time: Session 3: 12:00-1:00pm

Influence of Cold Air Inflow on Stable Isotope Composition of Initial Precipitation

STEM

Authors(s):

Amber Grace Hitchins† (Science|JMHC)

Abstract:

The leading edge of weather systems which produce showers and thunderstorms are associated with cold air inflow which generates low-pressure systems in the upper troposphere. Having an understanding of how water vapor is transported in the atmosphere and its interactions with water vapor from the local surface is crucial for improved weather prediction models. Precipitation water molecules contain multiple stable isotopes of oxygen and hydrogen. The ratio of these isotopes serves as an important tracer which is sensitive to variations in vapor evaporation from the surface and mixing of air in the troposphere. Most precipitation data used for stable isotope analysis in precipitation studies has been collected on a daily or weekly basis. However, there are benefits to collecting samples of this nature hourly to examine atmospheric processes impacting precipitation as storm fronts pass through. Sampling of this nature is important for low pressure systems where precipitation is short in duration but high in intensity. This study aims to investigate whether cold air inflow at the onset of a storm event influences the stable isotope composition of the initial raindrops using high frequency sampling. Precipitation samples were collected from storm events in Monticello, Illinois, and analyzed for d18O (oxygen-18) and dD (deuterium), and deuterium excess (d-excess) was calculated. We will analyze isotopic values in selected storm events to determine if cold air inflow influences initial precipitation isotope values.

Keywords:

Stable Isotopes; Precipitation; Cold Air Inflow; Rain Event

Mentor(s):

Lisa Welp (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1457

Presentation Time: Session 3: 12:00-1:00pm

Enhancing SCP Hotels' Brand Positioning Through Sustainability and Community Engagement

Business Case Study

Authors(s):

Brooklyn Grace Holt† (DSB); Camila Gumucio Granier† (DSB); Carolyn Elizabeth Szilagyi† (DSB); Justin Alexander Bolinder† (DSB); Austin Edward Springer† (DSB)

Abstract:

SCP Hotels, specifically Laguna Surf Lodge and Seven4One, strives to differentiate itself in the hospitality industry by emphasizing sustainability, community engagement, and wellness-focused travel. However, effectively communicating these core values to attract and retain eco-conscious travelers remains a key challenge. This research aims to analyze SCP Hotels' market perception, evaluate its competitive positioning, and develop strategic marketing recommendations to enhance its brand presence.

To achieve these goals, the study will first assess customer sentiment and key decision-making factors influencing SCP Hotels' target audience. Through market research and competitive analysis, the project will benchmark SCP Hotels against competitors, identifying strengths and areas for improvement in sustainability messaging and brand engagement. Finally, the research will provide actionable, data-driven marketing strategies to improve brand messaging, digital engagement, and customer outreach.

By leveraging insights from customer perception and competitive analysis, this research will equip SCP Hotels with effective strategies to strengthen its positioning in the hospitality market. The findings will guide SCP Hotels in optimizing its communication approach, ensuring that its commitment to sustainability and community engagement resonates with eco-conscious travelers while enhancing its overall brand appeal.

Keywords:

Strategic Marketing; Branding; Competitive Positioning

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1458

Presentation Time: Session 3: 12:00-1:00pm

The Correlation Between Lead Exposure and Preeclampsia in Pregnant Women

STEM

Authors(s):

Isabelle Patricia Hopf† (HHS)

Abstract:

Preeclampsia is a common condition that occurs exclusively in pregnant women. It is characterized by high blood pressure (hypertension) and elevated protein levels in the urine (proteinuria). Preeclampsia also causes headaches, blurred vision, and water retention in the body, resulting in swelling. This condition is life-threatening for the mother and child and causes negative effects on the mother's heart and blood supply to the placenta, and it damages the liver and kidneys. Exact causes of preeclampsia are unknown, but exposure to heavy metals have been recognized as a potential agent to this condition. My research will focus on the correlation between preeclampsia and lead exposure in pregnant women. Research conducted in Zanjan, Iran, from August 2015-March 2016, found a significant relationship between blood lead levels (BLL) and preeclampsia. The researchers used statistical software to calculate the p-values for the association between BLL and preeclampsia, as well as between BLL and systolic/diastolic blood pressure. The data suggested that as blood lead levels increase, the chance of developing preeclampsia and hypertension also increase. This information highlights the adverse health effects of lead exposure on pregnant women, including the potential life-threatening condition of preeclampsia.

Keywords:

Preeclampsia; Lead; Hypertension; Proteinuria; Blood Lead Levels

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1459

Presentation Time: Session 3: 12:00-1:00pm

Artificial Intelligence in Dentistry: Utilizing Diagnostics Interpreted by AI to Enhance Patient Understanding of Oral Health in Rural Areas

STEM

Authors(s):

Sabrina Nicole Hornung† (HHS|JMHC)

Abstract:

Purpose: This study addresses how Artificial Intelligence (AI) can aid rural dentistry practitioners to educate patients and optimize diagnostics. Significance: AI can provide increased education through enhancing diagnostics images to address a real problem in rural areas with a lack of oral health knowledge and decreased solicitation of service. Methodology: In this study, four dentists were interviewed, both from rural and urban areas, to discuss how AI is currently being used in dentistry. I solicit a particular focus on AI in diagnostics as an educational tool for patients to enhance their understanding of oral health and disease. Rural residents will be surveyed on how they avail themselves of dental services in order to help ascertain how AI could make a difference in improving rural public perception of diagnostics. The ultimate goal would be increasing use of dental services in rural areas. Results: I anticipate a mixture of benefits and challenges. AI in diagnostics will be more common in urban areas rather than rural areas due to costs and knowledge about AI technology. Rural residents may show a knowledge gap about understanding dental diagnostics that AI can rectify. Discussion: These results suggest that AI has potential benefits, and these benefits may overcome rural dentists' reluctance to use AI and aid patients understanding of dental diagnostics. Increasing solicitation of dental services utilizing AI can allow patients to be more aware, proactive, and engaging about their oral health thus improving rural dental health outcomes.

Keywords:

GenAI; Artificial Intelligence; Dentistry; Diagnostics; Healthcare

Mentor(s):

Richard D Johnson (Purdue University); Thomas J Rickert (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1460

Presentation Time: Session 3: 12:00-1:00pm

VIP EdTechDev: Developing an Accessible Physical Computing Course

STEM

Authors(s):

Cheyenne Mie Huggins† (Science); Samridhi Kakkar† (Science); Linda Ronglin Xu† (Science); lance Ma† (Science); Nicholas Gentry Viardo† (Engineering)

Abstract:

Have you ever wanted to build your own drone but didn't have the tools or skills to start? College students are often stuck with a desire to build something tangible but lack accessible opportunities to explore and gain hands-on experience in physical computing. Existing courses often require prior knowledge, require you to be in a specific major, or use outdated methods that don't promote independent problem-solving. These create barriers to entry and discourage those without a technical background. This course is developed to address these barriers by providing an accessible, beginner-friendly course that encourages experimentation and hands-on learning. We aim to teach students hardware concepts through projects, ranging from lighting an LED to building a drone. Future students will have the opportunity to create tangible products of their learning as a part of the curriculum using knowledge from the course. To allow students from all majors to participate, the course only has a basic programming language requirement. This semester, we have worked on studying existing project guides and developing our own by utilizing several technologies such as Jupyter Book, Myst Markdown, MicroPython, and the Raspberry Pi Pico. This course aligns with Purdue's commitment to advancing hardware education by providing an accessible, hands-on introduction to physical computing, lowering barriers to entry, and equipping students from all backgrounds with foundational hardware skills. Future testing will evaluate its effectiveness as an introductory course, refine its curriculum, and assess workload feasibility.

Keywords:

Engineering Education; Physical Computing; Problem-Solving; MicroPython; Raspberry Pi Pico

Mentor(s):

John H Cole (Purdue University); Jack Scarfo (Engineering); Aakanksha

Amol Shripal (Engineering); Soudabeh Taghian Dinani (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1461

Presentation Time: Session 3: 12:00-1:00pm

Using neural networks to predict microstructure evolution in granular materials

STEM

Authors(s):

Prashant Iyer† (Science|JMHC)

Abstract:

Granular materials are the second-most manipulated material in the industry after water, and are crucial in the pharmaceutical industry, agriculture, and energy production [1]. Granular systems exhibit path-dependent material response and irreversible deformations, requiring temporal information in the form of internal state variables (ISVs) that capture a material's mechanical history [2]. We propose using a multivariate distribution that can be updated with time according to an evolution equation. We use a Neural Controlled Differential Equation (NCDE) or a Recurrent Neural Network (RNN) to learn the evolution of a multivariate probability distribution [3]. These architectures are good to learn properties of systems that depend on their history and to predict how these properties evolve. We will show how different versions of these architectures perform on different examples.

References:

[1] Marcial Gonzalez, Payam Poorsolhjouy, Alex Thomas, Jili Liu, and Kiran Balakrishnan. Statistical characterization of microstructure evolution during compaction of granular systems composed of spheres with hardening plastic behavior. Mechanics Research Communications, 92:131–136, 2018.

[2] Mark F Horstemeyer and Douglas J Bammann. Historical review of internal state variable theory for inelasticity. International Journal of Plasticity, 26(9):1310–1334, 2010.

[3] He, Y., & Semnani, S. J. (2024). Incremental Neural Controlled Differential Equations for modeling of path-dependent material behavior. Computer Methods in Applied Mechanics and Engineering, 422, 116789.

Keywords:

Granular Materials; NCDE; RNN

Mentor(s):

Abhinav Ramkumar (Engineering); Marcial Gonzalez (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1462

Presentation Time: Session 3: 12:00-1:00pm

AutoIC - Integration of BIM for Bridge Modeling

STEM

Authors(s):

Tanay Jain† (Science); Jennifer Yunning Lu† (Science); Inaki Garcia Barcena Garcia‡

Abstract:

Building Information Modeling (BIM) is revolutionizing the construction industry by enhancing data management and streamlining workflows. Our project focuses on implementing BIM for bridge modeling by developing a software solution that efficiently extracts key information from bridge design charts and transfers it into an Excel spreadsheet.

The software is structured into three primary components: reading text from PDFs, analyzing the extracted text, and systematically inputting the relevant data into an Excel spreadsheet. OpenCV is employed for text extraction, ensuring precise data retrieval from bridge plans. The extracted data includes essential attributes such as bridge span, materials, load capacities, and other structural details. Through repeated testing on various bridge plans, we refine the accuracy and efficiency of the extraction process.

Once the data is obtained, an analysis phase processes the text to identify and categorize key structural parameters. The final component of the software ensures seamless data transfer into a structured Excel format, maintaining consistency for further BIM applications. This automation reduces manual data entry errors and enhances productivity in bridge modeling workflows.

By integrating OpenCV with advanced text analysis techniques, our software improves the digitization of bridge information, making it easily accessible for engineers and planners. The implementation of this system supports better decision-making in bridge design and maintenance, aligning with BIM principles for efficient infrastructure management.

Keywords:

Python; Artificial Intelligence; Construction Management; OpenCV; Bridge Modeling

Mentor(s):

Jiansong Zhang (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Jingyi Lai (Polytechnic); Fan Yang (Polytechnic); Bernard Nartey (Engineering); Meta Soy (Polytechnic); Bo Pang (Purdue University); Fan(Aria) Yang (Polytechnic); Hosam Hegazy (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1463

Presentation Time: Session 3: 12:00-1:00pm

Pre-PCI Risk Stratification

STEM

Authors(s):

Saloni Jajoo† (Science)

Abstract:

Percutaneous coronary intervention (PCI) is life-saving but carries the risk of complications such as coronary perforation, major bleeding, acute kidney injury, and mortality.. This study develops a machine learning-based risk stratification model to predict the risk of post-PCI complications, to augment preoperative risk stratification and dynamic risk management. The use of AI helps address the gap in risk prediction by using diverse clinical variables to improve accuracy and adaptability in the predictive models.

A comprehensive dataset of demographics, pre-procedural, and procedural clinical variables was preprocessed in order to reduce the number of input features based on clinical relevance.

The data was split into training, validation, and testing, using a 60-20-20 ratio using stratified sampling to ensure uniform class distribution across subsets. Three machine learning models—Logistic Regression, XGBoost, and Random Forest—were trained with and without feature selection. The models were evaluated based on performance metrics such as the confusion matrix, classification report, and F1 score. The AUC score was around 93% for most of the complications. The importance level score of the features is then used to refine the model further.

Results demonstrate effective patient risk stratification, identifying key predictors of post-PCI complications. This study highlights the potential of advanced machine learning models in preoperative risk prediction, enhancing clinical decision-making and improving patient outcomes.

Keywords:

Biomedical Engineering; Machine Learning; Data Science; Cardiovascular; Healthcare

Mentor(s):

Fiona Kolbinger (Purdue University); Muhammad ibtsaam Qadir (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1464

Presentation Time: Session 3: 12:00-1:00pm

Individual Tree Detection using deep learning models with UAV-Based images in Mixed Forests

STEM

Authors(s):

Yuexin Jiang† (Engineering)

Abstract:

Forests provide essential ecosystem services, making it crucial to understand their compositions, especially tree species, for effective management and conservation. Unmanned aerial vehicles (UAVs) equipped with RGB cameras offer a cost-effective and high-resolution solution for capturing detailed canopy images, enabling efficient large-scale forest monitoring. While existing studies primarily focus on tree species classification, a critical gap remains in utilizing UAV images for both tree detection and species-specific segmentation. This study focuses on individual tree detection using high-resolution UAV images. Our study area covers a mixed forest at Martell Forest in Indiana, including both natural and plantation forests. A dataset of 65 UAV images from the summer of 2023 was annotated with over 1,000 individual crowns for four ecologically significant species: northern red oak, white pine, black walnut, and black cherry. This study highlights the potential of deep learning models for integrating tree detection and species segmentation in forest inventories, offering a scalable solution for monitoring biodiversity. Additional findings and results will be presented at the conference.

Keywords:

Tree Detection; Deep Learning; Species Identification; RGB Images; Forestry

Mentor(s):

Yunmei Huang (Agriculture); Songlin Fei (Purdue University)

Other Acknowledgement(s):

Cameron Patrick Wingren (Agriculture)

Poster Presentation Abstract Number: 1465

Presentation Time: Session 3: 12:00-1:00pm

Preference for Charging Station Venues – A Comparison between Electric Vehicle Users vs. Non-Electric Vehicle Users

STEM

Authors(s):

Christina Joslin† (Science|JMHC|Graduate)

Abstract:

As the adoption of electric vehicles (EV) grows, the need for better planning of future charging infrastructure becomes increasingly critical. However, while prior research focuses on station placement and economic factors, fewer studies examine preferences on charging station venues at final destinations. This study examines these preferences among EV and non-EV users using a stated preference survey of 1,153 Indiana adults. Two sub-samples are considered: EV users (n = 177), who currently own an EV, and non-EV users (n = 976), who have never or previously owned one. EV users offer insights into real-world charging behavior, while non-EV users represent future potential adopters, making their preferences essential for infrastructure planning. This study evaluates participants' perceived charging frequency if public charging stations were available across seven different venue types—office, retail, medical, educational, transit, hotel, and restaurant— assessing factors that influence their stated preferences using a multivariate ordered probit model. For EV users, significant factors included employment status, household non-EV ownership, and travel frequency. Frequent travelers were less likely to charge at educational, retail, and transit locations, while those with more non-EVs in their household were less likely to charge at retail and medical venues. For non-EV users, significant factors included age, home type, incentive awareness, travel frequency, and urbanity. Older adults were less likely to charge in these venues, particularly offices, while those in urban areas were more likely to charge at educational and office locations. By identifying factors influencing charging preferences, this study informs future charging infrastructure investment and policy planning.

Keywords:

Electric Vehicles; Public Charging Stations; Preferences; Multivariate Ordered Probit; Charging Station Venues

Mentor(s):

Nadia Gkritza (Purdue University); Bruno cesar Krause moras (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1466

Presentation Time: Session 3: 12:00-1:00pm

Eye to Eye: Scaling Patterns and Ecological Functions in Mosquito Vision

STEM

Authors(s):

Grace Lynn Jurkovic† (Science)

Abstract:

Flying animals rely on ocular structures that promote efficient navigation of 3D environments. The development and maintenance of these ocular structures require considerable energetic investment. In addition, these organs can also increase the mass of the individual, a limiting factor for small flying organisms. In flying insects, eye sensitivity and spatial resolution are constrained both by energetic costs and body size, yet there is variation among species in eye size relative to body size. In mosquitoes, disparities in both the number and size of ommatidia have been documented among a few species, but it is unclear how such variation is associated with the ecological challenges faced by those species. We hypothesize that differences in the scaling of the compound eyes, and the dimensions of the ommatidia, across sexes and species are driven by ecological function. To assess this hypothesis, we focused on frog-biting mosquitos to analyze the allometric scaling of compound eyes across nine species characterized by distinct natural histories. Considering that mosquitoes frequently exhibit pronounced sexual dimorphism in foraging behavior, we also scrutinized the scaling patterns of the ocular structures in males and females within each species. Using light microscopy, we quantified ocular dimensions and characterized the structural attributes of the eyes. This research endeavors to augment our understanding of the visual adaptations of mosquitoes, underscoring the influence of body size on the architectural configuration of compound eyes in insects.

Keywords:

Sensory Adaptation; Compound Eye Morphology; Sexual Dimorphism

Mentor(s):

Ximena Bernal (Purdue University); Richa Singh (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1467

Presentation Time: Session 3: 12:00-1:00pm

Wearable System for Tracking Stroke Rehabilitation Progress

STEM

Authors(s):

Taran Reddy Kamireddy† (Engineering); Nadia Bailen Boluda† (Engineering); Lara Nour Courgi† (Engineering); Elias Malak† (Engineering); Owen Michael Bartel‡ (Engineering); Samarth Bhat‡ (Engineering); Cooper Lee Cotton‡ (Engineering); Pratika Kumar‡ (Engineering); Gema Roselyn Parra‡ (Engineering); Andrew Loren Peterson‡ (Engineering); Nicholas John Albrecht‡ (Engineering)

Abstract:

Approximately 80% of stroke survivors experience motor impairments in their upper limbs, impacting independence in daily activities. Traditional clinical assessments, such as the Action Research Arm Test (ARAT) and Modified Ashworth Scale (MAS), are limited by subjectivity and the inability to track detailed movement patterns continuously. The team used an intelligent glove equipped with Inertial Measurement Units (IMUs) and encoders to find a solution.

This project introduces an intelligent glove equipped with IMUs for real-time, objective monitoring of motor recovery. The glove integrates IMUs sewn into Neoprene fabric with 3D-printed components to ensure comfort, durability, accurate acceleration, angular velocity, and orientation tracking. Its modular design allows independent patient placement, facilitating consistent and continuous data collection. Machine Learning (ML) was used to detect deviations from healthy movement patterns.

In addition, four encoders are placed around the arm with a counter-sprung string that is attached to four of the patient's fingers, excluding the thumb. An ML model is used to generate predicted joint angles from the encoder output that can be measured to track the range of motion change over time and apply polynomial models to the data to generate R^2 values, quantifying how closely the patient's movements match smooth trajectories.

The IMUs and encoders work together to evaluate upper limb function. This cost-effective, wearable system provides objective feedback and supports at-home monitoring, reducing clinical visits while enabling personalized rehabilitation. Future work will focus on refining the ML

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

models and sensor configurations to enhance accuracy and expand the system's clinical applicability.

Keywords:
Stroke; IMU; Hand Assessment; Encoder; Machine Learning

Mentor(s):
Ken Yoshida (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1468

Presentation Time: Session 3: 12:00-1:00pm

Engineering Leadership: A Systems Approach to Collaboration and Communication

Social Science

Authors(s):

Saachi Katariya† (Polytechnic)

Abstract:

In today's increasingly global and interdisciplinary workforce, engineers must develop leadership skills that enable them to collaborate effectively across diverse teams and navigate complex challenges. Traditional engineering education primarily emphasizes technical expertise, often overlooking essential leadership competencies such as adaptability, communication, and conflict resolution. This study addresses this gap by developing a self-paced learning module that integrates a systems thinking approach to leadership development.

The module is designed to help engineering students strengthen key leadership abilities, including openness, adaptability, and cross-cultural communication. Over a 90-minute period, students engage with structured readings, case studies, and reflection activities that encourage critical thinking and practical application of leadership strategies. By simulating real-world scenarios, the module helps students understand how leadership decisions influence team dynamics and project outcomes.

This resource is structured to be both practical and flexible, allowing students to develop leadership skills at their own pace. By embedding these competencies into engineering education, the module equips future engineers with the tools needed to lead effectively in collaborative, multidisciplinary environments. Ultimately, this initiative prepares engineers to work successfully in varied professional settings, fostering teamwork, innovation, and strong decision-making in diverse contexts.

Keywords:

[no keywords provided]

Mentor(s):

Aparajita Jaiswal (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1469

Presentation Time: Session 3: 12:00-1:00pm

Raceline Optimization in Autonomous Racing using Quantum Annealing

STEM

Authors(s):

Azain Khalid† (Science); Ritwik Suresh Jayaraman† (Science|Graduate); Pranav Vijay Kumar† (Engineering); Jake Alan Patterson† (DSB); Khoi Xuan Mai‡ (Science|Graduate)

Abstract:

Raceline optimization is a critical component of autonomous racing, as it is the module that creates a vehicle's trajectory to achieve the fastest lap time. Although classical solutions can generate optimal racelines, prior algorithms are not perfect as they suffer from various drawbacks such as the curse of dimensionality. Thus, as a novel approach, we turn to quantum computing algorithms, specifically optimization through quantum annealing; an adiabatic approach that has demonstrated advantages over classical methods in combinatorial optimization problems.

Since raceline optimization falls within this category, we aim to leverage quantum annealing's probabilistic nature and its proven advantage in solving NP-hard and NP-complete combinatorial optimization problems to address the complexities introduced by discretization of the raceline during optimization. By mapping these problems into a Quadratic Unconstrained Binary Optimization (QUBO) formulation we can explore a much larger solution space when compared to classical methods. Therefore, we hypothesize that this approach would identify multiple near-optimal solutions that classical methods may overlook.

To test this, we encode constraints within the QUBO formulation using penalty terms to represent the track environment, manage high-dimensional optimization, and enforce optimization constraints. This solution is compared to state-of-the-art raceline optimization techniques for an autonomous IndyCar at Indianapolis Motor Speedway, a frequent venue for autonomous racing competitions. Performance is evaluated using two metrics, computation time and general trajectory characteristics (e.g. trajectory smoothness), to holistically evaluate the tested approaches.

Our findings offer insights into the viability of quantum models for raceline optimization and their potential impact on autonomous vehicle applications beyond racing.

Keywords:
Raceline Optimization; Autonomous Racing; Quantum Annealing; Optimization

Mentor(s):
Andres Felipe Hoyos Moreno (Engineering); Samuel Labi (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1470

Presentation Time: Session 3: 12:00-1:00pm

The History of Bovine Tuberculosis in the United States and its Modern Day Implications

Humanities

Authors(s):

Jolie Grace Klimczak† (Agriculture|JMHC)

Abstract:

The emergence of Bovine Tuberculosis in the early nineteenth century was the catalyst that brought American agriculture into the public health sphere. Since Robert Koch's discovery of tuberculosis in the late 1800s, tuberculosis and medicine have evolved side by side locked in a constant battle with each side looking to thwart the other. The initial lack of action by the American government led to sickness spreading across the country to humans and cattle alike causing a public health crisis. This also created financial hardships for farmers and resulted in many American citizens losing their lives to the disease; however, large-scale change in response to zoonotic diseases was accomplished and can still be seen to this day. Bovine Tuberculosis was a serious public health issue rising in the late 1800s and lasting through the late 1930s which caused scandals, a war, and the creation of multiple agencies and policies within the Department of Agriculture. By examining the actions of the United States government in response to Bovine Tuberculosis, this paper will offer insight on how to carefully continue combat against Bovine Tuberculosis in the modern day.

Keywords:

Bovine Tuberculosis; Bureau of Animal Industry; 1880s-2020s; Tuberculous Cattle Trust

Mentor(s):

Emma Maggart (Dynamic Redevelopment Solutions)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1471

Presentation Time: Session 3: 12:00-1:00pm

Exploring the Gap Moe: Analyzing Unknown Functions of Gaps in Bacteriophages AdaS and MellowYellow

STEM

Authors(s):

Lillian Grace Knight† (Agriculture|Engineering); Michael H Wang† (Agriculture|Engineering); Reina Cristine Perl† (Agriculture|Engineering); Sabina Anna Mazur† (Agriculture|Engineering); Madeline Marie Peterson† (Agriculture|Engineering)

Abstract:

Bacteriophages, viruses that infect bacteria, have two life cycles. In the temperate life cycle, the phage can enter a dormant phase and integrate into bacterial DNA, and in the lytic life cycle, the phage replicates and causes the bacterial host to lyse. This experiment explores how regulatory sequences affect the bacteriophage's life cycle using AdaS, a temperate phage, and MellowYellow, a lytic phage. DNA Master was used to evaluate the starts and lengths of gaps between genes and Phamerator was used to explore conservation of gaps with other bacteriophage genomes. MOTIF Search was used to analyze those gaps for regulatory sequences. The functions of regulatory sequences of AdaS and MellowYellow were compared. The conservation of gaps within other phages was confirmed for both phages. MOTIF Search found functions that support AdaS as a temperate phage, having motifs closely related to bacteria, and MellowYellow as a lytic phage, with inconclusive motif comparisons. Identifying regulatory sequences within phage genomes provide the possibility of turning those sequences on and off to determine the life cycle of the phage. Looking forward, it would be useful to further compare more gaps in lytic and temperate phages to compile a broader understanding of their function.

Keywords:

[no keywords provided]

Mentor(s):

Kari L Clase (Purdue University); Julia Ann Simler (Agriculture)

Other Acknowledgement(s):

Opeyemi Samuel Oduniyi (Agriculture); Marcelo Inaki I Guerrero Montalvan (Agriculture)

Poster Presentation Abstract Number: 1472

Presentation Time: Session 3: 12:00-1:00pm

Purdue Aerial Robotics Team - Competition Optics and Avionics

STEM

Authors(s):

William Andrew Kok† (Engineering); Abdulmalik Abiodun Busari† (Engineering)

Abstract:

In order for any electric aerial vehicle to fly there is a need for power storage, distribution, and management. Our goal this semester was to assemble and revise initial designs to produce a fully functioning DC electrical system for the other teams in PART to use to power all aspects of the vehicle. This started with battery pack assembly, then power distribution wiring and PCB work, and finished off with system testing. The implications of this work were seen by many different teams. The battery packs were custom built to fit in various parts of the fuselage which balanced the plane helping the airframe team. Our power calculations helped make sure the plane motors could work, helping the propulsion team. This also helped power the onboard computer which allowed the software team's code to run on the plane. The mechanisms team also relied on the power from our batteries to make their payload systems work. Without our sub-teams' efforts almost no part of the finished plane would be operational for competition use.

Keywords:

UAV Electronics; Avionics; Battery Design; Optics; Communications

Mentor(s):

Niall Patrick Moloney (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1473

Presentation Time: Session 3: 12:00-1:00pm

What Needs Do Parents and Youth Have That Can Be Fulfilled With an Afterschool Program?

Social Science

Authors(s):

Zainub Aamir Kokan† (Science|JMHC); Amanda Reese Catey* (Science|JMHC); Lydia Sue Gonzalez* (DSB); Hannah Krouse* (Ivy Tech Community College)

Abstract:

The time students spend outside of school is critical to their development. Research shows that student engagement in after-school programs leads to better academic and social development and supports working parents. Understanding the needs parents and youth have that after-school programs can fulfill is key to taking full advantage of critical after-school time. This study evaluated a community-based afterschool program to explore the needs of parents and youth living in public housing complexes. Pilot survey data was collected from 10 parents in the neighborhood to explore what program characteristics and student experiences matter most to parents, how many days a week parents want to have their child(ren) attend, and what areas of improvement they saw for the afterschool program. All parents considered the safety of their child, help with academic skills, help with social skills, and regular progress updates to be the highest priority needs in an afterschool program. All parents felt the program was doing a good job in all areas listed, with the exception of 50% requesting an increase in the number of days the program runs. When asked for improvements one parent said “more communication with parents on my child's progress,” and another “[Make it] Inclusive for children with disabilities and more involved in community”. While the program is meeting the majority of parent and youth needs, there are still ways the program can work to meet parents’ needs by creating an inclusive and inviting environment for parents and youth in the community.

Keywords:

Afterschool Program; Youth Development; Program Evaluation; Learning

Mentor(s):

Temitope Folasade Adeoye Olenloa (Purdue University)

Other Acknowledgement(s):

Rose Mbewe (Education)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1474

Presentation Time: Session 3: 12:00-1:00pm

The Synthesis and Characterization of 1-Decyl-3-Methylimidazolium Ligated CsPbBr3 Quantum Dots for Exciton Transport Analysis

STEM

Authors(s):

Sarah Marie Kolp† (Science)

Abstract:

Perovskite CsPbBr3 quantum dots (QDs) are novel materials whose highly tunable emission, high quantum yield, ability to self-assemble, and ability to efficiently transport excitons make them excellent candidates for revolutionizing current photovoltaics. However, gaps in the self-assembled lattice sample, a nonuniform size and shape distribution amongst the QDs, and insulating ligands can cause decreased exciton transport efficiency. Therefore, it is important to understand how ligand chemsitry can affect exciton transport and self assembly. 1-decyl-3-methylimidazolium (IM+10) has the potential to delocalize excitons due to its aromaticity. Currently, we are studying the influence exchanging oleylamine (OAm) for IM+10 has on the size and shape uniformity, emission wavelength, and quantum yield of the QDs. Ideal results in these areas are crucial precursors to potentially enhanced exciton transport, for which IM+10 has produced mixed results. Compared to OAm QDs, IM+10 QDs show increased size and shape distribution and a more unorganized 2D lattice. However, their increased quantum yield demonstrate less fluorescence quenching defects within individual QDs, prompting further study on how the size and shape distribution, self-assembly, and exciton delocalization could be improved for IM+10 QDs.

Keywords:

Quantum Dots; Exciton Transport; Self-Assembly; Quantum Yield; Perovskite

Mentor(s):

Nicholas Robert Favate (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1475

Presentation Time: Session 3: 12:00-1:00pm

Digitizing the Past: Using GIS to Integrate Analog and Digital Spatial Data for Bronze/Iron Age Hillforts in the Armenian Highlands

Humanities

Authors(s):

Melanie A Kreutz† (Liberal Arts|JMHC)

Abstract:

Recent years have seen important developments in archaeology in the transition from paper-based data collection and reporting processes to workflows based on digital forms of data collection, analysis, and visualization using geographic information systems (GIS). Nevertheless, there remains significant value in traditional analog "legacy" data in older publications and field notes, which often contain the only location and descriptive information on heritage sites, despite inherent challenges in discerning site locations from textual descriptions (often in multiple languages) or extracting coordinates from analog sketch maps. This project focuses on digitizing legacy geospatial for fortress sites dating to the Late Bronze Age/Early Iron Age (15th-10th centuries BCE) and Urartian Empire (9th-6th centuries BCE) sites in the Armenian Highlands. A list of 276 fortress locations was compiled through surveying archaeological literature in English, German, and Italian. Each site was manually identified and geolocated in Google Earth. The recorded data include geographic coordinates, elevation measurements, and, where available, fortification wall perimeter metrics, assembled in a geodatabase. This project has resulted in a more refined dataset for site location analysis in a GIS environment, using tools such as elevation and Terrain Ruggedness Index (TRI) as a precise means of studying settlement priorities during the Bronze Age to Iron Age periods. This research also demonstrates the importance of digitizing archaeological data to further settlement pattern studies, allowing for the creation of more complete maps of sites and spatial analysis in the greater Near East.

Keywords:

Armenian Highlands; GIS; Spatial Analysis; Bronze/Iron Age; Digital Humanities

Mentor(s):

Ian Lindsay (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1476

Presentation Time: Session 3: 12:00-1:00pm

Direct Conversion of Sulfide to Selenide Phase of Cu(In,Ga)(S,Se)2 (CIGSSe) via Se Vaporization

STEM

Authors(s):

Julia Ku† (Engineering)

Abstract:

Although most solar cells are known to be traditionally silicon-based, there has been an increase in attention towards solution-processed (CIGSSe) solar cells as it achieves higher efficiencies with thin-film technology and is more cost-effective for industrial scaling. This involves a two-step process, where a precursor film is solution-processed following a heat treatment, known as selenization. Typically, using liquid selenium, a sulfur-based Cu(In,Ga)S2 is converted to the selenide phase during selenization. However, converting the sulfide phase to the selenide phase with liquid Se promotes secondary phases, inhomogeneities, and irregular morphology at the macroscopic scale. To investigate a more optimal way for phase conversion, this study develops a methodology for the direct conversion from the sulfide phase to the selenide phase only using Se vapor. Current results have shown a change in phase at the surface in a range of temperatures between 315 C to 350 C by Raman spectroscopy and X-ray diffraction due to the minimization of the liquid phase. In addition, the conversion from the sulfide to selenide phase of CIGSSe will also be studied at different selenization temperatures for overall improvement in the photoluminescence of the absorber and the final power conversion efficiency of the device. Finally, the optimal synthesis conditions will drive the next steps to diminish the defect formation in the absorber and validate the implementation of Se vapors as the medium for the recrystallization of this thin film technology.

Keywords:

Solar Cells; Selenization; CIGSSe; Solution Processing; Inhomogeneities

Mentor(s):

Juan Sebastian Alban Dominguez (Engineering); Jhoan Andres Ruiz Velasquez (Engineering); Rakesh Agrawal (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1477

Presentation Time: Session 3: 12:00-1:00pm

The Effects of Exercise on Mental Health

Social Science

Authors(s):

Emily Marie Kuras† (HHS)

Abstract:

People are increasingly suffering from mental health issues in modern society. Millions of people in the United States are affected by problems such as stress, anxiety, and depression. There is a simpler answer than we have thought in the past: consistent physical activity. Research has proven exercise helps to improve emotional regulation by reducing stress levels, symptoms of depression and anxiety, while increasing cognitive function. Exercise helps with the release of neurotransmitters including dopamine while reducing levels of glutamate. Dopamine assists with mood regulation and emotional stability in general, while glutamate is connected to depressive symptoms. Additionally, exercise has been seen to improve memory, focus, and sleeping patterns which also contribute to a healthier mind. Different types of exercise such as aerobic activities, strength training, and yoga all contribute to psychological benefits. They promote relaxation, increase self-esteem, and encourage social interaction. This paper will explore a multitude of effects that exercise has on mental health. It will use diverse sources to highlight the significant impact of incorporating physical activity into everyone's day to day life. Exercise is a non-pharmaceutical approach that is affordable and accessible to everyone to strengthen mental health and overall quality of life.

Keywords:

Exercise; Mental Health; Depression; Anxiety; Cognitive Function

Mentor(s):

Beth Elly Baumgartner (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1478

Presentation Time: Session 3: 12:00-1:00pm

ECELabs - GPIO streaming

STEM

Authors(s):

Haejune Kwon† (Engineering); Rauf Emre Erkiletlioglu‡ (Engineering)

Abstract:

The ECELabs.io team is committed to supporting students by providing a remote-access platform for hardware laboratories. As part of this initiative, the GPIO Streaming Project focuses on developing a high-performance streaming system between the ECELabs.io website and a custom PCB-based hardware interface. This hardware features a USB-C port, an RP2040 microcontroller, an 8-segment numerical display, LEDs, push buttons, and 32 configurable input/output (I/O) pins for external circuit integration. The primary objective of this project is to optimize the embedded system of the GPIO streaming board by maximizing the streaming rate and minimizing packet loss to enable real-time updates and ensure accurate data transfer. To achieve this, the existing clock-based interrupt protocol will be replaced with a handshake-based method. This enhancement is expected to eliminate data transfer conflicts that currently lead to system freezes and shutdowns, significantly improving overall stability and efficiency.

Keywords:

IO board; ECE; Data Streaming

Mentor(s):

Junfei Li (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1479

Presentation Time: Session 3: 12:00-1:00pm

The Benefits of Bilingualism in a Globalized World

Humanities

Authors(s):

Zubin Lee† (Liberal Arts)

Abstract:

The importance of bilingualism is often overlooked by Americans because of the prevalence and global dominance of English. English has been considered a required education in many countries, making it the dominant language. As a lingua franca, English enables smooth communication regardless of nationality. Despite its dominance, bilingualism provides cognitive, cultural, and professional benefits. Research has shown that using multiple languages can enhance cognitive flexibility, problem-solving skills, and memory by switching between languages. Moreover, bilingualism encourages cross-cultural understanding and allows individuals to engage with diverse communities. Furthermore, bilinguals gain more career opportunities because employers value linguistic competence in the globalized world. For example, countries are expanding their global trade, international negotiations, and cultural interaction. Overall, the study will explore the long-term benefits of bilingualism based on the analysis of linguistic and cognitive research. This will include case studies from researchers of bilingualism and the significance of bilingualism in the interconnected world.

Keywords:

Bilingualism; Bilingual; Benefit; Globalization

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1480

Presentation Time: Session 3: 12:00-1:00pm

Purdue Ivy Tech Chips Program Analysis Project

STEM

Authors(s):

Philip Hwanseo Lee† (Engineering); Sophia Moon‡ (Engineering); Vishwajit Laxmanrao Patil‡ (Engineering); Jeevika Rajesh Purkar‡ (Engineering)

Abstract:

The semiconductor and microelectronic industry are on the rise and therefore present a need for a competent workforce. Because there is limited access and exposure to semiconductor and microelectronics knowledge, there is low awareness about potential careers for those who either want to or have potential to participate in these industries. The primary purpose of this research is to find what type of student profiles participate in a microelectronic and semiconductor summer program. Survey results, focus group transcripts, and application responses of 54 previous program participants were collected. They were qualitatively analyzed using a deducting coding approach. This creates experience participant profiles, and we predict that they will provide a clearer understanding of the types of people participating and groups that may be overlooked. The results will have implications for and benefit both who the program is reaching and not reaching when recruiting. They will also benefit the program developers who will try to broaden participation. Expanding the participant base will contribute to the growth of the semiconductor and microelectronic ecosystems and make them more diverse.

Keywords:

Semiconductor; Microelectronics; Profiles; Program

Mentor(s):

Shauna Nicole Adams (Engineering); Yash Ajay Garje (Engineering); Kerrie Douglas (Purdue University); Morgan M Hynes (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1481

Presentation Time: Session 3: 12:00-1:00pm

Small Scale Manufacturing of Clay on Mars

STEM

Authors(s):

Aelish Marie Ligon† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Manufacturing; Clay; Mars; Raspberry Pi; Small Scale

Mentor(s):

Stewart F Bauserman (Polytechnic); Steven R Dunlop (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1482

Presentation Time: Session 3: 12:00-1:00pm

Shaping Future Leaders: Business Students' Views on Leadership

Social Science

Authors(s):

Ying-Wei Lin† (Engineering); Minsu Cho† (Engineering); Yuma Ariga† (Engineering); Stavros Tzortzatos Gorrichategui† (Engineering)

Abstract:

Corporate success depends on leadership effectiveness, however, opinions of this quality vary greatly among different groups. Business students, and future professionals, develop leadership expectations based on academic teaching and cultural influences. This study investigates the views of large Midwest public American university business students on the equality of opportunity and effective leadership and whether the behavior of CEOs is linked with high stock performance. Although prior research shows that high-performing CEOs balance strategic decision-making, competitiveness, and corporate responsibility, students could prioritize ethical leadership and personal autonomy as the main success factors. We will survey 50 undergraduate business students to examine this and collect information on their opinions of corporate decision-making, leadership styles, and the role of competition in the success of the market. The results will be compared with existing research on CEOs' practices to identify possible discrepancies between student perception and real-world executive strategies. We hypothesize that students may favor transformative and ethical leadership models while highly successful CEOs are typically involved in difficult trade-offs, including risk-taking and competitive market positioning. This study helps to recognize the role of cultural values and leadership in how the performance of leaders changes in various cultural and academic contexts. This study aims to provide insights into the larger relationship between the American business culture of equality of opportunity and leadership development.

Keywords:

CEO; Leadership; Business; Equality of Opportunity; American Value

Mentor(s):

Haiyan Li (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1483

Presentation Time: Session 3: 12:00-1:00pm

Evaluating the Effectiveness and Limitations of Animal-Assisted Therapy for Children with Disabilities

Humanities

Authors(s):

Andrew David Linerode† (HHS)

Abstract:

In recent years, Animal-Assisted Therapy (AAT) has gained popularity as a possible complementary therapeutic method. AAT includes various activities that involve animals with the purpose of improving the emotional, physical, and mental well-being of individuals. This preliminary research project focuses on assessing the benefits of AAT on children with disabilities, such as Autism Spectrum Disorder (ASD), and examines the challenges in implementation and the ethical considerations associated with the method. This poster looks into the effectiveness of various types of AAT, with a focus on dogs, and their influence on stress reduction, communication, and overall quality of life for children with disabilities (Galvany-López et al., 2024). In this exploratory research project, I investigate the effects of AAT on children with disabilities, focusing on the psychological outcomes. To investigate this, I conducted a preliminary literature review of existing studies to assess the effectiveness and limitations of AAT (Kovács et al., 2024). Additionally, I conducted a survey online in which parents of children with disabilities shared their child's personal experiences with AAT. This research highlights the importance of evidence-based practices in AAT and underscores the necessity to standardize guidelines, ensuring the well-being of both the children and the therapy animals. The findings from this research have the potential to contribute useful insights into developing more effective and ethical AAT programs for children with disabilities.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1484

Presentation Time: Session 3: 12:00-1:00pm

A RISC-V Implementation of the Core-Local Interrupt Controller for the AFTx Series.

STEM

Authors(s):

Felix Liu† (Engineering); Mohammed Rafi† (Engineering)

Abstract:

The purpose of this study is to implement the Core-Local Interrupt Controller (CLIC) for Purdue SoCET's AFTx series SoCs. The CLIC serves as a direct upgrade to existing infrastructure in the form of the Core Local Interrupter (CLINT). It allows for preemption and nested interrupts, along with potential for more extensions and modes. Nested interrupts will allow for the system to handle multiple interrupts by accepting new interrupts in the middle of handling the current one. Same privilege level preemption (horizontal interrupts) are also supported. Additionally, the interrupts will be low latency and can support vectored format. The interrupts themselves can be set to custom priorities, allowing for configurable and unique interrupts.

This hardware will be used with the Platform-Level Interrupt Controller (PLIC) to send interrupts to up to four cores. The CLIC is backwards compatible with the CLINT and will turn on/off with upper bits of the xtvec register.

Keywords:

RISC-V; Hardware Architecture; Digital Design

Mentor(s):

Fnu Kumar Alabhya (Engineering); Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1485

Presentation Time: Session 3: 12:00-1:00pm

Data Transformation and Cleaning for Autonomous Vehicles: Ensuring Compatibility with AV-24 Platform and Enhanced Performance on Deep Neural Networks

STEM

Authors(s):

Austin S Lugo† (Engineering|JMHC); Emily Song† (Engineering); Shivani Sinha† (Science); Shreya Shrikrushna Pulujkar† (Engineering); Alexander Popescu‡ (Engineering)

Abstract:

Autonomous vehicles require real-time prediction and decision-making to optimize operation and safety in dynamic environments. This is vital to enhance autonomous motion prediction and prevent collisions while boosting competitive performance in high-speed settings. We plan to utilize machine learning models such as transformers and Long Short Term Memory (LSTM) for real-time motion prediction on a high-speed autonomous race car. However, such applications require vast amounts of data that are both accurate and optimized for the model training process. This data is compiled from various inputs on the vehicle, such as lidar sensors, radars, and cameras. Data from sensors that were originally on the previous car, the AV-21 must be transformed to suit the newer model, the AV-24, ensuring any models trained on this data will perform on the newer car. Additionally, removing noise from images and datasets that would confuse the training of our model could improve the performance, with hopefully only a small amount of additional processing. Advancing these methods will allow us to investigate and address relevant performance and safety concerns regarding autonomous racing.

Keywords:

Neural Network; Motion Prediction; Data Cleaning; Autonomous Vehicles

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1486

Presentation Time: Session 3: 12:00-1:00pm

Interfacing a Daughter Board for Caravel EFabless Chip

STEM

Authors(s):

Joseph Alexander Schelb† (Engineering); Han My Luu† (Engineering)

Abstract:

The purpose of this study was to create a daughterboard to communicate with a Caravel EFabless chip. Having a means to communicate with a chip allows users to test and verify the fabricated chip conveniently. The methods of this study are split into two different parts, communication with the EFabless chip and hardware integration. The method of communicating with the board is using a USB-C connection. The method of hardware integration of the chip is with the M.2 Connector, a standardized chiplet socket. This daughter board comprises standardized components such as a chiplet socket, a 5V USB-C source, and a USB to UART connector. To maintain accurate signal output, the board also comes with a linear voltage regulator and a MEMS oscillator specifically for the Caravel Chip. This type of daughter board can be made for large-scale production and used to test a variety of other EFabless chips. The communication and hardware integration of the chiplet is largely standardized between different chips, so this study is useful in its scalability.

Keywords:

[no keywords provided]

Mentor(s):

Vishnu Chaithanya Lagudu (Engineering); Matthew A Swabey (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1487

Presentation Time: Session 3: 12:00-1:00pm

Code and Development of Radar Sensors for Environment Feedback

STEM

Authors(s):

Jessica Frances Lyng† (Engineering)

Abstract:

The purpose of this design project was to develop a way for the Purdue RoboMaster robots to avoid hitting walls when in the competition arena, which can potentially damage critical parts of the robot and interfere with effective piloting. The design involves a custom STM32 board designed using Altium, and corresponding code to calculate the position of the robot. Mounted radar sensors would be connected to the STM32 on the robot, sending feedback of the robot's surroundings, which would be sent to code that utilizes the Kalman filter. This project was started in late September 2024 and is currently ongoing, with the soldering of the PCB being finished and its testing happening in the very near future. Testing will reveal if the design is adequate, but if not changes will be made. The next step will be to finish the embedded code for the sensors utilizing the STM32CubeMX and Keil uVision5 platforms. Code for the Kalman filter will also be implemented on these platforms as well. It is the goal of this project to prevent any unnecessary damage to the robot, and for better spatial awareness for the pilots in high-stress environments.

Keywords:

Robot; Code; Sensors; STM32; Kalman Filter

Mentor(s):

Abolfazl Hashemi (Purdue University); Zijian He (Engineering); Rongbo Hu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1488

Presentation Time: Session 3: 12:00-1:00pm

Predicting NCAA March Madness Outcomes: Assessing School Affinity and Bracket Forecasting Accuracy

Business Case Study

Authors(s):

Aryaa Madan† (DSB); Rayan Siddiqi† (DSB); Pahal Vishalkumar Kapatel† (DSB); Jacob Michael Zawacki† (DSB|JMHC)

Abstract:

This project aims to develop a predictive model for forecasting the final two rounds of the NCAA March Madness championship while evaluating the impact of school affinity on bracket predictions. Understanding whether regional bias influences forecasting accuracy is essential for refining predictive analytics in sports betting and fan engagement. To achieve this, we analyzed historical bracket data, testing data, and institutional statistics. Data preprocessing involved handling missing values, merging datasets, and engineering key features, including a binary School Affinity metric based on designated market areas (DMA). Missing values were replaced using local medians or linear regression to maintain data consistency.

We implemented two machine learning models: a Random Forest Classifier, chosen for its robustness in handling mixed data types and resistance to overfitting, and XGBoost, selected for its ability to model complex patterns effectively. Model performance was assessed using accuracy scores, confusion matrices, and cross-validation, while feature importance analysis was conducted to refine inputs and enhance generalizability. Preliminary results indicate that school affinity may introduce bias into bracket predictions, leading to overestimations of local team success. Addressing this bias through model adjustments can improve forecasting accuracy. Additionally, optimizing feature selection and hyperparameter tuning enhances model reliability.

This research contributes to the broader field of predictive analytics by demonstrating how behavioral biases impact data-driven decision-making in sports forecasting. Our findings offer valuable insights for analysts, sportsbooks, and fans looking to enhance their prediction strategies through data-driven methodologies.

Keywords:

Analytics; Forecasting; Machine Learning; Bias; Bracketology

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1489

Presentation Time: Session 3: 12:00-1:00pm

Perioperative Pressure Pain Threshold as a predictor of Acute and Chronic Postsurgical Pain Outcomes in Adolescents

STEM

Authors(s):

Hana Mohamed Mahmoud† (HHS|JMHC)

Abstract:

Introduction:

Predicting postoperative pain remains a challenge, particularly in pediatric patients. Pressure algometry (PA) is a simple, non-invasive bedside tool that measures pain pressure threshold (PPT), inversely correlating with pain sensitivity. While adult studies link PPT to age, sex, and postoperative pain outcomes, data on adolescent populations are limited. This study assessed the predictive value of preoperative and postoperative day 2 (POD2) PPT in children undergoing the Nuss procedure, addressing gaps in adolescent pain perception.

Methods:

We enrolled children aged 8 and older undergoing the Nuss procedure under standardized anesthesia. Exclusion criteria included severe respiratory or cardiac conditions, BMI > 35, non-English speakers, and recent major surgeries with opioid use. Patients completed psychosocial and pain assessments preoperatively, and pain intensity, opioid use, and PPT were recorded preoperatively and on POD2 using a handheld digital algometer. Regression analyses evaluated associations between age, sex, PPT, and postoperative pain outcomes.

Results:

Age independently predicted PPT ($r = 0.29$; $p < .001$), with older children exhibiting higher PPT, but no significant sex differences or age-sex interactions were found for pain intensity or unpleasantness. Higher PPT values correlated with reduced opioid use despite higher reported pain on POD0–2. However, preoperative and POD2 PPT did not predict subacute pain or opioid use post-discharge.

Conclusion:

Pressure algometry is a reliable bedside tool for assessing pain sensitivity. Findings suggest younger patients exhibit greater sensitivity, perioperative variables do not influence PPT, and higher PPT may predict lower opioid use, despite higher pain reports.

Keywords:
Pain Sensitivity; Postoperative Pain; Pain Pressure Threshold; Acute Pain; Opioid Use

Mentor(s):
Vidya Chidambaran (Cincinnati Childrens Hospital Medical Center)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1490

Presentation Time: Session 3: 12:00-1:00pm

Predicting March Madness Bracket Accuracy: The Role of School Affinity in Final Round Forecasting

Business Case Study

Authors(s):

Avi Manik† (DSB); Ark Kedia† (DSB); Somansh Hamen Shah† (DSB); Anurag Koripalli‡ (DSB); Brady Ivan Yoder‡ (DSB)

Abstract:

This project aims to predict the likelihood that a submitted March Madness bracket correctly forecasts the tournament's final two rounds, incorporating school affinity as a key factor. Understanding how user preferences, geographic location, and historical performance influence predictions can give the NCAA valuable insights into fan behavior. Our analysis utilizes datasets containing user-submitted brackets, school affiliations, and tournament outcomes. We preprocess the data by handling missing values, removing duplicates, and engineering relevant features to improve model performance. We employ predictive modeling techniques, comparing Random Forest (RF) and Gradient Boosting (XGBoost) to assess their effectiveness in forecasting tournament outcomes. RF captures complex decision-making patterns and nonlinear relationships, while XGBoost optimizes performance through iterative learning. Model evaluation includes confusion matrices and AUC-ROC analysis to gauge accuracy and predictive confidence. Preliminary findings suggest that school affinity significantly influences bracket choices, mainly when teams are geographically closer to the user. Additionally, win-loss records and tournament seeding contribute to prediction accuracy. This research has broader implications for sports analytics, informing NCAA marketing strategies and enhancing predictive tools for fans and industry stakeholders. By identifying key behavioral patterns in bracket selection, our findings contribute to a deeper understanding of consumer engagement in collegiate sports and provide a foundation for future research in predictive modeling for sports events.

Keywords:

Kedia Ark; Koripalli Anurag; Manik Avi; Shah Somansh; Yoder Brady

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1491

Presentation Time: Session 3: 12:00-1:00pm

Using ABCD Data to Identify Cardiovascular Protective Factors Among Black Youth

Social Science

Authors(s):

Charles W Mann† (Pharmacy|JMHC); Blessing Adomale Lesi† (HHS|JMHC); Khanh Ha Nguyen‡ (Science|JMHC)

Abstract:

Racial health disparities in cardiovascular disease risk are well-documented, with much of the research suggesting that Black people experience some of the worst outcomes in the US. Inequality in cardiometabolic risk is often observable during childhood and adolescence and can persist into adulthood. Thus, adolescence represents an important developmental period for early detection of health risk and resilience, in service of implementing multi-level intervention. A potential source of resilience for Black adolescents is their involvement in social contexts, such as sports, church, and their families. These contexts can promote healthy living and build social networks that support physical activity, maintaining a healthy diet, and avoiding substances that pose a risk to heart health.

The present study uses longitudinal data from the Adolescent Brain and Cognitive Development (ABCD) Study to investigate whether playing sports, religious involvement, and family support act as protective factors against cardiovascular disease risk.

Youth participation in sports, viewed here as a potential protective factor, was reported by parents across all waves. Church attendance and various parental and family support variables were also investigated as potential protective factors. Analyses will include multi-level modeling estimating within and between subject changes in each cardiovascular disease risk factor at each time point, while assessing whether the potential protective factors predict better health outcomes over time.

Keywords:

Cardiovascular Disease; Sports; Religion; Waist Circumference; Obesity

Mentor(s):

Paul A Robbins (Purdue University); Amy Milin Loviska (HHS); Kayla Kiara Fisher (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Kristine Marceau (Purdue University)

Poster Presentation Abstract Number: 1492

Presentation Time: Session 3: 12:00-1:00pm

Leveraging Shape Memory Alloys (SMAs) to Assist in Thermal Actuation of Origami Antennas

STEM

Authors(s):

Adina Ioana Margineantu† (Science); Prisha Rachakonda‡ (Polytechnic); Tanya Vijay‡ (Engineering); Jacob Daniel‡ (Engineering|JMHC); Sishir Mahavadi‡ (Engineering)

Abstract:

We innovated the traditional antenna makeup to include origami inspired designs and properties. Regular antennas have limited regions from which they can receive signal, and their size and shape makes them complicated to operate in space. An origami antenna will be able to move dynamically to receive more signal and be folded for maximum space conservation, making large scale communication more easily achievable. Shape memory alloys (SMAs) are a set of alloys that change between their martensite phase at lower temperatures to their austenite phase at higher temperatures. In the martensite phase, the metal can be deformed into any shape whereas in the austenite phase, the metal “remembers” its previous shape and then returns to it as it cools down. By implementing SMA wires in the folds of our designs, we can manipulate the shape of our antenna based on changes in temperature and internal stress of the wire. While building a real prototype of our design, we hope to see how quick the thermal actuation of the antenna is and how accurately this can be done autonomously.

Keywords:

Aerospace; Origami; Antenna; Signal; Materials

Mentor(s):

Ran Dai (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1493

Presentation Time: Session 3: 12:00-1:00pm

Secure Remote Control Raspberry Pi with SSH and XMRig

STEM

Authors(s):

Samuel Joshua McBroom† (DSB); Jonathan S Carr† (Engineering)

Abstract:

We have been given a Raspberry Pi 4B. We really wanted to try a remote desktop feature, where we could remotely run and manipulate a program running on a Raspberry Pi from a Windows computer. This exists, but we wanted to do it ourselves. We plan on using secure shell (ssh) through a local terminal and using the XMRig platform to connect and manipulate the hardware. XMRig is a platform for mining Monero, and since neither of us have mined any crypto before, we thought it would be cool to try it while we're already using the platform. We will most certainly not be making any money, and we might not even bother setting up a crypto wallet, but it will be an engaging experience to better understand cryptography, secure shells, and secure network creation.

Keywords:

Raspberry Pi; Remote Access; Secure Shell; Cryptography

Mentor(s):

Stewart F Bauserman (Polytechnic); Steven R Dunlop (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1494

Presentation Time: Session 3: 12:00-1:00pm

The Impact of Colostrum versus Milk Replacer Feeding on Circulating Metabolites in Male and Female Neonatal Piglets

STEM

Authors(s):

Caeden Patrick Meade† (Agriculture|JMHC); Courtney Elizabeth Phillips‡ (Agriculture|JMHC)

Abstract:

Colostrum, the first milk produced by mammals, is rich in bioactive compounds that play a critical role in neonatal immunological development and metabolic transition to postnatal environment. However, its influence on metabolic biomarkers remains underexplored. This study investigated the impact of colostrum (COL) versus milk replacer (MR) or MR with whey protein (MRW) feeding on circulating levels of protein, glucose, antibodies, acetate, ?-hydroxybutyrate (BHB)and citrate at 24 h postnatal. We hypothesized COL animals will gain more weight and have higher protein than MR animals. At birth, 96 (male, n=47; female, n=49) piglets weighing 1.2 to 1.8kg were assigned to one of five treatments: Immediately euthanized after birth (zero hour; ZH), stay on sow to suckle colostrum (SOS), or fed every two hours for 24 hours at 20% of their birth body weight of COL, MR, or MRW. Blood was collected and serum was isolated. SOS and COL treatments gained more weight in 24 h than MRW and MR ($P < 0.05$). Serum protein and immunocrit levels were significantly greater in SOS and COL than other treatments ($P < 0.05$). Glucose levels were significantly greater in MR than all other treatments ($P < 0.05$). The analysis of other analytes is ongoing at Bindley. Findings of higher protein, immunocrit, and growth in COL versus MR are consistent with our hypothesis. Since additional protein in MRW diet did not affect circulating levels of protein, this suggests that COL plays a role in increasing protein absorption or synthesis.

Keywords:

[no keywords provided]

Mentor(s):

Theresa M Anderson (Purdue University); Linda Marie Beckett (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1495

Presentation Time: Session 3: 12:00-1:00pm

Expected Impact of Community-Based Education with People Experiencing Substance Use Disorder on Pharmacy Student Skill and Comfort Level with Patient Interaction

STEM

Authors(s):

Kylie Rose Miskovic† (Pharmacy|JMHC)

Abstract:

Pharmacists are healthcare professionals who are trained to care for and educate patients of all health statuses in many different sets of circumstances. A very vulnerable population in society are those recovering from substance use disorder. Currently, Purdue University's pharmacy curriculum does not incorporate any pragmatic component of interaction with members of this vulnerable population. Through a relationship between the Purdue student chapter of the American Association of Psychiatric Pharmacists and the Recovery Café,?a local organization that provides a safe space for people in recovery of substance use disorder or in any type of recovery, this project involves social behavioral research to evaluate growth in a pharmacy student's skill and comfort level as an individual and as a professional when interacting with people with substance use disorder. Another objective of this research is to determine the need to add community-based content to the pharmacy school curriculum to get pharmacy students familiar with interacting with members of vulnerable groups. Data is collected in the form of a pre- and post-survey given to a pharmacy student attending an event at the Recovery Café before and after, respectively. The survey contains a modified Bogardus social distance scale asking students about their comfort level with treating patients with SUD and open-ended questions about motivation. Quantitative data will be analyzed with a Wilcoxon signed-rank test. Data collection has been ongoing from March 2024 to present and has been approved by the institutional review board (IRB).

Keywords:

Substance Use Disorder; Recovery; Pharmacy Student

Mentor(s):

Carol A Ott (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1496

Presentation Time: Session 3: 12:00-1:00pm

Patellar Tendon biomechanical properties and serum markers in adults with Type II Diabetes

STEM

Authors(s):

lauren Mitevski† (Agriculture|JMHC); Matthew Addison Fortino‡ (HHS|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Type II Diabetes; Metabolic Disorders; Tendon Pathology; Injury; Obesity

Mentor(s):

Chad C Carroll (Purdue University); Eric Gutierrez (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1497

Presentation Time: Session 3: 12:00-1:00pm

Photocurable Gel Actuators with Engineered Microstructures for Enhanced Energy Density and Actuation

STEM

Authors(s):

Uday Mittal† (Engineering|JMHC)

Abstract:

Electroactive polymers (EAPs) are materials that exhibit significant deformation under an applied electric field, making them ideal for applications in soft robotics and artificial muscles. Dielectric Elastomer Actuators (DEA) actuators are popular, but are not ideal due to their large operating voltages. While PVC gels offer low-voltage operation and large strains, their laborious casting methods restrict the integration of complex microstructure geometries. In contrast, photocurable gels offer a more versatile platform for integrating engineered microstructures, due to their rapid and adaptable UV-curing process.

This research explores the use of a photocurable gel, composed of CN9018, to enhance actuator performance through the incorporation of cone/triangular microstructures. A novel fabrication process is employed: a positive resin mold is first created, from which a negative PDMS mold is cast. This PDMS mold then serves as a template for UV-curing the CN9018 gel, thereby imprinting the desired microstructure onto its surface.

The primary objective is to increase the energy density of the actuator by modifying its surface geometry. Actuator performance will be evaluated by measuring displacement at varying applied voltages, along with varying the contact length and effective electrowetting angle of the microstructures. Comparative analysis will be conducted against a baseline gel actuator without microstructuring, which uses a metal mesh cathode to provide deformation. By demonstrating that engineered microstructures can enhance actuator performance and reduce operational voltage requirements, this work shows promise for future applications in tunable optics and acoustic metamaterials, where energy-efficient, low-voltage operation is essential.

Keywords:

Soft Actuator; Robotics; Healthcare; Experimental; Microstructure

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Alex Chortos (Purdue University); Alhammam Burhan A Niyazi (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1498

Presentation Time: Session 3: 12:00-1:00pm

Stabilizing anthocyanins through pectin interactions

STEM

Authors(s):

Ashley Zaira Mohammed† (Agriculture|JMHC)

Abstract:

Blueberries (Vaccinium sect. Cyanococcus) are rich in naturally occurring pigments, anthocyanins, which contribute to their vibrant color. Anthocyanins are known for their anti-inflammatory and antioxidant properties. Despite these benefits, anthocyanins exhibit low stability under high pH and temperature conditions, limiting their functional potential in the body. Previous studies explored anthocyanin-fiber interactions to enhance anthocyanin stability. Pectin, a polysaccharide, was effective in forming electrostatic interactions with isolated anthocyanins, thus increasing their stability and bioactivity. However, little is known about pectin's ability to stabilize and retain the bioactivity of blueberry anthocyanins within a whole food matrix (WFM). This study aims to characterize within a WFM how blueberry anthocyanins complex with additional pectin before and after in vitro upper digestion. Anthocyanin-pectin complexes were prepared by combining blueberry powder and apple pectin in acidified water. Controls included blueberry powder without additional pectin and a mixture consisted of blueberry and pectin without the complexing treatment. Phenolic compounds including anthocyanins were extracted from the controls and complexes before and after in vitro upper digestion. Preliminary results suggest that additional pectin binds to blueberry anthocyanins within the WFM. Spectrophotometric assays will be used to analyze total monomeric anthocyanin concentration, total phenolic content, and antioxidant capacity in the phenolic extracts to assess bioactivity after upper digestion. Enhancing anthocyanin stability within a whole food matrix could maximize their functional benefits in the body.

Keywords:

[no keywords provided]

Mentor(s):

Lavanya Reddivari (Purdue University); Sarah Lee Eckrote (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1499

Presentation Time: Session 3: 12:00-1:00pm

Purdue Ivy Tech Chips Program Research Project

Social Science

Authors(s):

Sophia Moon† (Engineering); Jeevika Rajesh Purkar‡ (Engineering); Philip Hwanseo Lee‡ (Engineering); Vishwajit Laxmanrao Patil‡ (Engineering)

Abstract:

The CHIPS and Science Act of 2022 aims to expand the workforce in the semiconductor industry. This led to the development of informal education programs such as the PITCH program by Purdue University and Ivy Tech University. This two-week-long program provides rising high school junior and senior students with hands-on project experience to enhance their understanding of semiconductors.

This study collected qualitative survey data from the participants in this program. Data collection methods included pre-program and post-program surveys to analyze the type of person participating in a microelectronic and semiconductor summer program. Deductive coding is used to analyze the data by creating focus groups for reasons for participation in the program. These focus groups include interests, experience, career goals, and more. There were fifty-four participants in this study, and focus group transcripts and survey results of these applicants were used as data sources for this research.

By constructing participant profiles, these results are analyzed to identify patterns of engagement of participants and the type of people participating in the program. These findings will inform program developers for future program iterations by analyzing participant profiles, assessing the effectiveness of activities, and guiding modifications to the program. These results is utilized to see what type of person is or is not participating in an informal summer learning program, such as PITCH, and how participation in the program can be broadened to a larger audience.

Keywords:

[no keywords provided]

Mentor(s):

Shauna Nicole Adams (Engineering); Yash Ajay Garje (Engineering);

Kerrie Douglas (Purdue University); Morgan M Hynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1500

Presentation Time: Session 3: 12:00-1:00pm

Enhancing Bone Fragment Identification in Forensic Anthropology Using Machine Learning

STEM

Authors(s):

Jacob Ray Morales† (Engineering); Sidh Jain† (Engineering); Alessandra Rice† (Engineering); Tuan Minh Pham† (Science); Puruo Wang† (Science)

Abstract:

Bone fragment feature identification is crucial in forensic anthropology. Throughout history wars and conflicts have left behind countless unidentified remains, often reduced to small bone fragments. Extracting features from these remains is essential for identifying diseased individuals. Conventional methods involve tedious manual classification of fragments and despite its importance, limited research has explored advanced methods for fragment classification. This study aims to develop an efficient autonomous computational model utilizing machine learning and deep learning concepts to aid bone fragment classification. To address this, we utilized 3D scanned models of tibia and radius bones from deer, where images were rendered to build a 2D dataset for processing. Next, we preprocessed the data via contrast enhancement and data augmentation, followed by implementing feature extraction via Histogram of Oriented Gradients (HOG), Gabor Filters, and Local Binary Patterns (LBP). The final processed data was passed through a trained SVM (Support Vector Machine) learning algorithm. By combining advanced neural network architectures with strategic dataset utilization, our goal is to develop an accurate and efficient bone feature extraction model. Our findings can highlight the potential of computational methods in bone identification within forensic anthropology, offering a more efficient approach to streamline the classification process.

Keywords:

Machine Learning; Classification; Support Vector Machines; Anthropology; Bone Fragment Identification

Mentor(s):

Edward J Delp (Purdue University); Fengqing Zhu (Purdue University); Andrea Marie Tener (Purdue University); Carla Zoltowski (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1501

Presentation Time: Session 3: 12:00-1:00pm

Establishing temporal bone quality changes in progressive chronic kidney disease (CKD)

STEM

Authors(s):

Ishita Mukadam† (Engineering)

Abstract:

Chronic kidney disease (CKD) is a significant global health issue, is an under-recognized global health concern, causing more deaths annually than many other major diseases. Characterized by a gradual decline in kidney function, CKD leads to increased bone fragility and a 2-100 times increased fracture risk, which is associated with elevated mortality compared to individuals without CKD. However, detecting this risk through conventional gold-standard imaging methods is challenging. Thus, it is hypothesized that changes in bone water content occur before detectible alterations in bone minerals, offering a new biomarker for predicting bone fragility. This research investigates two crucial aspects of CKD-related bone deterioration. First, temporal changes were investigated in bone water content during CKD progression using novel biomedical engineering concepts including medical imaging, mechanical testing, thermogravimetric analysis (TGA), and infrared (IR) microscopic imaging. Additionally, a dynamic method was developed to quantify glycosaminoglycan (GAG) content in the cortical bone matrix throughout CKD progression. This involved using an Alcian blue staining procedure, followed by code to quantify staining intensity. Alcian blue binds to acidic mucopolysaccharides in bone's matrix which contains collagen, and thus binds to negatively charged glycosaminoglycans, providing a detailed analysis of their potential role in regulating cortical bone matrix water. This approach, combined with mechanical testing, TGA, and IR, was crucial in assessing bone hydration, structure, and molecular changes. These findings have potential applications in identifying new biomarkers for early detection of bone fragility and developing targeted therapies to address CKD-specific bone pathology.

Keywords:

Chronic Kidney Disease; Bone Water; Fracture Risk; Medical Imaging; Collagen

Mentor(s):

Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgement(s):
Renee Chantal El Miller (Engineering); Wikum Roshan Ban Ranasinghe Mudiyanselage (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1502

Presentation Time: Session 3: 12:00-1:00pm

Moon Clouds? Modeling an Ancient Lunar Atmosphere with Photochemical & Climate models

STEM

Authors(s):

Rowan Nag† (Science)

Abstract:

Recent studies have suggested the Moon may have once supported an atmosphere with a surface pressure comparable with that of Mars. This atmosphere would have been formed and sustained by the outgassing of volcanic volatiles by lunar mare. The greatest activity for this outgassing happened at around 3.5Ga with an established atmosphere lasting up to 70 million years, with the atmosphere primarily made of CO, S, and H2O. Current estimates of the volume of volatiles deposited into this atmosphere vary greatly. Similarly, the properties of the resulting atmosphere differ between outgassing estimates. Here, we use a 1-D atmospheric model, ATMOS, to further constrain the temperature, pressure, and chemical composition up of this paleolunar atmosphere. These atmospheric properties can then be used to predict volatile transport and deposition rates during this time in the Moon's history and aid in the search for in situ resources on the moon.

Keywords:

Planetary Atmospheres; Lunar Volcanism; Lunar Volatiles; Atmospheric Escape; Photochemical & Climate Models

Mentor(s):

Alexandria Vincenza Johnson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1503

Presentation Time: Session 3: 12:00-1:00pm

Ridership Prediction with external weather data

Business Case Study

Authors(s):

Bao Chau Chau Nguyen† (DSB); Kelly Ann Igo† (DSB); Lejia Zhou† (DSB); Anushka Sharma† (DSB)

Abstract:

This project utilizes machine learning models to predict public bus routes' ridership based on weather factors. By analyzing historical ridership data alongside weather conditions, the model aims to uncover patterns that influence passenger demand. The methodology involves data preprocessing, feature selection, and model training using software such as Excel, R, and Python. The goal of this project is to optimize bus operations by providing data-driven recommendations on fleet adjustments in response to weather conditions. By predicting ridership fluctuations, transit authorities can make informed decisions on adding or reducing buses, ultimately improving service efficiency and reducing operational costs. Model performance will be evaluated using error metrics and validation techniques to ensure reliability in real-world applications.

Keywords:

[no keywords provided]

Mentor(s):

Xing Wang (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1504

Presentation Time: Session 3: 12:00-1:00pm

Deep Neural Network approach for distinguishing the Higgs signal from background noise

STEM

Authors(s):

Joshua David Oberholtzer† (Science|JMHC); Sydney Metz† (Science|JMHC); Sri Krishna Teja Mannava† (Science); Thea Lee Bielejec† (Science|JMHC)

Abstract:

The purpose of this study is to develop a deep neural network or DNN model to classify and separate the Higgs Boson signal from background noise in data from the compact muon solenoid (CMS) detector at CERN. Being able to identify these signals accurately is essential for the advancement and the understanding of particle interaction. This study utilized datasets provided by Dr. Andreas Jung containing various variables, such as the Higgs mass and Z Boson masses. Using a supervised machine learning approach, a deep neural network was trained and validated to distinguish between signal and background events. Performance was assessed using training and validation loss, validation accuracy (AUC), receiver operating characteristic (ROC) and DNN score distributions. The results from the trained DNN demonstrated a good separation of the Higgs signal from the background noise with the ROC curve and AUC scores indicating sufficient accuracy. The DNN score distribution has a clear distinction between signal and background predictions. These results suggest that deep learning can significantly increase the efficiency of Higgs Boson identification and also highlight the growing role of machine learning in research using large datasets. However, measures need to be taken to avoid biases in data selection and to maintain integrity. The following are appended: (1) Python scripts for the data prior to processing; (2) Training and evaluation plots: loss curves, AUC scores, ROC analysis, and DNN scores; (3) Key physics variables used in the classification.

Keywords:

Higgs Boson; Deep Neural Network; Signal Classification; CMS

Mentor(s):

Heather Nicole Martin (Science); Andy Jung (Purdue University)

Other Acknowledgement(s):

Santosh Bhandari (Science)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1505

Presentation Time: Session 3: 12:00-1:00pm

Y-Branch Splitter Optimization using with Finite Difference Time Domain (FDTD) Solver

STEM

Authors(s):

Rohan Imhotep Ojha† (Engineering|JMHC)

Abstract:

We design and optimize performance of a Y-branch splitter using Lumerical's Finite-Difference Eigenmode (FDE) solver and calculations in MATLAB. Y-branch beamsplitters typically consist of a single-input waveguide that splits into two output-waveguides. A multi-mode beam is inputted, and modes are split into the two output branches. An effective beam splitter ensures minimal power loss, with approximately equal intensity in each output (~half input intensity).

In the initial design stage we establish links between key design parameters (e.g. materials, waveguide dimensions, junction angles) and performance, which is measured by power loss. We analyze effective indices, mode field distributions, and intensity profiles across different waveguide cross-sections. We tie performance characteristics to understanding of physics and practical applications of the Y-branch system discussed in previous research.

Next, we reproduce existing research that optimizes a low-loss Y-junction by varying waveguide widths using a genetic algorithm, and extend this research to different shaped junctions, namely introducing nonlinear output channels. Through this analysis we identify possible optimal design configurations for various applications considering practical limitations such as fabrication tolerances and spatial limitations. We tie our results to our understanding of Y-branch splitter behavior, and provide insight into its potential for usage in advanced photonic circuits. This work contributes to the field of integrated photonics, advancing knowledge of complex optical component design.

Keywords:

Optics; Lumerical

Mentor(s):

Vivek vasantrao Wankhade (Engineering); Jason Dwight McKinney (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1506

Presentation Time: Session 3: 12:00-1:00pm

DFT and LEC for AFTx07+

STEM

Authors(s):

Tei Okamoto† (Engineering); Cameron Thomas Patt† (Engineering)

Abstract:

The purpose of this project is to verify the physical layout and the logical netlist of the AFTx07+ is consistent with the design provided by the Digital Design team. The Cadence suite of tools were used to accomplish this task (ie. Genus, Innovus, Conformal) which were commanded by TCL and yaml scripts. For DFT, we want to implement scan chains on the physical chip to ensure that the chip's logic was not altered during manufacturing (ie. shorts, stuck at faults, transition faults). For LEC, Cadence Conformal is used to mathematically verify that the logic of the chip was not changed between different flow steps (ie. synthesis, routing, post-route, etc.). Once the chip is manufactured, the projects will ensure that the chip is testable and logically equivalent to the initial netlist provided by Digital Design.

Keywords:

Digital Design; Formal Verification

Mentor(s):

Mark Johnson (Purdue University); Matthew A Swabey (Purdue University); Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1507

Presentation Time: Session 3: 12:00-1:00pm

Distribution of Biosolid-Impacted Recreational Farm Ponds Contaminated with Per- and Polyfluoroalkyl Substances (PFAS) in Indiana

STEM

Authors(s):

Rachel Christine Quisil Ordiales† (Engineering); Sadie Grace-Lucero Keegan† (Agriculture)

Abstract:

Per- and polyfluoroalkyl substances (PFAS) are toxic, anthropogenic chemicals that are ubiquitous in humans and the environment around the world. During waste-water treatment processes, PFAS become concentrated in municipal biosolids, which are commonly applied to agricultural fields as crop fertilizer. During precipitation events, agricultural biosolid runoff might introduce PFAS into nearby aquatic habitats like recreational farm ponds, which are commonly stocked with popular gamefish, namely Largemouth Bass. Both longer-chain, or “Forever” PFAS, and shorter-chain PFAS “precursors” are frequently detected in municipal biosolids and can occur in biosolids-affected ponds and wetlands. Total PFAS body burdens increase with increasing trophic position, meaning top trophic-level predators like bass have significantly higher levels of PFAS contamination than their prey, and are a potentially significant route of human PFAS exposure. Despite farm ponds being common aquatic habitats across the United States, to date, no studies have examined PFAS fate in farm ponds, nor their bioaccumulation in gamefish like bass. The objective of this project will be to determine the distribution of all potential biosolid-impacted agricultural ponds that can sustain a Largemouth Bass population in Indiana, so statewide PFAS contamination of agricultural ponds can be further assessed through 1) pond owner surveys and 2) chemical analyses of field samples. Preliminary analyses in ArcGIS Pro have identified over 1000 ponds in Indiana that are within 100m of an agricultural biosolid-application site. Our study will help address the lack of available information on the distribution and impact of agricultural biosolid-application sites that affect nearby recreational farm pond ecosystems.

Keywords:

GIS; Ecotoxicology; PFAS; PFAS Fate; Biosolids

Mentor(s):

Andrew Charles Todd (Interdisciplinary & Special Programs); Maria

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Soledad Sepulveda (Purdue University); Youn jeong Choi (Purdue University); Linda S Lee (Purdue University); Tyler D Hoskins (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1508

Presentation Time: Session 3: 12:00-1:00pm

Adhesive Trends of Zein-Tannic Acid for Biomedical Use

STEM

Authors(s):

Franko Vinko Orszag† (Science); Donovan Kole Bear Godman† (Science)

Abstract:

Plant based adhesives that work in wet environments and at body temperature are appealing for biomedical applications. The purpose of our research project is to prepare a series of adhesive formulations from corn zein proteins and tannic acid to find trends in adhesion strength when applied underwater. Our research design includes preparing ten compositions with different ratios of zein to tannic acid. Each adhesive sample was applied underwater to metal substrates in saline solution at 37oC. Metal is used here as a model substrate because adhesion is relatively strong and trends can be evaluated easily. Adhesives were cured for one hour in saline solution, then removed from the water bath and immediately tested with lap shear. The maximum force at bond failure was recorded and divided by the surface area for at least five glued substrates. The adhesion data for all zein tannic acid compositions were summarized and presented as a function of composition. A maximum in adhesion strength was observed at a specified ratio of zein to tannic acid. This best adhesive composition is specific to the use on metal substrates in a saline environment and at 37oC. Our initial results provide a starting composition to be further formulated and evaluated for faster curing in the physiological environment.

Keywords:

Adhesive; Zein; Underwater

Mentor(s):

Gudrun Schmidt (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1509

Presentation Time: Session 3: 12:00-1:00pm

Investigating Embedded Sensing in Metamaterials for Thermal Management Applications

STEM

Authors(s):

Sonia Panchal† (Engineering|JMHC)

Abstract:

Pumped two-phase cooling can significantly improve heat dissipation capabilities in thermal management systems (e.g., data centers) but can also cause maldistribution problems and yield to fluid flow instabilities. Innovative sensing and flow controls can offer new pathways to develop new self-aware thermal management components. Specifically, Metamaterials can be engineered with a variety of materials and configurations, including bistable and multi-stable structures, and these structures can react to external stimuli and record the information based on the interaction. The use of bistable passive actuating sensors relies on the use of electrically conductive printed filament to sense and react to temperature variations. The project focuses on exploring different designs for a sensor and comprises the calibration and setting up of specific printers. Two 3D printed thermoplastics will be tested to achieve the objective of snap through by using the different coefficients of thermal expansion and pre-strain fields to trigger the snap-through actuation at controlled temperatures. Thermoplastic polyurethane (TPU) and polylactic acid (PLA) samples will be printed based on Abaqus modeling and tested in an environmental chamber. The application of the sensors can advance thermal management systems by responding to temperature and pressure changes. The goal is to ultimately create a system of bistable passively actuating sensors that can respond to temperature and pressure inputs and create a more robust and resilient thermal management system.

Keywords:

Bi-Stability; Filaments; Conductive; Thermoplastics; Snap-Through

Mentor(s):

Amanda Elizabeth Stone (Engineering); Davide Ziviani (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1510

Presentation Time: Session 3: 12:00-1:00pm

Retrofitting Legacy ICE Vehicles for Autonomous Operation: A Systematic Integration Approach

STEM

Authors(s):

Pratham Patil† (Engineering); Alexander Jonathan Collins† (DSB); Neal Noel Lobo† (Engineering); Bobby Gu† (Engineering); Jake Aron Brenner† (Engineering); Dean Michael La Point† (DSB); Jeet Brahmbhatt‡ (Engineering)

Abstract:

This project focuses on developing a cost-effective approach to convert an internal combustion engine (ICE) vehicle into an autonomous platform. Leveraging insights from an existing autonomous cart, we aim to retrofit the ICE system with advanced sensor arrays, electronic control units, and drive-by-wire mechanisms to enable self-driving capabilities. Our research involves a thorough assessment of the vehicle's mechanical and electrical architecture to identify key areas for modification.

We will integrate sensors such as LiDAR, cameras, and radar, and develop algorithms for sensor fusion, path planning, and obstacle detection. Safety protocols—including emergency stops and redundancy in critical components—will ensure robust operation. Testing will be conducted in controlled environments and real-world scenarios to evaluate performance and reliability.

Project Objectives and Future Work:

The research and development vehicle project will serve as a testing platform for AMP's racing kart and autonomous driving algorithm, demonstrating AMP's advances for potential grants and sponsorships. Initially, we will convert a go-cart into an electric autonomous vehicle, with plans to later convert a full-scale vehicle. The outcomes aim to provide AMP a competitive edge in the Autonomous Karting Series and further advance the performance of autonomous vehicles in the future.

Keywords:

Autonomy; Engine; Retrofitting; Conversion; Combustion

Mentor(s):

Shreya Ghosh (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1511

Presentation Time: Session 3: 12:00-1:00pm

Predicting Electric Vehicle Sales: A Model-Based Approach to Forecast Purchase Trends

Business Case Study

Authors(s):

Ricardo Andres Pena Rojas† (DSB|JMHC); Brandon James Rodarmel† (DSB); Colin Lucas Wellington† (DSB|JMHC); Alec Michael Walter‡ (DSB)

Abstract:

The goal of our research is to analyze if regional differences in electric vehicle make, model, and type are influenced by confounding factors like income, education, and employment rates. By comparing models with and without these controls, we aim to identify significant regional predictors. Our objective is to create a model that helps car dealerships, and manufacturers optimize their product mix and predict best-selling cars based on regional economic factors, improving preparation in an uncertain macroeconomic environment.

This study employs logistic regression and Naive-Bayes models to identify key predictors of electric vehicle sales across US regions. Descriptive statistics will provide insights into these predictors, while Naive-Bayes will explore trends among categorical variables, with box plots assessing mean differences. Model performance will be evaluated using RMSE for continuous data, F1-Score for classification accuracy, and MCC and PR-AUC to address class imbalance and optimize precision-recall balance in predictions.

This project aims to develop a predictive model that helps car manufacturers and distributors forecast the most successful electric vehicle types for major US regions based on past sales data. By optimizing product offerings, the model could increase profitability for sellers and manufacturers, while potentially boosting public support for electric vehicle adoption, contributing valuable insights to business practices and the broader field of predictive analytics. The data created from the model would be able to bring a competitive advantage for dealers who use it in order to influence the electric vehicles they offer to their customers.

Keywords:

EV Sales Forecasting; Predictive Modeling; Regional Market Analysis; Machine Learning in Business; Consumer Demand Prediction

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1512

Presentation Time: Session 3: 12:00-1:00pm

Temporal Coding in Viscoelastic Multistable Bits

STEM

Authors(s):

Mariana Peres Duarte† (Engineering)

Abstract:

Interest in mechanical computing has surged in recent years, but direct translations from digital to mechanical computation, especially in the context of von Neumann architectures, face scalability challenges. Neuromorphic architectures which rely on in-memory computing can help overcome these scalability constraints. Additionally, using mechanical properties, like structural stiffness, as a mechanism for information encoding and decoding paves the way to utilize these structures for memory storage and computing applications.

In this work, we explore the development of mechanical memory systems that utilize the mechanical properties of materials for information encoding and decoding. The mechanical memory abstraction we propose involves using asymmetric bistable structural bits and global stiffness to store and retrieve information. This is similar to how neurons store and process information biologically. Furthermore, the viscoelastic properties of the selected material allow for temporal stiffness modulation. Temporal coding is the mechanism by which information is encoded and decoded based on the timing of the events (i.e., by switching states and tracking the global stiffness of the system). We show that the time-dependent stiffness response augments mechanical memory storage if stiffness thresholds are established. This method could enable multiple logic operations to be performed at different time intervals using the same hardware, facilitating in-memory computation. We also experimentally validate the concept of order dependency when the system has two mechano-bits with dissimilar geometric properties. In this case, the order in which the mechanical bits are actuated yields a distinct temporal stiffness response that can further expand the system's memory capacity.

Keywords:

Mechanical Computing; Bistability; Viscoelasticity; Temporal Coding

Mentor(s):

Jose R Rivas (Engineering); Andres Arrieta Diaz (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1513

Presentation Time: Session 3: 12:00-1:00pm

Role of Histone Modifiers in Pathogenesis and Drug Resistance in C.glabrata

STEM

Authors(s):

Mateo Perroud† (Agriculture|JMHC)

Abstract:

Fungal infections are becoming an increasing global health concern, resulting in over 3.75 million deaths per year. One of the most common fungal infections is candidiasis, a fungal infection caused by members of the Candida genus. Currently, we only use three classes of drugs to treat candidiasis. Azoles are the first line of drug treatment for candidiasis due to their bioavailability, low cost, and low toxicity, and the other two drugs are echinocandins and polyenes. Unfortunately, drug-resistant isolates of C.glabrata have formed, which are resistant to both Azoles and echinocandins, making the development of new antifungals crucial. In C.glabrata, histone modifiers have been shown to regulate genes in pathogenesis and drug resistance. We have generated knockout mutants of histone modifiers, which have been shown to impact drug resistance and pathogenesis in C.glabrata. To probe the role of these histone modifiers in drug resistance and pathogenesis, we have had to generate double knockouts, some of which have been shown to be synthetically lethal. To overcome this obstacle, we have developed the auxin-induced degradation (AID) and second-generation AID2 system to degrade target proteins. These systems allow for the specific degradation of a protein with the addition of auxin or an analog 5-Adamantyl-IAA. We demonstrated the effectiveness of this tool in C.glabrata by knocking down a histone modifier relating to fluconazole susceptibility with the AID system, leading to decreased protein levels, increased fluconazole susceptibility, and similar gene expression to that of a knockout strain.

Keywords:

C.glabrata; AID; Pathogenesis; Drug Resistance; Fluconazole

Mentor(s):

Scott D Briggs (Purdue University)

Other Acknowledgement(s):

Victor Anthony Gutierrez Schultz (Agriculture); Smriti Hoda (Agriculture)

Poster Presentation Abstract Number: 1514

Presentation Time: Session 3: 12:00-1:00pm

Reaching Market Potential: A Garbanzo Case Study

Business Case Study

Authors(s):

Grace Elizabeth Peter† (DSB); Kaitlin Rose Otto† (DSB); McKenna Rae Toltzman† (DSB); Sydney Lynn Williams† (DSB); Kiersten Serenity Fisher‡ (DSB|JMHC)

Abstract:

Despite its prime location near Purdue University, Garbanzo Mediterranean Fresh is not fully reaching its market potential, as many local consumers remain unaware of the brand. This research aims to expand Garbanzo's consumer base, increase profitability, and provide broader marketing insights applicable to businesses targeting college students.

Using a mixed-method approach, our study will incorporate a focus group (6-12 participants), customer interviews, and a large-scale survey of Purdue students to assess brand awareness and the discovery process of Garbanzo. The focus group will explore consumer behaviors in discovering new businesses, while customer interviews at Garbanzo will uncover how current patrons first encountered the brand. The survey will provide quantitative data on brand recognition and consumer sentiment within the student population and visiting families; Garbanzo's most relevant target market.

Our anticipated findings will highlight the effectiveness and shortcomings of Garbanzo's current marketing strategies while identifying optimal approaches to enhance brand awareness and customer loyalty. The results will offer actionable insights for Garbanzo and other businesses seeking to maximize engagement within a university-centric market.

Keywords:

Brand Awareness; Marketing; Segmentation

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1515

Presentation Time: Session 3: 12:00-1:00pm

Close Calls: Evaluating Auto Annotation Accuracy in GeneMarkS and Glimmer in Bacteriophage Genomes

STEM

Authors(s):

Mia Cynthia Pfeiffer† (Agriculture|Engineering|JMHC); Lauren Marie Schinker† (Agriculture|Engineering|JMHC); Kole Allen Luckett† (Agriculture|Engineering|JMHC); Erin E Chapmond‡ (Agriculture|Engineering|JMHC)

Abstract:

Following discovery, characterization, and sequencing, bacteriophage genomes are categorized and annotated. Two major auto annotation programs used are Glimmer and GeneMarkS. As different algorithms, they assess genes differently, resulting in different gene start site conclusions and varying accuracy. Conditions influencing the accuracy of the programs were assessed. Through DNA Master, the accuracy of the programs were statistically analyzed in the conditions of conserved and nonconserved areas in the genomes of bacteriophages Skitty, AdaS, MrSmee, and RadFad. Analysis was specifically focused on the number of false positives and false negatives called by each of the programs within the two conditions. Statistical analysis showed there was a significant difference in the accuracies of the programs within the two conditions. Glimmer was more accurate in areas of conservation but had false positives in both conditions. Using case study observations within genes from Skitty, research was conducted into why Glimmer had a much larger value of false positives than GeneMarkS which had more false negatives. It was found that 25% of false positives by Glimmer had favorable results when reversed. While differences between the programs were discovered, ultimately using both programs provides the most accurate auto annotation results as the programs catch the mistakes made by the other. The differences discovered can be used to make auto annotations more efficient in future genome annotation. This allows for more bacteriophage genomes to be sequenced and added to the library for medical and food safety uses.

Keywords:

Bacteriophage; GeneMarkS; Glimmer

Mentor(s):

Kari L Clase (Purdue University); Julia Ann Simler (Agriculture)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Opeyemi Samuel Oduniyi (Agriculture); Marcelo Inaki I Guerrero Montalvan (Agriculture)

Poster Presentation Abstract Number: 1516

Presentation Time: Session 3: 12:00-1:00pm

Understanding sex and gender in past populations using new proteomics techniques

STEM

Authors(s):

julia Phelan† (Science); Gaia Rose Cannoot‡ (Science)

Abstract:

Traditional observational methods for sexing skeletal remains rely on subjective morphological analysis, which can lead to interobserver error. These methods are also unreliable for sexing juvenile remains as those individuals have not undergone puberty, therefore they lack the secondary and tertiary sex characteristics on which these methods rely. Proteomic sex estimation with tooth enamel is a promising method for analyzing archeological remains due to sample preservation, a comparatively low-cost, and application to juvenile remains. Amelogenin has varying isoforms, which are encoded by the X and Y chromosomes. Therefore, the identification of either peptide in each sample using proteomic methods indicates the presence of each chromosome, allowing for sex estimation. Our aim is to develop a proteomic sex estimation method to apply to remains in the Tombos Archeological Site collection. Proteomic analysis would aid in a irming the correlation between female sex and flexed burial position previously investigated, and in identifying the sex of the juvenile individuals in the collection. Sample preparation adapted from previous publications (Gamble et al., 2024; Rebay-Salisbury et al., 2020; Stewart et al., 2017) is currently undergoing optimization, and a targeted (PRM) proteomic method for ease of identification is also in development.

Keywords:

Sex and Gender; Sex Estimation; Proteomics; Bioarcheology

Mentor(s):

Michele Buzon (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1518

Presentation Time: Session 3: 12:00-1:00pm

Optical Rebrightening of Supernovae through ZTF Forced Photometry data.

STEM

Authors(s):

Shawanwit Poomsa-ad† (Science); Vincent Cody Stavig† (Science); Abhiansh Parwal† (Science); Marygrace Michelle Fagan† (Science|JMHC)

Abstract:

Optical rebrightening in supernovae light curves causes a significant increase in luminosity after the initial dimming phase after the explosion. To pinpoint the exact causes of rebrightening, a larger sample set is needed. The Zwicky Transient Facility (ZTF) is conducting a survey that has identified over 10,000 supernovae since 2018, however only a handful of these have been found to show this phenomenon. We will utilize forced photometry of ZTF light curves that allows for deeper analysis of faint signals. It is unrealistic to manually investigate each light curve to determine its features, including rebrightening. In this study, we aim first to leverage data from known rebrightening events to create a filter system to identify similar candidates. We will then evaluate our model on a data set comprising of thousands of unexplored forced photometry light curves. The filter will tag candidate rebrightening events, with a focus on rebrightening supernovae, allowing astronomers to determine whether follow-up observations on these objects and locations are warranted. Our model will enable subsequent analysis on reclassification of observed data and potentially identifying and helping to understand the origin of rebrightening events.

Keywords:

Physics; Astrophysics; Time-Domain-Astrophysics; Photometry; Rebrightening

Mentor(s):

Danny Milisavljevic (Purdue University); Dylan Scott Caudill (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1519

Presentation Time: Session 3: 12:00-1:00pm

Cracking the Code: Unveiling REU Experiences Through Data Analysis

STEM

Authors(s):

Jeeranun Poopanead† (Polytechnic)

Abstract:

Understanding the impact of undergraduate research programs requires more than just numbers it demands a deep dive into participant experiences. This study examines the final evaluations of a Research Experiences for Undergraduates (REU) program, leveraging qualitative analysis to uncover patterns and insights from 14 participants. Using NVivo, responses were trying to identify recurring themes and trends. Broad categories like “Persistence” were further refined into specific subthemes, enhancing clarity and depth. The research process involved defining each theme, highlighting key phrases, and selecting representative quotes to ensure an accurate portrayal of participant perspectives. By focusing on the research methodology, this study highlights the power of qualitative analysis in capturing the nuances of student experiences. The findings will provide valuable insights for improving REU programs and enhancing future research opportunities for undergraduates. This work demonstrates how structured data analysis can transform raw feedback into meaningful narratives that drive program development and student success.

Keywords:

Qualitative Analysis; Academic Development

Mentor(s):

Lisa B Bosman (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1520

Presentation Time: Session 3: 12:00-1:00pm

Real-Time Controllable Adaptive Numerically Controlled Machine Platform

STEM

Authors(s):

Alexander Popescu† (Engineering)

Abstract:

CNC machining aims to use precisely controlled cutting tools to remove material from a workpiece and form a pre-designed 3D part. However, vibrations during the cutting process, temperature fluctuations, varying tool sharpness, and more factors can affect the finish of the completed part. These factors are difficult to predict, especially as designs get more complex. This project aims to create a flexible NC machine platform to be used for research into investigating how to react to these variables in real time and avoid the negative effects they have on the finished product. We hope to be able to more effectively research this area using a variety of methods. An in-depth sensor suite mounted to the machine will create data that can be analyzed to predict the important factors ahead of time. We also hope that real time adaptations to variables in the cutting process like spindle speed can react to these variable changes using analytical and statistical methods to produce a more accurate machined product. Our main result will be the design and assembly of this platform, leading to new research opportunities in this field.

Keywords:

CNC; Machining; Data Analysis; System Integration; Composite Manufacturing

Mentor(s):

Garam Kim (Purdue University); Eduardo Barocio Vaca (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1522

Presentation Time: Session 3: 12:00-1:00pm

Understanding colloidal stability of two-dimensional Ti3C2Tx MXene using UV-Vis-NIR Spectroscopy

STEM

Authors(s):

Janvi Ishana Prasad† (Engineering)

Abstract:

MXenes are a diverse group of two-dimensional (2D) transition metal carbides, nitrides, or carbonitrides. Titanium carbide (Ti3C2Tx) is the flagship MXene that was first discovered in 2011 and has garnered >70 % of MXene literature. A couple unique features of Ti3C2Tx MXene include high electrical conductivity (~24000 S/cm) and solution processability (-30 to -50 mV zeta potential in water), positioning it as a promising material for a wide range of nano ink applications, from energy storage to biomedicine. Ti3C2Tx MXene is typically synthesized and stored in water and water-processability is an advantage for their scalability and industrial adoption as nano inks. However, the presence of water has been observed to break down the structure of MXenes over time, resulting in degradation due to hydrolysis-mediated oxidation. This study investigates the potential of using organic solvents to mitigate degradation and increase Ti3C2Tx MXenes shelf stability. We compared Ti3C2Tx MXene colloids stability and degradation in water to organic and green solvents, with the aim of enhancing their long-term viability for different applications. We used UV-Vis-NIR spectroscopy to track time-dependent changes in absorbance to gain insights into degradation and oxidation processes. By comparing how MXenes behave in water versus organic and green solvents, we explore crucial information about solvent-dependent colloidal stability. We also present strategies to reduce oxidation and extend shelf-life of Ti3C2Tx MXenes by solvent exchange. Understanding solvent effects on degradation mechanisms will enable more environmentally responsible approaches to MXene development and application.

Keywords:

2D Materials; Ethanol; MXene; Solvent; Stability

Mentor(s):

Babak Anasori (Purdue University); Anupma Thakur (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1523

Presentation Time: Session 3: 12:00-1:00pm

Further Study of Root Knot Nematode with Suppressive Soil Types

STEM

Authors(s):

Sonia Amaris Propst-Zuverza† (Agriculture)

Abstract:

[Abstract Redacted]

Keywords:

Root Knot Nematode; Suppressive Soil

Mentor(s):

Lei Zhang (Purdue University)

Other Acknowledgement(s):

Vijay Singh Kunwar (Agriculture); Marilyn Alexandra Vargas (Purdue University)

Poster Presentation Abstract Number: 1524

Presentation Time: Session 3: 12:00-1:00pm

Purdue Ivy Tech Chips (PITCH) Program Analysis Abstract

Social Science

Authors(s):

Jeevika Rajesh Purkar† (Engineering); Philip Hwanseo Lee‡ (Engineering); Sophia Moon‡ (Engineering); Vishwajit Laxmanrao Patil‡ (Engineering)

Abstract:

The PITCH Program expands the semiconductor workforce through informal education and hands-on learning. It aims to increase awareness and interest in semiconductors and microelectronics while broadening industry participation. Limited education access contributed to a lack of awareness about career opportunities. By engaging high school students in technical and career-focused activities, the program fosters early involvement. This research analyzes qualitative data from the PITCH Program to evaluate its impact on high school students' interest in engineering and microelectronics, identifying key themes that influenced engagement. This study examines how participation shaped students' perspectives by analyzing qualitative data using deductive coding and themes from focus group transcripts. Data was gathered from survey and application answers of 53 participants and focus group transcripts. Qualitative analysis was conducted through manual coding, categorizing responses based on predefined themes. This approach identified patterns in interest development and engagement with microelectronics and semiconductors. The study anticipates increased awareness and interest in semiconductor careers, along with the development of technical and problem-solving skills. Identifying areas where participants expressed heightened interest can inform future outreach. Findings may guide improvements in outreach strategies and curriculum design, supporting broader participation in semiconductor education and workforce development.

Jeevika Purkar (School of Mechanical Engineering), Sophia Moon (School of Mechanical Engineering), Vishwajit Patil (School of Engineering Education), Philip Hwanseo (School of Engineering Education), Shauna Adams (School of Engineering Education), Yash Garje (School of Engineering Education), Kerrie Douglas (School of Engineering Education), Morgan Hynes (School of Engineering Education)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
[no keywords provided]

Mentor(s):
Kerrie Douglas (Purdue University); Shauna Nicole Adams (Engineering); Yash Ajay Garje (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1525

Presentation Time: Session 3: 12:00-1:00pm

The Future of Biodegradable Implants: Enhancing Healing and Reducing Surgical Complications

Humanities

Authors(s):

Jeffrey Jesus Quintanilla† (HHS)

Abstract:

Biodegradable implants are a new type of medical device that has awakened great expectations. Because these implants are designed to gradually break down safely into the body, they do not need to be surgically removed once their work is done, potentially reducing complications and lowering health care costs. Standard biomaterials are available to ensure better safety, higher functionality, and better efficiency of biodegradable implants in such diverse applications as orthopedic, cardiovascular, and drug-delivery systems (Smitch et al., 2021). However, challenges remain regarding the controlled degradation rate and biocompatibility of these materials. In this exploratory research project, I analyze the advantages and drawbacks of biodegradable implants in contemporary medicine, especially concerning their use in bone regeneration and post-surgical recovery. As part of my investigation, I conducted a literature review including recent studies regarding biodegradable metallic implants such as polylactic acid and magnesium-base implants concerning their performance, biocompatibility, and their effect on healing and patient outcomes. Furthermore, I reviewed case studies on biodegradable implants for orthopedic applications, to assess their performance in practice. These studies highlight the need for biodegradable implants to enhance medical therapies while reducing complications such as the need for surgical removal of permanent implants. This investigation provides insights into the future of bioresorbable medical devices and advances in biomaterials development.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1526

Presentation Time: Session 3: 12:00-1:00pm

Quantitative Analysis of Shape and Topological Changes in Enveloping Cells during zebrafish epiboly

STEM

Authors(s):

Aakarsh Nagendra Rai† (Science|Graduate)

Abstract:

Epiboly in zebrafish is a critical process that depends on the coordinated thinning and spreading of the enveloping layer (EVL) and deep cells. Using high-resolution microscopy of embryos, we capture detailed data of EVL cells. The primary motivation is to understand how, zebrafish embryos develop under different circumstances and mutations. We then apply advanced image-processing pipelines to map three-dimensional data onto two-dimensional projections while preserving depth information enabling robust cell segmentation and 3D tracing. Through these computational methods, we extract descriptors—cell area, aspect ratio, circularity, neighbor exchange rates, and junction angles—to gauge the cell movement and arrangement. This will help us deepen our understanding of the cell behavior and morphology during epiboly. Currently, we're employing a neural-network for segmenting the 2d projections of the cells. But the model processes each frame independently and so we can't track the same cell across frames for analysis (different labels). So, we're measuring the cell overlap to make the labels uniform. Following this will be an analysis of the cell-neighbor changes for all the cells in the frames. This is to gain insights about cell behavior during epiboly. With our current tracking of cells across frames, our preliminary analysis suggests that the number of neighbor changing events reduce as epiboly proceeds, although the expectation was an increase. In the future we'll be exploring the cause of the disparity between the expected neighbor changes and observed ones. One possible explanation is the poor segmentation by our ML model which we plan on fine-tuning.

Keywords:

Image Processing; Cell Segmentation; Computer Vision; Machine Learning

Mentor(s):

Linlin Li (Purdue University); David M Umulis (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1527

Presentation Time: Session 3: 12:00-1:00pm

Impacts of a Potential TikTok Ban

Business Case Study

Authors(s):

Varsha Raj† (DSB|JMHC)

Abstract:

This study examines the potential effects of a looming TikTok ban on the marketing industry, with a particular focus on influencer marketing, shifts in marketing tool utilization, and changes in brand-generated content. Given TikTok's role as a dominant platform for digital marketing and brand engagement, its potential removal presents significant challenges and strategic adjustments for businesses.

Utilizing secondary data analysis, this research investigates key variables such as platform utilization, content types, and brand dependency on TikTok for influencer-driven campaigns. The study aims to provide preliminary data insights and outline a structured research process to assess the broader implications of a TikTok ban.

The expected findings will contribute to an understanding of how brands and marketers may need to pivot their strategies in response to platform restrictions, offering insights into alternative digital marketing approaches and influencer engagement strategies in a shifting social media landscape.

Keywords:

TikTok Ban Impact; Influencer Marketing; Marketing; Social Media Marketing

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1528

Presentation Time: Session 3: 12:00-1:00pm

Utilizing Participatory Action Research to Publish The First Yusku Mayangna Dictionary

Humanities

Authors(s):

Collin Thomas Reagin† (Liberal Arts); Prasiddhi Shivakumaran‡ (HHS)

Abstract:

Linguistic research on minoritized languages relies on community collaboration to ensure ethical and meaningful documentation. This study focuses on Yusku, a dialect of Mayangna spoken in Nicaragua, using Participatory Action Research (PAR), a method that fosters reciprocal engagement between linguists and community members. Rather than treating speakers as passive subjects, PAR involves them in every stage of research, from defining goals to analyzing linguistic data. Through this approach, the Yusku-speaking community expressed a need for a monolingual dictionary to support their school system and strengthen intergenerational language transmission.In response, external researchers and local speakers collaborated through training workshops to record lexical entries, refine linguistic analyses, and incorporate cultural context. These sessions also facilitated knowledge exchange, with linguists gaining deeper insights into the language's structure while community members developed linguistic analysis and documentation skills. After two years of joint effort, the dictionary was completed in December 2024, marking a milestone in Mayangna language preservation. Beyond this achievement, the project has spurred new goals, including expanding the dictionary, developing additional educational materials, and supporting language acquisition initiatives for children. This research demonstrates how PAR fosters sustainable language documentation by centering community needs and expertise. More broadly, it highlights the value of equitable, collaborative methodologies in linguistics and other disciplines, offering a model for ethical engagement with indigenous and minoritized language communities. By prioritizing mutual benefit, projects like this contribute to both linguistic scholarship and the preservation of cultural diversity.

Keywords:

Linguistics; Language Documentation; Indigenous Knowledge; Language Preservation; Indigenous Studies

Mentor(s):

Alyssa Alexandria Nez (Liberal Arts)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Elena Benedicto (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1529

Presentation Time: Session 3: 12:00-1:00pm

Metrology-Assisted Machining for Additively Manufactured Fiber-Reinforced Composite Tooling

STEM

Authors(s):

Nathan Thomas Rice† (Engineering|JMHC)

Abstract:

In additively manufactured composite tooling technology, additively manufactured parts require a post machining process due to the nature of additive manufacturing, stacking layers of material on top of one another. Since the surfaces will not be even, it becomes difficult to set references for the machining process. In the current state of technology, setting references requires many manual measurements, as well as approximations and guesswork. This leads to a time consuming and only somewhat accurate procedure to prepare the composite part for machining. Improving upon this process for composite manufacturing is critical compared to normal machining, as composite stock is manufactured to be extremely close to the final dimensions of the part, whereas normal metal milling uses stock with much more room for error.

This project aimed to enhance composite part machining accuracy while reducing setup time by integrating a laser scanning metrology system. Laser scanning was chosen for its high precision, producing 3D scans with only microscopic errors. A 3D scan of the manufactured part was generated and overlaid with its original CAD model. A best-fit algorithm was then applied to identify key reference points within the part, using the flat CAD surfaces as reference to the uneven surfaces of the additively manufactured scan. These reference points were then triangulated within the CNC machine's coordinate system, enabling an optimized machining path to be developed and executed with minimal manual intervention.

The development of this procedure involved reviewing and integrating existing methods in optical metrology, CNC touch probing, mesh analysis, and optical scanning improvements. The results demonstrated that the proposed approach successfully reduced setup time while maintaining or improving machining accuracy. The findings suggest that incorporating this procedure into the additive manufacturing workflow can enhance precision and efficiency in post-processing, making it a valuable step toward automating high-accuracy machining for composite materials.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Composites Manufacturing; Laser Metrology

Mentor(s):
Garam Kim (Purdue University); Rishabh Pammi (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1530

Presentation Time: Session 3: 12:00-1:00pm

Understanding the Effects of Co-Solvents in Enhancing Efficiency and Stability of Zinc Metal Anodes

STEM

Authors(s):

Emily Lucille Richardson† (Engineering|JMHC)

Abstract:

Aqueous zinc-metal batteries (AZMBs) have emerged as promising energy storage solutions due to their cost-effectiveness and environmental compatibility. However, their performance is often hindered by dendrite formation and parasitic reactions, such as hydrogen evolution and corrosion. These issues can be mitigated by introducing electrolyte additives or replacing pure water with a co-solvent. In this study, we investigate the effects of various co-solvents in zinc battery electrolytes and their influence on zinc deposition efficiency and side reactions. Electrochemical techniques, including fast-scan cyclic voltammetry (FSCV), linear sweep voltammetry (LSV), and chronoamperometry, are employed to analyze deposition behavior and reaction kinetics. Additionally, X-ray diffraction (XRD) and coin cell studies are done to study deposition morphology and long-term stability. Our results highlight the critical role of electrolyte composition in modifying zinc deposition, influencing charge transfer kinetics, suppressing side reactions, and enhancing zinc stability. These findings provide valuable insights into optimizing electrolyte formulations for improved performance and stability, contributing to the advancement of next-generation zinc battery technologies.

Keywords:

[no keywords provided]

Mentor(s):

Jeffrey Edward Dick (Purdue University); James Hoang Nguyen (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1531

Presentation Time: Session 3: 12:00-1:00pm

Assessing Arsenic Contamination in Soil: A Secondary Analysis of Airport Site Data

STEM

Authors(s):

Katelyn Riddle† (HHS); Jacob Alan Malone‡ (HHS|JMHC)

Abstract:

Arsenic is a naturally occurring element that may pose health risks when present in soil at elevated levels. Human exposure to arsenic primarily occurs through ingestion and inhalation, with children being particularly vulnerable to higher exposure due to hand-to-mouth behaviors and contact with soil. In 2022, the Indiana Department of Environmental Management (IDEM) established a residential soil guideline of 10 parts per million (ppm) for arsenic. This study aims to assess soil arsenic concentrations in Greater Lafayette and compare them with IDEM's guideline. This is a secondary analysis of a study investigating heavy metal concentrations in soil near Purdue University Airport. It is hypothesized that prolonged arsenic exposure exceeding the residential soil guidelines is more likely to be seen in off-campus residential areas. 180 soil samples were collected approximately every ~0.1 mile to 4 miles in a ring around the Purdue University Airport. Sample processing included, drying, sieving, and weighing the samples to ensure uniform density before using a portable X-ray fluorescence (XRF) monitor to determine arsenic concentrations. Preliminary results are currently available for N=161 samples. These indicate that the median arsenic concentrations are 9.95 ppm and range from 4 ppm to 36 ppm across the Greater Lafayette Area. Although not all sampling locations were in residential areas, N=74 (46.0%) exceeded the IDEM residential guideline. These findings emphasize the need for targeted soil assessments to protect public health in locations that involve prolonged soil contact. Further analysis is ongoing.

Keywords:

Arsenic; Heavy Metals; Soil; Residential Guidelines; Community Health

Mentor(s):

Ellen M Wells (Purdue University); Jung Hyun Lee (HHS)

Other Acknowledgement(s):

Emily G Marvel (HHS); Ashley Jean Hannah (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1532

Presentation Time: Session 3: 12:00-1:00pm

Rethinking Police Training to Prevent Deadly Force

Social Science

Authors(s):

Max A Ringger† (Polytechnic)

Abstract:

The use of lethal force in law enforcement is a highly scrutinized and controversial subject growing in the United States. This research identifies potential training improvements, including optimized de-escalation techniques, expanded mental health crisis training and the utilization of several alternative non-lethal tools such as Brazilian Jiu-Jitsu to enhance officer control. A comprehensive examination of case studies, civilian/officer mortality data, current police academy mandates and interviews with law enforcement professionals were undertaken to evaluate the effectiveness of existing non-deadly force tactics training. The aim of this article is predicated on the goal of minimizing the risk of lethal force. The factors of situational context, officer safety and real-world feasibility are considered and applied where applicable to ensure a holistic conclusion can be reached. As hypothesized, the results of the investigation reveal significant variance in training approaches with fluctuations in the dependency on force across police academies. In addition, it is apparent that alternative fatality avoidance measures are being underutilized. The implications of this research and the employment of new age alternative non-lethal tools have the potential to improve the public perception of police officers, and more importantly, to save lives.

Keywords:

Police; Deadly Force; Training; De-Escalation; Lethal

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1533

Presentation Time: Session 3: 12:00-1:00pm

A Comparative Analysis of Pure and Recycled Carbon Black on the Mechanical, Thermal, and Microstructural Properties of Mortars

STEM

Authors(s):

Akshay Makarand Risbud† (Engineering)

Abstract:

Concrete serves as the backbone for much of the world's infrastructure due to its durability and versatility. However, the production of one of its main compounds, cement, is linked to an important consumption of natural resources and to the emission of harmful pollutants. The introduction of nanoadditives in concrete has the potential to reduce the cement required to achieve a given performance. Carbon black, an aggregate nanomaterial derived from hydrocarbons, has amassed much attention for its filler capabilities and electrical conductivity in concretes. However, the cost makes pure carbon black an unviable option. The use of recycled materials addresses this issue, and that of abiotic depletion of natural resources. This project evaluates the use of pure carbon black (PCB) and recycled carbon black (RCB) on the mechanical and thermal properties of cementitious composites. Initial tests included characterizing select PCB and RCB products by size and chemical composition. Batches of three different mortars were fabricated; a reference mortar without nanoadditives, a mortar with 1% of PCB by cement weight, and a mortar with 1% RCB by cement weight. 6 prism samples were produced for each mixture, using a 28-day wet curing process. Upon curing, the mortar samples were subject to flexural and compression tests, and their thermal properties were analyzed. Understanding the attributes of both additives will provide a foundational understanding toward elucidating the role of RCB's in the concrete industry. Research findings will set the groundwork toward more resilient infrastructure utilizing sustainable construction materials.

Keywords:

Carbon Black; Recycled Materials; Nanoadditives; Construction Materials; Sustainability

Mentor(s):

Maria mirian Velay Lizancos (Purdue University); Rui Bai (Engineering); Aniya Edwards (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1534

Presentation Time: Session 3: 12:00-1:00pm

Impact Mechanics of Avian Collisions: Assessing Forces and Fracture Risk

STEM

Authors(s):

Kaley Roe† (Engineering)

Abstract:

Egg-laying hens experience calcium deficiency due to the abundance of eggs produced, which leads to osteoporosis and weakened bones. In cage-free housing, hens can move but at the same time interact with obstacles resulting in a prevalence of broken keel bone. Physical testing is needed to better understand how a complex body acts against impact forces. New insights will enable the designing of cage-free housing with reduced fracture risk, improved animal welfare, and enhanced egg production. This study aims to quantify the collision forces and impact distance experienced by avian subjects when they crash into obstacles. These measures are understood to describe the severity of the impact and the risk of keel bone fracture. A pendulum device was constructed to analyze an object of mass m with velocity v by hitting a force plate. The impact force and impact duration are directly measured. A compression loading set-up was built to measure the object's compressive resistance. The measured average impact force and impact distance are compared to theory of impact mechanics. To ensure accuracy, the system was validated using a silicone sphere before acquiring actual data from a broiler chicken body purchased from a supermarket. The study will report on impact forces and distances experienced by the avian body, comparing measured data with theoretical impact mechanics. This comparison will help assess the applicability of fundamental impact mechanics theory to avian impact analysis, ultimately contributing to the development of safer cage-free housing environments.

Keywords:

Impact Mechanics; Collision Forces; Compressive Resistance

Mentor(s):

Thomas H Siegmund (Purdue University)

Other Acknowledgement(s):

Charles Joseph Macwilliams (Engineering)

Poster Presentation Abstract Number: 1535

Presentation Time: Session 3: 12:00-1:00pm

Annealing Solutions for Large-Scale Nanophotonic Design Spaces.

STEM

Authors(s):

Vishruth Satuloori† (Science)

Abstract:

The fabrication complexity associated with large-scale nanophotonic surfaces and the computational complexity in designing optimal solutions means traditional optimization models struggle to navigate the complex design spaces and find optimal solutions. Simulated Annealing, Quantum Annealing, and Variational Classical Annealing (VCA) can navigate the complex design spaces while providing optimal solutions for the design space. The annealing solutions are implemented on the latent space that comes out of an autoencoder, and the algorithm then identifies high-performing regions with optimal solutions and high figures of merit. Implementation of activation functions such as ReLU and the Sigmoid function also makes it possible to further improve learning by eliminating linear learning, allowing for increased learning complexity, and can better define the solution space for a given design. Results are expected to focus on the implementation and performance of Simulated Annealing and VCA, with expected results showing Simulated Annealing outperforming VCA, followed by an exploration of the theoretical implications of quantum annealing, particularly on how an ideal realization of quantum annealing could outperform and provide unique advantages over the other two solutions. Future applications include applying these algorithms to develop and optimize single-photon emitters, as well as applications in machine-learning quantum device fabrication, such as the development of photonic circuits for linear optical quantum computing.

Keywords:

[no keywords provided]

Mentor(s):

Vea Iyer (Engineering); Yuheng Chen (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1536

Presentation Time: Session 3: 12:00-1:00pm

Mechanical Testing Standards for Tendon - Are they Equivalent?

STEM

Authors(s):

Sarah Schloff† (Engineering)

Abstract:

Tensile testing of tendon is used to characterize the mechanical properties of the tissue, however, a standardized method has not been determined. Currently, dog-bone shaped coupons are considered the “gold standard” for tensile mechanical testing due the uniform strain along the gauge length and subsequent fracture point in the gauge midpoint. This study compared the reproducibility and accuracy of tensile testing of Superficial and Deep Digital Flexor Tendon (SDFT and DDFT) with coupon geometries defined by 3 ASTM standards, 2 ISO standards, and 2 independently published protocols. Simulations of the tensile behavior of tendons were done in ABAQUS (SIMULIA) with a non-linear elastic model for all geometries. With these, strain maps over time and stress strain curves during elastic deformation were compared. Simulations showed that the circular gauge section concentrated stress at a single point, possibly caused by a stress riser created at the non-curved intersection between the grip and gauge section, which would lead to inaccurate measurements. Dog-bone geometries had differing elastic moduli, which could be a result of mechanical properties of tendon being non-linear and anisotropic due to the aligned fibers of the matrix. By examining the FEA of each standard, the results of ex-vivo mechanical testing can be estimated, which will then be validated to determine which geometry should be used in future studies.

Keywords:

Orthopedics; Regenerative Medicine; Tissue Engineering; Tendon

Mentor(s):

Dianne Little (Purdue University); Paula A Sarmiento Huertas (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1537

Presentation Time: Session 3: 12:00-1:00pm

Additive Manufacturing with Hybrid Continuous and Discontinuous Fiber Systems

STEM

Authors(s):

Thomas Edgardo Schmitz† (Engineering|JMHC)

Abstract:

Additive manufacturing (AM) of fiber-reinforced thermoplastic composites has gained significant interest in recent years due to its potential for rapid prototyping, design flexibility, and reduced material waste. AM using discontinuous fibers enables high-speed printing but compromises mechanical strength, whereas continuous fiber AM offers superior strength and stiffness but is constrained by low print speeds and weak interlayer adhesion. To bridge this gap, this research explores a hybrid approach by coextruding both discontinuous and continuous fibers, aiming to achieve high print speed and enhanced mechanical strength. Computational models will be developed in Abaqus FEA to predict the mechanical behavior of the printed material, accompanied by experimental trials that led to modifications of the coextrusion nozzle. Once optimal samples are obtained, tensile tests and microscopy will be conducted to evaluate mechanical properties and detect potential defects.

The expected outcome is developing a hybrid system capable of achieving an optimal print speed while exhibiting mechanical strength superior to discontinuous fiber composites but approaching that of continuous fiber composites. This study also aims to surpass the performance of dual extrusion methods by enhancing interlayer bonding, ultimately improving print quality. The development of such a system could significantly expand the applications of AM in industries such as aerospace, automotive, and robotics, where a balance between speed and mechanical performance is essential.

Keywords:

Additive Manufacturing; Carbon Fiber; Mechanical Engineering

Mentor(s):

Eduardo Barocio Vaca (Purdue University)

Other Acknowledgement(s):

Mohammed Abir Mahdi (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1538

Presentation Time: Session 3: 12:00-1:00pm

A Methodology for Detecting Helicobacter Hepaticus in an Inflammatory Bowel Disease Mouse Model Through Feces

STEM

Authors(s):

Sydnie Alexandria Scozzaro† (Science|JMHC)

Abstract:

Inflammatory bowel disease (IBD) is a spectrum of disorders characterized by distinct patterns of intestinal inflammation, a dysregulated intestinal immune response, and a dysbiosis of the gut microbiota. One gut microbe that can induce IBD in susceptible mouse strains is the gram-negative bacteria helicobacter (H.) hepaticus. In humans, H. hepaticus is not commensal and must be ingested, while in mice, it is commensal and is a part of the gut microbiome residing in the mucus portion of the cecum and colon. Previous studies have shown that H. hepaticus can be detected in the feces of mice, though the literature is limited. This project aims to critically evaluate a method for determining the presence and quantity of H. hepaticus in both normal and infected mice by extracting the bacteria's DNA through their feces, determining their presence with gel electrophoresis, and quantifying the amount of H. Hepaticus using qPCR. Here I demonstrate that our method was successful and could be routinely used to identify not only H. hepaticus in the feces of mice, but the methodology can be applied for any other chosen bacteria.

Keywords:

[no keywords provided]

Mentor(s):

Matthew Olson (Purdue University); Nicole L Anderson (Science)

Other Acknowledgement(s):

Valerie Phoebe O'Brien (Purdue University)

Poster Presentation Abstract Number: 1539

Presentation Time: Session 3: 12:00-1:00pm

Real-Time Health Monitoring: A Wireless System for Triboelectric Sensor Data Acquisition and Analysis

STEM

Authors(s):

Adam Jair Selby† (Engineering|JMHC)

Abstract:

Integrating wearable health sensors with wireless application platforms is transforming health monitoring practices. Skin-like Triboelectric Sensors are a promising alternative to bulky and rigid commercial devices. However, their subtle electrical outputs require complex circuit designs to integrate these devices into wearable wireless platforms. This project is focused on designing and implementing a system that effectively connects a triboelectric sensor to a wireless application for health monitoring, enabling real-time data acquisition and analysis with high data fidelity. The hardware component encompasses sensor interfacing, signal processing, and data transmission, while the software component emphasizes the development of efficient communication protocols, data visualization, and user interface design. By merging both hardware and software, this project aims to enhance usability, maintain racially unbiased accuracy, and extend battery life in health monitoring applications. The resulting system will contribute to the advancement of smart healthcare solutions, facilitating continuous and remote patient monitoring capabilities

Keywords:

[no keywords provided]

Mentor(s):

Wenzhuo Wu (Purdue University); Pedro Henrique de Souza Barbosa (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1540

Presentation Time: Session 3: 12:00-1:00pm

The Statistics Behind Fantasy Basketball: A Deep Dive into Category Leagues

STEM

Authors(s):

Karthik Selvaraj† (Engineering)

Abstract:

Daily Fantasy Sports (DFS) is a great way to engage with friends and connect over a common interest. DFS is an exciting hobby where participants draft players from a professional sports league to compete with other custom-drafted teams each week. In points-based leagues, players' box score stats are plugged into formulas to generate their earned "fantasy points". By the end of the week, the team with the most fantasy points wins. However, fantasy basketball allows users to score differently in "category leagues". In category leagues, fantasy teams aggregate individual stats to try and win the most categories. As a result, ranking and drafting players becomes much more complex. How do you compare players that specialize in different stats? This paper aims to review and analyze the approaches to drafting and ranking players in category leagues. We compare and contrast the methods used in point and category leagues, demonstrating the unexpected complexity behind category-based fantasy basketball. While most DFS participants like to use Z-scores for their analysis, we have found other statistical methods lead to more accurate, meaningful results such as the "G-score" and "H-score". We explore how these statistical tools along with machine learning methods can yield a more insightful analysis compared to traditional rankings from DFS providers. The goal of this paper is to provide participants with more robust tools for evaluating players in category-based fantasy basketball leagues. Future work may include how these methods can be applied to different types of leagues such as dynasty or rotisserie formats.

Keywords:

Statistics; Machine Learning; Daily Fantasy Sports; Fantasy Basketball; Basketball

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1541

Presentation Time: Session 3: 12:00-1:00pm

FatFs Kernel for AFTx07+ Microcontroller

STEM

Authors(s):

Aiden Hughes Sexton† (Engineering); Tushar Singh† (Engineering|JMHC); Hojun Choi† (Engineering); Dhruv Dipesh Shah† (Engineering|JMHC)

Abstract:

Having a file system is a key component of a modern operating system as well as advanced embedded systems. This project sought to implement the FatFs (File allocation table File system) in connection with a minimal kernel for the AFTx07+, a student-created RISC-V based microcontroller. The file system uses Secure Digitial (SD) card as the backing storage, which communicated with the AFTx07+ using Serial Peripheral Interface (SPI). The project is pre-silicon software, so FPGA emulation of the AFTx07+ is used for software development and testing. The project development is split into two key phases, the development of driver level software for interfacing with the SD card, and the development of a command-line interface, allowing for the manipulation of files.

A successful demonstration of this project will involve a command-line interface in which a user can format a disk for the FatFs, create/edit/delete files and directories, and traverse in and out of directories. This will demonstrate completion of the project's goals and function as an interactive demo of the AFTx07+. Additionally, it will lay the groundwork for more advanced work in the future, such as the creation of an operating system for the AFTx07+ or making use of FatFs to implement features such as loading and running program files from memory.

Keywords:

32 bit – RISC-V; FatFs; File System; Kernel; SD card

Mentor(s):

Cole Aaron Nelson (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1542

Presentation Time: Session 3: 12:00-1:00pm

Optimizing Machining Parameters for Additively Manufactured Fiber-Reinforced thermoplastic Composites

STEM

Authors(s):

Andrew R Sheedy† (Engineering); Sucheol Woo‡ (Polytechnic); Varunavi Kaveri Raghuraman* (Engineering)

Abstract:

Extrusion deposition additive manufacturing (EDAM) is employed to efficiently produce carbon fiber tooling molds with fiber-reinforced thermoplastic composites for aerospace components, wind mill blades, and more. Traditionally for such molds, large metal stock is machined requiring lengthy manufacturing times from the volume of material removed to achieve the final form. EDAM allows lighter, stronger molds to be made more efficiently as after production only finishing to the final tolerances with a 5-axis trimmer is necessary. This study seeks to investigate the optimal machining parameters for achieving high surface finish quality, as machining thermoplastics presents challenges such as delamination and fiber breakage. A purposeful experimental design will be selected and carried out to analyze the effects of spindle speed and feed rate on finish quality, which is crucial for the accuracy of the molded part. A surface finish tester will provide quantitative feedback by measuring the roughness of the machined surface. Data regarding audio, vibration, and temperature will be collected and analyzed to predict variables indicating finish defects. MTConnect will allow the measured data to be viewed simultaneously with machine data output values such as spindle load. Slower feeds (< 0.005 inches per tooth (IPT)), and higher speeds (> 500 surface feet per minute (SFM)) are expected to produce the smoothest surfaces (< 0.5 µm) with feed rate expected to be the primary determinant of surface roughness. Findings will improve future finishing operations on large scale additive manufacturing (LSAM) machines, increasing the quality of finished parts.

Keywords:

CNC Machining; Thermoplastic Composites; Additive Manufacturing; Machining Parameters; Optimization

Mentor(s):

Garam Kim (Purdue University); Eduardo Barocio Vaca (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Jiho Lee (Purdue University); Yuseop Sim (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1543

Presentation Time: Session 3: 12:00-1:00pm

Balancing Authority and Authenticity

Social Science

Authors(s):

Tyrone John Shields† (Engineering)

Abstract:

In high-stress military environments, leadership becomes strict and authoritarian, and individuals tend to take on a persona that is not genuine. Authentic Leadership entails self-knowledge, openness, consistency of behavior and values, and a focus on being yourself and not playing a "character." This research investigates the influence of leadership personas on the mental health and performance of individuals and teams and whether Authentic Leadership increases resilience and well-being through its effect on leaders' mental state and working relationships with subordinates. Recent coverage in the Washington Post discusses a study performed by the Marine Corps identifying the dangers of a false persona and attributes it to elevated rates of stress, loneliness, and suicide. Through an analysis of leadership psychology, military mental health research, and workplace stress literature, this study evaluates whether leaders who embrace authenticity experience improved personal well-being and stronger team cohesion. The findings contribute to the discourse on leadership development in high-stress professions, advocating for a model that balances authority with authenticity.

Keywords:

Mental Health; Authentic Leadership; Stress

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1544

Presentation Time: Session 3: 12:00-1:00pm

Automating the Discovery of Tidal Disruption Events

STEM

Authors(s):

Dean Patrick Shock† (Science); Tiancheng Zhang† (Science); Camden Michael French† (Science); Dominic J Harbin† (Polytechnic)

Abstract:

If a star travels too close to a supermassive black hole (SMBH), the star may be ripped apart by the immense tidal force of the black hole - a phenomenon known as a tidal disruption event (TDE). Ever since their discovery by Komossa and Bade in 1999, TDEs have been a fascination for astrophysicists due to the insights they provide on relativistic jet formation, early galaxy evolution, accretion dynamics and more. To date, only around 100 TDEs have been identified, which is not a big enough data set to do meaningful large-scale research on. Our goal is to automate TDE identification to provide a larger sample size of confirmed TDEs to aid SMBH research. To achieve this, we used data on transients provided by data brokers ANTARES and ALeRCE and sorted by survey type and distance from each transient's host galaxies to pinpoint specific transients that are likely to be TDEs. Going forward, we plan to use known TDE light curves as training templates for a machine learning model. This, combined with host galaxy information, will assist in identifying TDEs from the pool of candidates collected by the aforementioned sorting procedure, and help us achieve our goal of streamlining TDE identification.

Keywords:

[no keywords provided]

Mentor(s):

Ziwei Ding (Science); Danny Milisavljevic (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1545

Presentation Time: Session 3: 12:00-1:00pm

New Bayesian Methods for Fluorescent Lifetime Imaging Microscopy

STEM

Authors(s):

Ishaan Kartik Singh† (Science|JMHC)

Abstract:

Fluorescent lifetime imaging (FLIM) is a well-established method in biology for visualizing both the location and chemical environment of emitters within a cell, and has shown great promise in imaging metabolic molecules like NADPH/FAD, pH sensing, and indirect determination of molecular distances. In brief, FLIM determines and spatially maps the average time molecules take to fluoresce (their fluorescent lifetimes). This process is fundamentally quantitative, and accordingly, optimizing data analysis for extraction of lifetimes is of central focus in FLIM research. In this project, we have developed new Bayesian methods for lifetime determination in FLIM. These methods perform two key advancements: better informed data analysis specific to time-gated FLIM, a specific form of FLIM that enables use of ultra-advanced cameras, and more precise data analysis at quicker speeds via Hamiltonian Monte Carlo, a well-established statistical method in the Bayesian methodology. The combination of these two advancements allows us to reap all the benefits of Bayesian statistics within the context of FLIM, without the loss in computational efficiency typically associated with Bayesian data analysis. In particular, this method allows for priors to be used, to integrate any expectation researchers have about lifetimes, and propagates full distributions into any inferred parameters, allowing for easy visual analysis of uncertainty. Further development of this data analysis method will greatly benefit FLIM research and data analysis, and could even pave the way to real-time implementations of Bayesian methodology in FLIM

Keywords:

Bayesian; Fluorescence; Microscopy; Statistics; Physics

Mentor(s):

Jing Liu (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1546

Presentation Time: Session 3: 12:00-1:00pm

Gaseous Accretion onto Different Mass Eccentric Binaries

STEM

Authors(s):

Thomas Anthony Slamecka† (Science)

Abstract:

Interactions between a binary system and gas disk occur in a variety of astrophysical contexts. Binary evolution arises in protoplanetary disks in which planets are formed, stellar companions, and supermassive black hole binaries. Previous work has been done to analyze the interactions of a binary system with equal mass components. However, this does not accurately represent systems with large mass differences that are largely not understood, such as stellar and planetary systems. I aim to characterize unequal mass binary-gas-disk interactions through direct simulation. To accomplish this, I utilize DISCO: A 3D moving-mesh magnetohydrodynamics code designed for the study of astrophysical disks (Duffel, 2016). I focus my study on mass ratios of q = 1, 0.3, 0.1, and 0.01, the last of which being roughly ten times that of Jupiter and the Sun. Using simulations with linearly increasing eccentricity, I collect data for orbits with eccentricity ranging from e = 0 to e = 0.9. With simulated data, I individually model the gaseous accretion rate onto the primary and secondary masses from eccentricity e = 0 to e = 0.8 using Fourier coefficients derived in D'Orazio et al. 2024. I plan to use this data to extend the functionality of the open-source Python package "binlite" (D'Orazio et al. 2024) that rapidly generates accretion models of eccentric binaries. My version of binlite will account for unequal mass binary systems. I additionally calculate the time rate of change of semi major axis and eccentricity to determine the stability of eccentric orbits.

Keywords:

Astronomy; Simulation; Black Hole; Stars; Physics

Mentor(s):

Paul Cole Duffell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1547

Presentation Time: Session 3: 12:00-1:00pm

Acoustic Bioaerosol Removal in HVAC Systems

STEM

Authors(s):

Sohum Singh Sodhi† (Engineering)

Abstract:

Air pollution is one of the most critical global health challenges, contributing to seven million premature deaths annually. This is largely due to the limitations in conventional filtration systems. Even high-efficiency filters exhibit a Most Penetrating Particle Size (MPPS) range of 0.1–0.3 µm, where filtration is at its lowest. Among significant health risks, bioaerosols—including SARS-CoV-2, Influenza, and Rhinovirus—fall within this size range. To address these limitations, controlled acoustic waves can be applied to enhance filtration efficiency by producing radiation and streaming forces. Acoustic radiation creates pressure gradients that direct particles towards the filter, while streaming generates small vortices which restrict particle movement. Together, these forces prolong particle interaction with the filter and maximize capture efficiency. A bench-scale experimental setup was designed to study the effects of acoustics on particle behavior and filtration performance. Improvements in particle capture rates were measured under various acoustic conditions and particle compositions using data analysis. Our findings suggest that integrating acoustics into conventional filtration can revolutionize air purification systems by addressing the MPPS challenge. Future work will focus on optimizing acoustic parameters and scaling this technology for real-world applications.

Keywords:

Air Filtration; Bioaerosols; Acoustics; Particle Dynamics

Mentor(s):

Sudharshan Anandan (Engineering)

Other Acknowledgement(s):

David Warsinger (Purdue University)

Poster Presentation Abstract Number: 1548

Presentation Time: Session 3: 12:00-1:00pm

Evolutionary Psychology in Relation to Serial Homicide

Social Science

Authors(s):

Kayleigh Camryn Stuckwisch† (HHS)

Abstract:

The purpose of this research project is to investigate the connections between evolutionary psychology and serial homicide. The research will be gathered through various secondary sources such as books and articles on evolutionary psychology, serial murder, and possible connections. Research will also be conducted through consulting professors at Purdue University. This research and the findings will contribute to forensic science and the theories why the extreme behavior of serial homicide takes place.

Keywords:

[no keywords provided]

Mentor(s):

Catherine Jean Shukle (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1550

Presentation Time: Session 3: 12:00-1:00pm

Utilizing an FPGA as Off-Chip Memory

STEM

Authors(s):

Oscar Surendranath† (Engineering); Connor Matthew Lai† (Engineering)

Abstract:

Purdue University's SoCET designed and sent out for fabrication their newest SoC, the AFTx07 chip with revisions and support for new technologies. However, the current AFTx07 chip does not have on-chip memory. Our project involves the utilization of an FPGA, specifically the Artix-07, as off-chip memory to support the AFT chip. The FPGA can be coded to act as random access memory. We will be designing a PCB that connects the two via the FMC LPC connector standard allowing them to interface. The PCB will integrate power delivery for the AFTx07, pull-up/down resistors to stabilize floating inputs, and reverse-bias protection for voltage-sensitive I/O cells. It will include peripheral components such as status LEDs to enable real-time verification of the SoC's operations. This solution will not only enhance the AFTx07's memory flexibility but also establish a scalable validation framework for future revisions. The project will demonstrate the viability of FPGA-emulated memory in resource-constrained embedded systems, offering a cost-effective alternative to conventional SRAM architectures.

Keywords:

[no keywords provided]

Mentor(s):

Matthew A Swabey (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1551
Presentation Time: Session 3: 12:00-1:00pm

Performance of Plant-based Underwater Adhesives on Limestone Substrates

STEM

Authors(s):
Pim Rae Tee† (Science); Vaanathy Periyarselvan† (Science)

Abstract:
Nontoxic underwater adhesives that perform well under physiological conditions are essential for oral and dental applications. The degradability of a plant-based adhesive is desirable when the material needs to be removed on demand. The objective of our study is to investigate the performance of an underwater adhesive formulated from corn zein protein and tannic acid. The experimental design included the preparation and evaluation of a series of zein-tannic acid formulations and zein-only controls. These adhesive formulations were applied to limestone substrates underwater, then glued together and cured in saline solution at 37 degrees Celsius. Given some similarity in composition to calcium carbonate, limestone provided a cost-effective alternative model substrate to the more expensive hydroxyapatite coatings. The glued and cured limestone substrates were evaluated using lap shear testing. During testing, a glued substrate is pulled apart at a constant rate of extension while the pulling force is recorded. The adhesive strength was calculated by dividing the maximum force observed at bond failure by the value of the glued surface area. Our findings demonstrate a significant increase in adhesive strength with tannic acid concentration. The enhanced performance is likely due to the synergistic effect of corn zein's hydrophobic nature and tannic acid's ability to crosslink the zein while forming strong bonds to the limestone surface. The enhanced adhesive properties of this zein-tannic acid formulation hold significant promise for developing dental applications, where reliable bonding in moist conditions is critical.

Keywords:
[no keywords provided]

Mentor(s):
Gudrun Schmidt (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1552

Presentation Time: Session 3: 12:00-1:00pm

Chemogenetic Tools in Zebrafish: Visualizing and Manipulating Bioelectric Activity.

STEM

Authors(s):

Maitreyee Panini Telang† (Science)

Abstract:

Bioelectricity refers to the endogenous electrical signals generated and mediated by the movement of ions across the cell membrane. Bioelectricity plays crucial physiological roles in various biological systems and processes, such as embryonic development, regeneration, and cancer. Researchers have been using chemogenetic tools, DREADDs (Designer Receptors Especially Activated by Designer Drugs), and GEVI (Genetically Encoded Voltage Indicators), to manipulate and visualize in-vivo bioelectric activities in primate and murine models. Zebrafish have extensively been used for studying embryonic development and modeling diseases due to their advantages in tractable genetics and early embryo transparency. However, these tools are

not available in zebrafish. To visualize and manipulate in vivo bioelectricity, this study aims to apply and validate the function of DREADD and GEVI in the zebrafish model. We have generated a series of transgenic zebrafish lines. Each fish line contains a DREADD and a GEVI component under the UAS promoter, and the transgene insertion has been validated by PCR. This study aims to validate the GEVI reporter of the transgenic fish lines by crossing UAS-DREADD-GEVI fish lines with tissue-specific Gal4 fish lines. Our experiment shows that GEVIs are visible in some fish lines and indicates the tools can be employed to control membrane potential in zebrafish. We expect these zebrafish lines will serve as a valuable resource for research in bioelectricity across fields like neuroscience, cardiology, and developmental biology.

Keywords:

GEVI; DREADD; Bioelectricity; Zebrafish

Mentor(s):

Ziyu Dong (Vet Med); GuangJun Zhang (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1553

Presentation Time: Session 3: 12:00-1:00pm

Tomato pinworm (Keiferia lycopersicella) distribution and location analysis in Indiana High Tunnels

STEM

Authors(s):

Sydney Anne Territo† (Agriculture)

Abstract:

High tunnels provide shelter for plants as well as lengthen the growing season, making them advantageous for growers, and resulting in an increase in their implementation. Additionally, the use of high tunnels in urban agriculture has increased, due to their efficient use of space and the security they provide crops. However, plant pests that dwell in warmer areas, such as the tomato pinworm (Keiferia lycopersicella), may find the shelter and warmth that the high tunnels provide extremely beneficial. As a result, their populations flourish in these spaces and their damage becomes challenging to manage. This observational study investigates the distribution of tomato pinworm in high tunnel environments over the course of the growing season in Indiana. Through month-long trap counts, we will analyze the density of tomato pinworms found in locations throughout Indiana, comparing their distribution over time as well as comparing their density across location types. This study will provide new insights into tomato pinworm activity in high tunnels, with implications for the effects they have on farms of differing communities.

Keywords:

Entomology; Tomato; High Tunnel; Agriculture

Mentor(s):

Laura L Ingwell (Purdue University); Samantha Willden (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1554

Presentation Time: Session 3: 12:00-1:00pm

Leveraging LLMs for the prediction of Aphasia severity directly from Speech

STEM

Authors(s):

Emily Angel Tumacder† (Engineering|JMHC)

Abstract:

Aphasia affects effective communication and daily functioning. Current aphasia detection relies on diagnoses from speech pathologists after comprehensive examination. However, we can lower costs of clinical diagnoses with automatic aphasia diagnosis. We propose a user-friendly, end-to-end method of aphasia severity prediction through direct input of patient speech into pre-trained LLMs, without a need for intermediate score calculations or feature extractions. We compiled clinician-annotated conversational text from AphasiaBank (MacWhinney et al., 2011), which we performed partial cleaning on to use in LLM prompting. To implement Llama 3.2-1B-Instruct, we designed a few-shot prompt template that conducts a multi-class classification (severe, moderate, mild, latent) of the patient's conversation. We can apply this prompt to produce labels for large-scale clinical data. We performed an initial test on 500 lines of data. The model exhibited a 19.4% accuracy rate, having the highest individual accuracy of 44% when classifying severe utterances, the lowest individual accuracy of 3% when classifying mild utterances. Complex text inference requires multi-step reasoning difficult for a 1B parameter model to produce with just examples. The strength of the examples provided in the prompt is also a factor; mild utterance structure tends to vary and mimic that of other severities while severe structure is more distinct. Without a deeper knowledge of the structure, the model is likely to be confused. Further research can utilize finetuning of LLM to determine if there is any effect on prediction accuracy. At this stage, we can provide a promising approach to developing methods for automatic aphasia diagnosis.

Keywords:

NLP; LLM; Aphasia; AI; Linguistics

Mentor(s):

Yan Cong (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1555

Presentation Time: Session 3: 12:00-1:00pm

Wearable Electrochemical Sensors for Proactive Personalized Health

STEM

Authors(s):

Surya Pratheek Turaga† (Engineering|JMHC); Margaret H Prokopy† (Engineering|JMHC); Maria Therese Kufahl† (Engineering|JMHC); Vishakh Menon† (Engineering|JMHC)

Abstract:

Wearable sensors are becoming more prevalent in healthcare, as they allow for non-invasive and continuous remote monitoring of biomarkers in sweat, which can improve data collection and analysis for greater healthcare efficiency and diagnosis accuracy. Biomarkers are indicative of different physiological states, and tracking them effectively reveals valuable information about reactions to medical treatments, physical health, and even psychological state. Through measurement of galvanic skin response, temperature, and sweat, an enzyme-free electrochemical skin interfaced wearable sensor array can collect and transmit information via bluetooth to a microcontroller for sweat analysis. Our results will show that this sensor can conduct concurrent, continuous monitoring of a variety of biomolecules in sweat. Currently, most biomarker

testing is conducted through more invasive techniques like blood or urine samples, which require time and specialized equipment to analyze. Having a noninvasive wearable method allows for quicker and more efficient collection of biomarker data. The completed design will demonstrate that noninvasive wearable sensors have potential to replace current invasive detection methods with real-time monitoring. In the future, continuous tracking of important health markers can improve observation of various correlations to physiological conditions, leading to enhanced human health outcomes.

Keywords:

Wearable Technology; Electrochemical Sensors; Remote Healthcare; Microcontroller Programming; Nanomanufacturing

Mentor(s):

Wenzhuo Wu (Purdue University); Jing Jiang (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1556

Presentation Time: Session 3: 12:00-1:00pm

Spatial Prediction of Gaussian Processes with the Confluent Hypergeometric Difference Covariance Function

STEM

Authors(s):

Joseph Mitchell Van Valer† (Science)

Abstract:

In spatial statistics, modeling spatial processes requires an ability to quantify the physical properties of a random field. In particular, statisticians are interested in the expected value at each location and the covariance between data at two given locations. A common approach to the latter is the usage of isotropic covariance functions, which express covariance between a variable at two locations in a spatial random field as a function of their Euclidean distance. Several classical covariance functions such as the exponential, Gaussian, Cauchy, and Matérn classes provide distinct advantages, but tend to pose undesirable limitations. A statistician could ideally model the rate of decay of dependence at increasing distances (tail decay), smoothness of the process (differentiability), and whether spatial variable values are are negatively correlated at some distance (hole effect). Recent efforts have been made to construct a covariance function with controllable polynomial tail decay and differentiability, but without the possibility of the hole effect. In this presentation, we propose the Confluent Hypergeometric Difference covariance function, which repurposes the Confluent Hypergeometric covariance function to allow for all three: controllable polynomial tail decay, differentiability, and hole effect.

Keywords:

Spatial Statistics; Gaussian Process; Covariance Functions

Mentor(s):

Drew Yarger (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1557

Presentation Time: Session 3: 12:00-1:00pm

AWARE: A wearable self-powered smart pressure sensors for workplace injury prevention

STEM

Authors(s):

Dhruva Vedula† (Science|JMHC); Mrigas Ajay Iyer† (Science)

Abstract:

Work-related injuries incurred an economic cost exceeding $160 billion in the United States alone in 2020, prompting companies to invest heavily in safety hazard prevention. Inspired by these efforts, we propose a scalable framework for wearable self-powered pressure sensor networks to track and prevent hazardous ergonomic posturing and overloading in material handling in real-time. Our approach centers on developing a human digital twin powered by a low-cost, high-performance data collection system. The process begins with an orthogonal camera setup tracking human movements, extracting information on joint angles and displacements during load lifting. This visual data is then correlated with input from a triboelectric pressure sensing network integrated into the user's insoles and gloves. Leveraging machine learning algorithms, we train a model that enables the sensors to independently monitor ergonomic hazards without relying on camera input. The system utilizes this model to detect hazardous ergonomic working conditions in real-time, promptly alerting the employee via an ultra-low power Bluetooth module connected to a mobile application. By reducing the incidence of workplace injuries, this initiative aims to mitigate the negative impact on employees and alleviate economic burdens from work compensations and workforce depletion.

Keywords:

[no keywords provided]

Mentor(s):

Wenzhuo Wu (Purdue University); Pedro Henrique de Souza Barbosa (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1558

Presentation Time: Session 3: 12:00-1:00pm

Greyhouse Business Case Study: Increasing revenue with food sales

Business Case Study

Authors(s):

Ishika Vellaboyina† (DSB); Yeshua Hernandez† (DSB); Haley Genevieve Slaboch† (DSB); Katelyn Marie Hansa‡ (DSB); Kathleen Marie Soedel‡ (DSB)

Abstract:

Greyhouse Coffee seeks to increase sales of its food items, particularly at its Chauncey location. This case study aims to evaluate customer awareness of the cafes food offerings and assess the effectiveness of current marketing efforts, including in-store displays, signage, and digital advertising. Additionally, the research will identify key barriers preventing customers from purchasing food, such as price sensitivity, perceived quality, variety, appeal, and convenience. Finally, the study will explore potential incentives such as food and drink pairing deals that could encourage more food purchases. The findings will provide strategic recommendations to enhance food sales and improve customer engagement with Greyhouse Coffee's menu offerings. This information will be used by Greyhouse and cafe's alike that require information regarding food sales in their business structures.

Keywords:

Customer Awareness; Food Sales; Marketing Effectiveness; Consumer Behavior; Promotions

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1559

Presentation Time: Session 3: 12:00-1:00pm

Purdue Aerial Robotics Team - R&D Airframe and Mechanisms

STEM

Authors(s):

Robert Henry Walch† (Engineering); Elijah Temesgen Ponds† (Engineering); Ron Cheng Xuan Chay† (Engineering); Justin Sprangers† (Engineering|JMHC); Timber Michael Bionda‡ (Engineering)

Abstract:

This research aimed to identify the most efficient manufacturing processes for the VTOL while minimizing cost and time. The focus was on mold creation, carbon fiber layups, and 3D printing for wing cutouts and tilt rotor mechanisms. Building on last semester's work, which included a truss and bulkhead internal structure, carbon fiber fuselage, and foam core wings covered with monocoat, we explored mold-making options. While negative molds provide higher precision and smoother finishes, they require more material and machining time. We chose a positive mold, which offered sufficient accuracy at a lower manufacturing cost. For material selection, foaming was the fastest and most affordable option, offering adequate precision and ease of production. Regarding layups, we opted for wet layups due to team expertise, cost efficiency, and the desired final fuselage accuracy. For the wings, after evaluating various methods, CNC hot wire cutting proved to be the most efficient. Several test pieces were made to optimize cutting rates, wire temperature, and machine setup, resulting in an accurate and reliable process. Finally, for the tilt rotor mechanisms, we researched the correct tolerances for an optimal fit, ensuring smooth movement and strong support. After numerous 3D prints and tests, a tolerance of half a millimeter was determined to be ideal, excelling in all test cases.

Keywords:

VTOL; Mechanism Design; Aircraft Design; Composite Materials; Additive Manufacturing

Mentor(s):

Niall Patrick Moloney (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1560

Presentation Time: Session 3: 12:00-1:00pm

Physical Design Verification for a System on Chip

STEM

Authors(s):

Minghan Wang† (Engineering); Asavari Deshmukh† (Engineering); Yash Singh‡ (Engineering)

Abstract:

The increasing complexity of System-on-Chip (SoC) designs demands rigorous verification to ensure functional correctness and manufacturability before fabrication. Verification is critical in identifying and addressing design issues early in the development cycle, preventing costly errors in later stages. As part of the System on Chip Extension Technologies (SoCET) project, our Verification Team is dedicated to validating monolithic chip designs to ensure compliance with foundry specifications. Our team utilizes the Skywater 130nm process design kit (PDK) to run and debug key verification checks, including Design Rule Checking (DRC) and Layout Versus Schematic (LVS). These checks are performed using industry-standard tools such as Flowtool, Virtuoso, and Calibre, enabling us to detect and correct design rule violations systematically. The verification process is iterative, requiring continuous refinement of the layout to resolve detected errors and optimize the design for manufacturability. Through our verification flow, we have successfully executed DRC and LVS checks which identify key issues such as density errors, spacing violations, and discrepancies between the synthesized and the circuit diagram netlist(s). These findings highlight critical areas requiring adjustments to meet the foundry requirements. Additionally, we are working on addressing antenna errors and PNR (place-and-route) violations. Resolving these verification challenges is crucial as any unresolved errors can lead to fabrication failures or suboptimal performance in the final tapeout. By systematically refining the layout and optimizing the verification flow, our team contributes to the development of a manufacturable chip that meets industry standards.

Keywords:

Design Flow; SoCET; Verification; Physical Design; Semiconductors

Mentor(s):

Timothy Francis Hein (Engineering); Mark Johnson (Purdue University); Swapnil Bansal (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1561

Presentation Time: Session 3: 12:00-1:00pm

Differing Roles of Pediatric Physical Therapy in Children with Neurological Disorders

STEM

Authors(s):

Madeline Rose Wanninger† (HHS)

Abstract:

Pediatric physical therapy is pivotal in supporting children with neurological disorders, aiming to improve mobility, functional independence, and overall quality of life from a young age. While physical therapy interventions are known to contribute to motor outcomes, the extent of their impacts across various disorders remains an area of further exploration. Though traditional methods like Vojta and Bobath therapies prevail in some clinics, recent advancements such as virtual reality, robot-assisted gait training, and wearable exoskeletons introduce evidence-based methods that are tailored to individual neurological disorders. The research I reviewed provides an overview of newer, personalized approaches, while also incorporating diverse trials that evaluate both traditional and contemporary techniques. Each article highlights the significance of early intervention in helping pediatric patients reach developmental milestones, showcasing the effectiveness and availability of various therapeutic approaches. By analyzing these processes, along with their outcomes and limitations, this study seeks to provide a comprehensive understanding of the degree to which pediatric therapy techniques can be adapted to meet the diverse needs of children with neurological disorders.

Keywords:

Neurological Disorders; Intervention; Pediatric Physical Therapy; Motor Outcomes

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1562

Presentation Time: Session 3: 12:00-1:00pm

Responses To Transposition In Carolina Chickadees (Poecile carolinensis) Of Central Indiana

STEM

Authors(s):

Bruce Daniel Ward† (Purdue University); Rachel Pinto† (Science)

Abstract:

Bird song is typically used by male songbirds to attract mates and defend territory from rival males. Several songbird species have demonstrated an ability known as transposition where they change the frequency of elements of the song but maintain consistent ratios between notes. Black Capped Chickadees transpose songs, while the closely related Carolina Chickadees, despite having the ability to recognize and repeat tones, have not been previously shown to transpose songs. However, we have identified several populations of Carolina chickadees in central Indiana that clearly transpose their songs. We are currently studying eight Carolina chickadee populations, four of which use transposition and four that do not. Birds are presented with five different playback types: true transposition, transposition of only one note, and three songs that vary in frequency but that are not transposed.

Assuming that transposition carries information only where it is part of the repertoire, we predicted that transposing birds will respond more strongly to transposed playbacks compared to populations with no transposition. Contrary to our prediction, birds from all populations responded strongly to transposed songs. In addition, birds from the least disturbed sites responded with a diversity of songs, whereas birds from the most disturbed sites responded with a limited number of song types. Finally, birds from two transposing populations responded with transposed songs themselves and birds from the population with partially transposed songs responded with partially transposed songs. Our results indicate that transposition is a salient element of song repertoire even where birds do not use transposition.

Keywords:

Transposition; Animal Behavior; Auditory Responses; Chickadees

Mentor(s):

Jeffrey R Lucas (Purdue University)

Other Acknowledgement(s):
Jonathan B Jenkins (Science)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1563

Presentation Time: Session 3: 12:00-1:00pm

Otterbein Ecological Residential Improvement Plan

STEM

Authors(s):

Andrew Yang Waskin† (Agriculture)

Abstract:

This ecological residential project has 3 ecologically focused goals to drive a landscape design, but also improve the overall health of the environment to be sustainable for the homeowners under unique landscape conditions. The site is located in Otterbein, Indiana and has many underlying issues that will be addressed in this project, some of these include poor water quality and unique soil, which will be the primary issues to be addressed. Later, it will focus on how to establish a fish habitat in such unique conditions. Addressing these issues will prolong the health of the site as well as make it so that the client is immersed into nature and contributing to the health of the environment, while being able to live in the comfort of their home. The most important research question to inform the site design portion of this project is how the peat soil impacts the water and the livability of the site. The question is addressed through intensive consultations, case studies, and GIS data available to formulate science based conclusions. Utilizing that data, I am able to target specific areas around the site that will either be optimal or an area that needs dire improvements, such as areas of water pooling, shoreline erosion, and stormwater management while also being more specific to address the issues. I learned a lot through research and consultations, such as how peat soil is usually acidic in nature and is composed differently than other soils that leads to the release of a bunch of excess nutrients and composition to contain the water. In addition, lessons learned included a progressive order in establishing a fish habitat in terms of the abiotic and biotic factors that need to be introduced to create a successful habitat. This result drastically changes the development since the timeline and order of design needs to be worked around a little more and since there is more of a tighter schedule for the framework.

Keywords:

Ecology; Peat Soil; Fish Habitat; Landscape Architecture

Mentor(s):

Aaron W Thompson (Purdue University)

Other Acknowledgement(s):
Anna Aleksandro Paltseva (Purdue University); Jon G Charlesworth (Purdue University)

Poster Presentation Abstract Number: 1564

Presentation Time: Session 3: 12:00-1:00pm

Affordability of Prosthetic Devices

Humanities

Authors(s):

Emily Wei† (Engineering|JMHC)

Abstract:

The affordability of prosthetic devices is a significant barrier to accessibility for individuals with limb loss, especially in low-income communities. This exploratory research study aims to identify the key factors contributing to the high cost of prosthetics, including production-related expenses as well as systematic factors. This analysis is conducted through a review of articles covering the economic and structural challenges that limit access to prosthetic care, as well as existing studies that examine prosthetic developments and challenges. Results include factors like advanced materials and technologies, manufacturing techniques, long-term maintenance expenses, insurance coverage, and healthcare obstacles. By identifying these elements, this research seeks to contribute to a broader understanding of how technological and systematic factors intersect to raise prosthetic costs and provide insight into potential methods for reducing expenses and improving the availability of affordable prosthetic options, ultimately improving the quality of life for those who rely on them.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1565

Presentation Time: Session 3: 12:00-1:00pm

Arbuscular Mycorrhizae Fungi (AMF) Infection in Sorghum

STEM

Authors(s):

Victoria Pearl White† (Science)

Abstract:

Sorghum is a plant that can survive stressful environments more than other crops. Survival is enhanced by its beneficial relationship with Arbuscular Mycorrhizae Fungi (AMF) allowing the plant to get water and nutrients under stressful conditions. The purpose of this study is to characterize and quantify the presence of AMF infections in genetically diverse varieties of sorghum. Sixteen sorghum varieties were grown in a field with low nutrient levels. Each variety had three replicate plants collected and their roots were analyzed for AMF infection after Trypan Blue staining. Five root fragments from each plant were inspected under a microscope. Amounts of fungal hyphae in roots were ranked on a scale of zero to three, zero being no infection at all and three being highly infected. We found there was a significant difference in infection rates between the varieties with a p-value of 0.079 on a 90% confidence level. The variety ABJASIDO has the lowest mean infection rate, whereas P-721 and P898012 have the highest mean infection rate. These roots were, then, compared to the same varieties in a fertilized field, and there was no infection. There was also a statistical difference between the heights of genetically different varieties, with a p-value of 7.16E-05 on a 95% confidence level. It was also found that the majority of the varieties had other fungi present in their roots. This research can allow sorghum growers to selectively pick the varieties they can grow under stress conditions associated with changing climatic conditions and likely will reduce the amount of fertilizer needed for good crop growth.

Keywords:

Sorghum; Arbuscular Mycorrhizae Fungi

Mentor(s):

Cindy H Nakatsu (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1566

Presentation Time: Session 3: 12:00-1:00pm

Trafficking and signaling abnormalities of the EGFRvIII patient variant

STEM

Authors(s):

Samuel Alan Wieczorek† (Science|JMHC); Anna Maria Seebold* (Science|JMHC)

Abstract:

The Epidermal Growth Factor Receptor variant III (EGFRvIII), found in several aggressive cancers, is characterized by an in-frame deletion of exons 2-7, resulting in a constitutively active variant. Notably, EGFRvIII is absent in normal tissues, making it an attractive target for therapeutic treatments. In this study, we investigated the trafficking and signaling properties of EGFRvIII. Our results showed that cells expressing EGFRvIII triggered the formation of a unique, previously unidentified intracellular compartment that displayed nearly complete colocalization with early endosome and endoplasmic reticulum markers, indicating a hybrid Endosomal-ER nature. Furthermore, we identified EGFR's Ser1142 as a key residue needed for compartment assembly: specifically, the EGFRvIII-Ser1142Ala mutated variant was unable to induce hybrid-compartment assembly. Overall, our results indicate that the phosphorylation of Ser1142 controls the localization, trafficking, and stability of EGFRvIII. To identify the Ser/Thr kinases involved in Ser1142 phosphorylation, we next coexpressed EGFRvIII with dominant negative (DN) variants of kinases known to phosphorylate receptors such as EGFR. Our results showed a significant reduction in compartment formation when CamKIV DN is co-expressed with EGFRvIII. In contrast, a dominant positive CamKIV construct enhanced compartment formation, underscoring the essential role of the CamK family in vIII-compartment assembly while likely targeting Ser1142. Indeed, our work supports the indication that the phosphorylation of Ser1142 plays a role in regulating the localization, trafficking, and stability of EGFRvIII. This project aims to unravel and characterize the molecular mechanism by which EGFRvIII disrupts intracellular physiology, providing the foundations for the development of innovative cancer therapies.

Keywords:

EGFRvIII; Ser1142; Ser/Thr kinases; Cancer; Trafficking

Mentor(s):

Ruben C Aguilar (Purdue University); Sneha Subramanian (Science)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Kathryn Marie Myers (Purdue University)

Poster Presentation Abstract Number: 1567

Presentation Time: Session 3: 12:00-1:00pm

The Fight for Gender Equity in Drug Trials

STEM

Authors(s):

Alexandra M Wildridge† (Science|JMHC)

Abstract:

Historically, women have been underrepresented in clinical trials, with a federal ban preventing female participation being overturned in only 1993. Consequently, many medical technologies, procedures, and medications that we utilize to this day are based on their function and success within only the male population. This exclusion poses significant risks, as hormonal fluctuations and other biological differences can impact drug metabolism, efficacy, and side effects. Additionally, menstruation is frequently treated as a confounding variable in drug trials rather than a factor that needs studied. This research utilizes a systematic review of medical literature and policy to evaluate barriers to female participation in clinical trials, including recruitment practices and sociocultural factors, while also highlighting ongoing efforts and recommendations to improve representation. After careful examination, it was evident that improvements in representation have been made, but there are still large gaps. By identifying key areas for reform, this work ultimately aims to advocate for equitable medical research that ensures safer, more effective treatments for women.

Keywords:

Healthcare; Feminism; Medicine; Gender Studies; Clinical Trials

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1568

Presentation Time: Session 3: 12:00-1:00pm

Memory Subsystem Implementation for Accelerated Matrix Processor

STEM

Authors(s):

William Wong† (Engineering); Yue Yin† (Engineering); varun Vaidyanathan† (Engineering|JMHC)

Abstract:

We have designed a memory subsystem for a systolic array, serving as the central hub for interconnectivity between the instruction set architecture (ISA), systolic array, and scheduling subsystems. Our approach involves developing an architecture that includes an instruction cache (i-cache) for fetching instructions, a data cache (d-cache) for scalar values, a memory arbiter to manage data flow, and a scratchpad to house memory banks and handle outputs to the systolic array. To validate our design, we will test it using a flip-flop array with a counter, first verifying values stored and loaded like in a normal RISC-V processor and then create our own test cases to verify our scratchpad.

The i-cache and d-cache are made to be reconfigurable depending on any necessary block organization. The i-cache will be optimized to handle instruction retrieval, while the d-cache will be configured to store scalar values for the operations performed by the systolic array. The memory arbiter will direct the flow of data by giving first the scratchpad, then the d-cache, and finally the i-cache priority to the ram. This scratchpad will serve as an intermediary, providing two FIFO buses to transmit matrix inputs and weights into a multiplexer feeding into the systolic array. The scratchpad is implemented as a split transaction software managed cache to be able to handle multiple requests from different sources simultaneously.

Keywords:

[no keywords provided]

Mentor(s):

Anand Raghunathan (Purdue University); Sooraj Chetput Venkataraghavan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1569

Presentation Time: Session 3: 12:00-1:00pm

A Comparative Narrative Review to Improve Tobacco Health Issues in Rural Indiana

Social Science

Authors(s):

Mallory Caroline Young† (HHS|JMHC)

Abstract:

Introduction

Indiana reports higher tobacco use and lung cancer rates than the national average,1especially in rural communities facing limited tobacco policies and healthcare access. This study provides evidence-based recommendations to reduce tobacco prevalence in a 100% rural county in Indiana.

Methods

A comparative analysis was conducted by gathering data on demographics, tobacco programs, and healthcare access from three Indiana rural counties – one with the highest smoking rates (100% rurality), one with the lowest smoking rates (81% rurality), and the study county. Data from the US Census, Indiana Department of Health, and local health departments were compared to identify similarities and differences across the counties to provide initial recommendations for future actions as well as further research.

Results

Demographic factors were similar across the three counties - median age (41-43 years), race (93.1% -- 94.3% white), and median income ($62,526-$71,084). However, there were differences in new lung cancer rates and tobacco control programs. The county with the highest smoking rates and the study county had higher new lung cancer rates (0.09%) and lacked an active tobacco control program. Contrarily, the county with the lowest smoking rate had a new lung cancer rate of 0.06%, a smoke-free hospital, tobacco cessation programs, and an active tobacco coalition.

Conclusion

This study has three main recommendations for the study county: 1) Develop tobacco cessation programs within healthcare institutions, 2) collaborate with healthcare institutions to adopt smoke-free policies on

their campus, thus de-normalizing smoking and protecting residents from second-hand smoke, and 3) develop an active tobacco control coalition.

1. https://www.in.gov/health/tpc/files/Adult-Tob-Use-updated-10.23.2023.pdf

Keywords:
Tobacco; Rural; Cancer; Smoking; Indiana

Mentor(s):
Omobukola Otoise Usidame (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1570

Presentation Time: Session 3: 12:00-1:00pm

Development and Testing of the QSPI on FPGA

STEM

Authors(s):

Cecilie Zhang† (Engineering); Renzhi Yongtian† (Engineering); Atharva Umesh Bhide† (Engineering)

Abstract:

This project focuses on developing and testing the QSPI Interface on the AFTx08, a 32-bit RISC-V system on chip (SoC). The Quad Serial Peripheral Interface (QSPI) is an advancement of the standard Serial Peripheral Interface (SPI) with a faster data transfer rate. Standard SPI uses one communication line which might limit speed and efficiency in certain applications. The QSPI improves on this by having four communication lines in parallel and it can be used in either single, dual, or quad mode. Due to QSPI's increased bandwidth, it's often used when high-speed data is crucial, for example in flash-memory operations for faster write and read access. Additionally, QSPI supports XIP (Execute in Place) which means that it can execute code directly from external flash memory without loading it to the RAM. This is highly beneficial for the AFTx08 which has limited on-chip RAM. Following further testing on a FPGA and improvement of the RTL, we aim to integrate QSPI as a replacement for the current SPI on the AFTx08. This will not only improve the overall performance but at the same time also provide a robust framework for future teams that will work on the AFTx08.

Keywords:

[no keywords provided]

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering); Cole Aaron Nelson (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1571

Presentation Time: Session 3: 12:00-1:00pm

SoCET Synopsys Flow & Memory Compiler

STEM

Authors(s):

Robert Yida Zhang† (Engineering|JMHC); Nathan Nanchuen Yu† (Engineering)

Abstract:

We are creating a Synopsys design flow and leveraging its extensive suite of EDA tools to enhance our chip design and manufacturing processes. Our primary goal is to bring the AFT-X07+ chip through a completely new Synopsys flow into a GDSII file that can be fabricated. Synopsys distinguishes itself from other EDA suppliers with a broader portfolio, particularly in its IP offerings as it is the largest IP licensor in the industry. This also means we have more access to higher quality PDKs including TSMC180, which we hope to add support for and use for AFT-X07+ and future chips. Our goal is a tapeout-ready Synopsys flow that can be used for current and future tapeouts.

A key component of Synopsys's offerings is Memory Compiler, a tool that generates optimized memory blocks for specific PPA constraints and integrates with leading PDKs. As modern applications require high-speed data processing, customizing memory configurations is critical for achieving efficient, performant designs. We will familiarize ourselves with and use Synopsys Memory Compiler to add support for a developed PDK and implement an SRAM banking model to produce custom SRAM bank layouts. By partitioning SRAM, we can manage concurrent access, significantly improving data throughput and overall system performance.

Looking ahead, this new Synopsys flow will streamline our design process and lay the groundwork for future developments in DFT, unified metrics, and more. We plan to develop a parallel memory access system with a sophisticated memory controller to manage simultaneous data requests and improve scalable performance.

Keywords:

Synopsys; Design Flow; SRAM; Parallel Memory

Mentor(s):

Timothy Francis Hein (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1572

Presentation Time: Session 3: 12:00-1:00pm

Losing Credit on Credit Cards?

Humanities

Authors(s):

Hantao Zhang† (HHS)

Abstract:

Many individuals purchase goods with a credit card, because it is convenient and safe. However, a result of this behavior is that these individuals may pay additional fees leading to greater debt. According to research, the number of credit cards owned by US person that only pays the minimum balance rose to 10.75%, a 12-year high from July to September 2024. That means they are going to suffer from an annual APR of 20% on average. What's more, there is a late payment fee from 25-40 every month based on different banks.

In my research, I explore the causes for rising American credit card debt, how much debt and fees they need to pay, and the solution to this problem. To better understand this issue, I conducted a literature review including peer-reviewed essays and popular sources. I also interviewed 10 students at Purdue about their credit card usage and their ability to pay the debt. My research is important because we can understand the operation strategy of the credit card company. What is more, saving money little by little will end up saving a lot, and my research can help Purdue students.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1573
Presentation Time: Session 3: 12:00-1:00pm

Solar Energy Map of Mars: Modeling PV Energy Yields on Mars

STEM

Authors(s):
Kira Xinran Zhong† (Engineering)

Abstract:
[Abstract Redacted]

Keywords:
Solar Panels; Mars; Energy

Mentor(s):
Peter Bermel (Purdue University); Muhammad A Alam (Purdue University); Jabir Bin Jahangir (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1574

Presentation Time: Session 3: 12:00-1:00pm

How Students Interpret Variability between Categorical and Quantitative Scatter Plots

STEM

Authors(s):

David H Zis† (Agriculture)

Abstract:

The use of mathematical and statistical skills, known as quantitative reasoning, plays a crucial role in the growth of students' capabilities within Science, Technology, Engineering, and Math (STEM) fields. One skill crucial for students includes interpretation of data displays. Within data visualization, understanding variability and statistical terms is useful for most people, regardless of occupation or field of study. This study sought to measure student's understanding of variability within different graph types. First, we conducted 29 undergraduate student interviews among a wide range of demographics. Students analyzed various bar graphs, categorical scatterplots (categorical on x-axis and quantitative on y-axis), and quantitative scatterplots (quantitative variable on each axis). We asked them to define variability at the start and end of each interview as well as how difficult they found interpreting the variability in each graph. Each student drew a trend line on a quantitative scatterplot and a mean line on a categorical scatterplot. We analyzed student answers by graph type using descriptive coding to look for trends. We found that students favored bar graphs and least preferred categorical scatterplots. Students used various aspects of the graph and focused on different points to draw mean and trend lines. Nine students' definition of variability remained the same after the interview while the 20 others changed. Because categorical scatterplots display the data with more transparency, we recommend instructors incorporate categorical scatterplot construction and analysis in their classrooms where appropriate.

Keywords:

Graphs; Variability; Interpretation; Statistics

Mentor(s):

Lauren Stoczynski (Purdue University); Stephanie M Gardner (Purdue University)

Other Acknowledgement(s):

Anna McCoy (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1600

Presentation Time: Session 4: 1:30-2:30pm

Elevated Oxidative Stress in the Anterior Cingulate Cortex of Welders Exposed to Manganese

STEM

Authors(s):

Lissette Mariel Aguiar† (HHS|JMHC)

Abstract:

Manganese (Mn) is essential for metabolism and cognition but can cause motor, cognitive, and psychiatric impairments at high levels. Previous research found increased gamma-aminobutyric acid (GABA) in the thalamus of welders exposed to Mn. This study examines Mn's impact on metabolism, oxidative stress in the anterior cingulate cortex (ACC), and its relation to motor function.

Thirty-one welders, 25 non-welding factory controls, and 12 university controls underwent imaging with a 3T Siemens MAGNETOM Prisma MRI scanner. Magnetic Resonance Spectroscopy (MRS) with a HERMES sequence measured GABA, Glutamate+Glutamine (Glx), and the antioxidant glutathione (GSH). Motor function was assessed using the Unified Parkinson's Disease Rating Scale (UPDRS), and air sampling measured workplace Mn and Fe exposure.

Mean Mn air levels were significantly different across groups ($p < 0.0001$), with welders at 200.5±227.1 µg/m³, factory controls at 4.8±2.9 µg/m³, and university controls at 0.07±0.06 µg/m³. Welders also had higher UPDRS scores (6.8±4.4) than factory (5.1±3.9) and university controls (1.9±1.6). No significant differences were found in ACC GABA or Glx, but GSH was reduced in welders ($p = 0.02$) and factory controls ($p = 0.07$). A negative correlation between UPDRS and GSH ($R = -0.4$, $p = 0.0035$) suggests oxidative stress contributes to motor decline.

Results indicate oxidative stress in Mn-exposed workers, even factory controls, likely due to shared exposure. Future research will explore ACC metabolism's role in cognitive function.

References:1. Dydak U, et al. Environ Health Perspect. 2011;119(2):219-224.?2. Ma R, et al. Neurotoxicology. 2018;64:30-42.3. Zitka O, et al. Oncol Rep.2012;28(4).4. Racette BA, et al. NeuroToxicology 2012;33:1356-1361

Keywords:

Neurotoxicity, Metals; Biomarkers; Antioxidants; Manganese; Welding

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):

Ulrike Dydak (Purdue University); Jessica Ann George (HHS); Brian Matthew Bozymski (HHS); Gianna K Nossa (Purdue University); Cora Faye Mizimakoski (Purdue University); Chang Geun Lee (HHS); Jae Hong Park (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1601

Presentation Time: Session 4: 1:30-2:30pm

Advancing Jailbreak Strategies: A Hybrid Approach to Exploiting LLM Vulnerabilities and Bypassing Modern Defenses

STEM

Authors(s):

Mohamed Alaa Moham Ahmed† (Engineering); Mohamed Sameh Abde Abdelmouty† (Engineering); Alex Sangwoo Park† (Science); Gunvanth Reddy Kandula† (Science|JMHC)

Abstract:

The advancement of Pre-Trained Language Models (PTLMs) and Large Language Models (LLMs) has led to their widespread adoption across diverse applications. Despite their success, these models are vulnerable to a multitude of attacks in their lifecycle stages that exploit their inherent weaknesses to bypass safety measures. Two primary types of inference-phase attacks are token-level and prompt-level jailbreaks. While token-level attacks enable transferability to black-box models like GPT by embedding adversarial sequences into prompts, their limitations include detectable patterns and reliance on gradient-based token optimization. Conversely, prompt-level attacks leverage semantically structured inputs to elicit harmful responses but depend on iterative feedback from target LLMs, which can falter if responses are inconsistent. We propose two different hybrid approaches that integrates token- and prompt-level attack techniques to enhance the effectiveness of jailbreak attacks across diverse PTLMs. Building on the previous hybrid approach that successfully integrated GCG and PAIR that achieved higher attack success rate(ASR), this semester's research extends that methodology by exploring a new combination of GCG and WordGame+. The extended approach will be rigorously tested against advanced defense mechanisms such as Gradient Cuff and GuardReasoner to comprehensively assess the robustness of these defenses and identify vulnerabilities. Through empirical testing on modern LLMs like Vicuna and Llama, we aim to assess the resilience of these defenses and identify potential vulnerabilities exposed by our approach. Our findings will contribute to a deeper understanding of the evolving attack-defense dynamics in LLM security and inform future safeguards against adversarial exploitation.

Keywords:
Jailbreak Attacks; Hybrid Approach; Large Language Models; Jailbreak Defenses

Mentor(s):
James C Davis (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1602

Presentation Time: Session 4: 1:30-2:30pm

Enhancing Urban Crime Analysis with Machine Learning and Python-Based Data Matching

STEM

Authors(s):

Mateus Ananias†

Abstract:

Data-driven analysis plays a crucial role in understanding complex urban and social patterns. However, cross-referencing large-scale datasets remains challenging due to inconsistencies, missing information, and the computational cost of traditional matching techniques. In this research, we develop a Python-based framework to cross-check crime incident reports and shooting victim datasets, ensuring accurate data matching and extracting meaningful insights. Our approach consists of three stages. First, we preprocess the datasets by cleaning, filtering, and structuring the information to enable efficient comparisons. Second, we implement cross-checking techniques using Pandas and Scikit-Learn, leveraging machine learning to identify correlations between incidents and victims, even when inconsistencies exist in the data. Third, we analyze the results using advanced data visualization and pattern recognition techniques, providing a comprehensive view of crime trends. This research aims to automate dataset organization, enhancing data integrity and accessibility for crime analysis and policymaking. We will conduct experiments to verify that our methodology improves matching accuracy, reduces computation time and provides valuable information on the distribution of crimes. By integrating machine learning and automated cross-referencing techniques, this study contributes to a broad data science-driven approach to urban safety analysis, demonstrating the potential of computational methods to improve decision-making and public policy.

Keywords:

Data Analysis; Machine Learning; Phyton; Cross-Checking; Urban

Mentor(s):

Jing Gao (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1603

Presentation Time: Session 4: 1:30-2:30pm

The Environmental and Economic Impacts of Dams on the Laurentian Great Lakes: A Prescriptive Analysis

STEM

Authors(s):

Peter James Arroyo† (Agriculture)

Abstract:

The purpose of this research is to analyze the environmental and economic impacts of dams on the Great Lakes region and assess if their existence should be re-evaluated. Dams have been utilized in many different cultures and are prevalent across the United States as a method of flood control, irrigation, power generation, and tourism. The research will be conducted mainly through a document study of environmental impact reports and research on dams, combined with economic reports of constructing dams and their impact on the local economies of the Laurentian Great Lakes. To find the critical dams in the Laurentian Great Lakes region I will use databases to find the dams that have the greatest impact on aquatic environmental quality, flood protection, irrigation, and the economy of the surrounding areas. The findings will be used to develop a policy recommendation for dealing with the economic and environmental impacts that dams have in the Laurentian Great Lakes region, which could be the removal of dams, improvement of dams, or being left operating as is. This research will be important for quantifying the impacts of dams on the aquatic ecosystems, economy, and natural resources of the Laurentian Great Lakes region.

Keywords:

[no keywords provided]

Mentor(s):

Catherine Jean Shukle (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1604

Presentation Time: Session 4: 1:30-2:30pm

Measuring galvanic sweat response to indicate stress levels through a non-enzymatic skin-integrated biofuel cell sensor.

STEM

Authors(s):

Pragathi Arunkumar† (Engineering)

Abstract:

Galvanic Sweat Response (GSR) refers to the change in electrical conductivity of the skin due to physiological variables such as potential stress increases or hormonal abruptions. As hormonal excretions present in sweat under factors such as emotional stimulation and increased cognitive workload can vary, the measurable conductivity of the skin changes with this variation. Through our work, we aim to create a biocompatible conductive film that can measure the electrical variations from this sweat response. This conductive hydrogel is tuned to be flexible and stretchable to make a wearable skin-integrated biofuel cell sensor. This film can be utilized in an electrochemical sensor designed to carry the electrical charge from the thin film and analyze the data to determine a physiological stress response. This physiological response can be used to indicate potential stress responses or signs of cognitive distress in its user. This is made possible by developing the functional materials needed to measure signals with higher sensitivity and improved signal-to-noise ratio (SNR), which can pick up minute changes in electrical conductivity. We develop this sensor as a lightweight, wearable alternative to commercially available devices.

Keywords:

Galvanic Sweat Response; Biofuel Cell Sensor; High Sensitivity Wearable Sensor; Biocompatible Conductive Hydrogel; Signal-to-Noise Ratio

Mentor(s):

Nachiket Vatkar (Engineering); Wenzhuo Wu (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1605

Presentation Time: Session 4: 1:30-2:30pm

Clicks to Conversions: Leveraging Social Media Engagement for Teenage Purchasing Behavior

Business Case Study

Authors(s):

Pranshu Aryal† (DSB|JMHC); Ria Trikha Singh† (DSB); Tishia Talia Darmawan† (DSB|JMHC)

Abstract:

Teenagers are a driving force behind market trends, with social media platforms like TikTok and Instagram significantly influencing their purchasing decisions. However, many small businesses struggle to convert social media engagement into actual sales. This study examines the relationship between engagement metrics (likes, comments, shares) and teenage purchasing behavior to identify the most effective digital marketing strategies. The goal is to develop data-driven insights that help small businesses increase conversion rates by 15% over a six month period.

Our approach integrates data mining techniques, while leveraging social media analytics, demographic insights,and e-commerce transaction data. We employ Exploratory Data Analysis (EDA) to uncover correlations between engagement and sales, visualization techniques to illustrate trends, and machine learning models to predict purchasing behavior and segment teenage consumers.

Preliminary findings indicate that interactive, trend-driven content, particularly video-based and peer-shared posts, has a strong impact on conversion rates. By understanding these patterns, small businesses can optimize content strategies, allocate ad budgets more effectively, and refine their marketing efforts to maximize engagement-driven sales.

Beyond business applications, this research contributes to the broader field of predictive analytics by demonstrating how social media engagement serves as a powerful predictor of consumer behavior. By embracing a data-driven approach, small businesses can strengthen brand loyalty, enhance customer relationships, and drive sustainable growth in an increasingly digital marketplace.

Keywords:

Social Media Analytics; Small Businesses; Data Analysis; Engagement Metrics; Teenagers

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1606

Presentation Time: Session 4: 1:30-2:30pm

Morphological changes associated with living in urban environments in invasive cane toads

STEM

Authors(s):

Diego Bailen Boluda† (Science); Antonio Alejandro Pinto* (Science)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Ximena Bernal (Purdue University); Andrew Joseph Mularo (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1607

Presentation Time: Session 4: 1:30-2:30pm

Fold and Behold: Predicting Protein Functions with Structural Models

STEM

Authors(s):

Isaac Robert Bailey† (Agriculture|Engineering|JMHC); Owen Louis Hoerner† (Agriculture|Engineering); Saydie Ann Bannister Hannah† (Agriculture|Engineering); Katy Brauer† (Agriculture|Engineering)

Abstract:

Annotating a genome requires determining where protein-encoding genes start and end, as well as assigning functions to the proteins. The determination of protein function is usually accomplished through comparison to previously identified proteins, but it can also be done through visual qualitative inspection of the structure. Protein modeling software can be used to predict the 3-dimensional structure of proteins with high accuracy by using the amino acid sequence of a genome. The genome of bacteriophage GoldDust was analyzed, identifying proteins with unknown functions. The unknown function of gene 14 in GoldDust is determined through visual analysis. AlphaFold and Robetta were used to generate structural models of proteins that have unknown functions. These results were compared qualitatively to proteins from similar genomes in the FL cluster. Phamerator was used for qualitative analysis between genomes in the FL cluster. HHpred, PhagesDB, and NCBI database were used for obtaining functions, E values, and probability matches for proteins of similar structure in a variety of organisms. The encoded protein was analyzed by finding similar proteins through HHPred in the MPI bioinformatics toolkit, comparing the structure to other proteins on AlphaFold and Robetta, and by looking at the surrounding proteins through Phamerator. It was determined to be a terminator protein. In the future, more hypothetical proteins can be identified using this method, adding to the already known functions of GoldDust genes. These newly determined functions can also be used to adjust protein functions in highly conserved genomes, such as Vibaki.

Keywords:

Bacteriophage; Protein

Mentor(s):

Kari L Clase (Purdue University); Opeyemi Samuel Oduniyi (Agriculture)

Other Acknowledgement(s):
Marcelo Inaki I Guerrero Montalvan (Agriculture); Julia Ann Simler (Agriculture)

Poster Presentation Abstract Number: 1608

Presentation Time: Session 4: 1:30-2:30pm

Visualize Music using Generative Models of Artificial Intelligence

STEM

Authors(s):

Utkarsh Bali† (Science); Tim Nadolsky‡ (Science); Liam Matthew Stonestreet‡ (Science); Henry Hengyi Tsay‡ (Science)

Abstract:

This study investigates the intricate interplay between auditory and visual modalities through advanced artificial intelligence methodologies. Recognizing that music is inherently multisensory, capable of eliciting complex emotional responses, triggering memory recall, and inspiring vivid mental imagery, we propose a novel framework for real-time visual synthesis of musical experiences. This framework is designed not only to enrich auditory perception but also to enhance accessibility for individuals with hearing impairments by transforming auditory cues into dynamic visual representations.

Our approach is underpinned by a multi-stage pipeline. Initially, we extract essential audio features, including chroma, tonnetz, spectral contrast, and Mel-Frequency Cepstral Coefficients (MFCCs) to capture the harmonic, rhythmic, and timbral characteristics of the music. We then employ change point detection using the ruptures module to segment the audio into structurally meaningful components. These segments form the basis for a sophisticated prompt-generation mechanism, where extracted features are mapped to emotional and contextual descriptors, thereby ensuring the creation of a musically coherent visual narrative. To mitigate the limitations of traditional large language models (LLMs), our method incorporates direct note-to-mood mappings in conjunction with the LLama model for low-latency prompt generation. For video synthesis, we utilize generative models such as PyramidFlow and AnimateDiff, which guarantee high-quality, frame-consistent scene generation. Finally, the visual sequences are temporally aligned and concatenated to form a cohesive final video. The results demonstrate the potential of this framework to create a rich, multisensory representation of music, thereby opening new avenues for artistic expression and assistive technology in the realm of sensory augmentation.

Keywords:

Music Visualization; Audio Feature Extraction; Generative Artificial Intelligence; Hearing Accessibility; Large Language Models

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Yung-Hsiang Lu (Purdue University); Yeon Ji Yun (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1609

Presentation Time: Session 4: 1:30-2:30pm

Understanding The Rural Environmental Health Landscape: Exploring The Link Between Arsenic Exposure and Cancer Rates in Hartford City, Indiana

STEM

Authors(s):

Hannah Ashley Bard† (HHS); Tamia A Austin‡ (HHS)

Abstract:

[Abstract Redacted]

Keywords:

Arsenic; Cancer; Rural Health Disparities; Soil Sampling; Community Engaged

Mentor(s):

Ellen M Wells (Purdue University)

Other Acknowledgement(s):

Edem Fabrice Sededji (HHS); Sa Liu (Purdue University); Sherrie M Steiner (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1610

Presentation Time: Session 4: 1:30-2:30pm

AI Use in the Marketing Industry

Humanities

Authors(s):

GeonHyo Beom† (HHS)

Abstract:

Have you ever considered how Artificial intelligence (AI) is utilized in human society? In the new era, this novel technology has been inaugurated in various fields of human lives regardless of whether individuals notice. For example, there are AI assistants, medical implementations, and marketing industries. In this poster, I focus on the impact of employing AI in marketing. For this preliminary research project, I examined not only several peer-reviewed articles and popular sources but also student surveys to examine both the advantages and disadvantages of the implementation of AI in the marketing field. This project recognizes potential concerns for the usage of AI in marketing, including things that Purdue marketing students and employees would be concerned about. To excavate this issue, I conducted a brief survey that examines how consumers think of the role and impact of AI in marketing and how they are concerned about the potential harm that may happen due to AI implementation in this field. This research will contribute insights to two major viewpoints on AI in marketing. First, it highlights new viewpoints of using AI in this area and how it will be efficient than they might even imagine. Moreover, it will become a chance to look back at what can be potential hazards that might happen when people become too dependent on AI.

Keywords:

Artificial Intelligence; Marketing; Efficiency; Hazard; Information

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1611

Presentation Time: Session 4: 1:30-2:30pm

Examining Institutional Bias in the U.S. Court of Claims: The Impact of Claimant Type on Case Outcomes

Social Science

Authors(s):

Lucy Anne Bolles† (Liberal Arts)

Abstract:

Our research presents an exploration of the United States Court of Claims, a crucial yet under-studied institution responsible for resolving diverse claims against the federal government, including treaty rights, reparations for wrongful convictions, and intellectual property enforcement, among others. Despite its importance, the Court of Claims has not received substantial academic attention. The Court of Claims Lab seeks to address this gap by coding and analyzing over 170 years of cases, creating a publicly accessible database that includes key case variables, such as the type of claimant, nature of claim, defendants, amounts claimed, and outcomes. In my presentation, I will explore whether the type of claimant influences case outcomes, specifically focusing on whether individual contractors and private citizens are more or less likely to prevail compared to firms and corporations. By examining these categories of claimants, I will assess whether institutional biases or systemic patterns emerge that favor one group over another. This analysis will involve statistical comparisons of case outcomes based on claimant type, examining factors such as the amount claimed, the nature of claim, and the specific defendant involved. Additionally, I will explore whether certain claim types - such as reparations, intellectual property rights, or contract disputes - are more likely to favor large entities. The findings of this research will offer valuable insights into institutional structures, revealing how various claimant types interact with the legal system, inform potential reforms to federal courts, and contribute to shaping the future implementation of federal policies.

Keywords:

Court; Code; Claimant; Claims; Policy

Mentor(s):

Logan Strother (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1612

Presentation Time: Session 4: 1:30-2:30pm

Resolving Gene Prediction Discrepancies: Comparing Glimmer and GeneMark in Bacteriophage Genome Annotation

STEM

Authors(s):

AnnaBella Marie Brown† (Agriculture|Engineering); Delilah Ruth Flora† (Science|JMHC); Pooja Sriram† (Agriculture|Engineering); Madelyn Clair Watson† (Agriculture|Engineering)

Abstract:

Genome annotation tools, like Glimmer and GeneMark, are essential for predicting open reading frames (ORFs) in bacteriophage genomes. However, there are often discrepancies between the two tools that raise questions about the underlying mechanisms used to call start sites. This study evaluated the mechanisms of Glimmer and GeneMark to determine the cause of these discrepancies. Using annotations from the bacteriophage AdaS, abnormal gene calls from the two tools were compared, and discrepancies were analyzed to understand their impact on genome annotation. Features such as algorithm type, training method, ORF selection, and RBS consideration were analyzed to elucidate their respective strengths and weaknesses more comprehensively. Annotations of two genes from AdaS yielded conflicting predictions from Glimmer and GeneMark. The first case showed Glimmer calling a gene in the forward direction, while GeneMark called the same gene in reverse. Another case study showed a gene that was only called by Glimmer due to its atypical coding potential. GeneMark operates using a Hidden Markov Model and self-training while Glimmer uses an Interpolated Markov Model. Glimmer also determines the probability of genes using the longest ORFs and reading in the forward direction. Conversely, GeneMark reads in the reverse direction and determines atypical coding potential by dinucleotide probabilities compared to typical tetranucleotide probabilities. These findings will provide insight into the reliability of gene prediction software and guide future bacteriophage genome annotations. A better understanding of these tools will enable researchers to make more informed decisions when resolving gene call conflicts and improving genome annotation accuracy.

Keywords:

Bacteriophages; Genome Annotation

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Kari L Clase (Purdue University); Julia Ann Simler (Agriculture)

Other Acknowledgement(s):
Opeyemi Samuel Oduniyi (Agriculture); Marcelo Inaki I Guerrero Montalvan (Agriculture)

Poster Presentation Abstract Number: 1613

Presentation Time: Session 4: 1:30-2:30pm

Pedestrian Detection in EarthCam Images: Benchmarking Three Object Detection Methods

STEM

Authors(s):

Ishaan Bangarraju Buddharaju† (Science); Aryan Kiran Kumar Chamarajanagar† (Science); Ishita Shukla† (Science); Parth Nitin Ranade† (Science)

Abstract:

This study examines pedestrian activity patterns before and during the COVID-19 pandemic using EarthCam images to develop time-series representations of pedestrian counts. We evaluate three detection methods: Faster R-CNN, HOG-SVM, and YOLO. A pre-trained Faster R-CNN initially achieved an F1 score of 0.7, which improved to 0.77 after training the weights on our dataset. Applying image inversion techniques further raised the F1 score to 0.8 by enhancing detection in low-resolution and darker regions. To explore alternative methods, we implemented an SVM model with blob detection and HOG feature extraction. While HOG-SVM improved pedestrian differentiation compared to basic blob detection, it struggled with high contrast and pedestrian variability, leading to a high number of false positives. Given these challenges, we shifted focus to YOLO which shows promising preliminary results. Future research will refine the YOLO model, extend the analysis to video data, and potentially explore hybrid frameworks. This work contributes to pedestrian detection advancements with applications in urban planning, public safety, and mobility analysis.

Keywords:

Pedestrian Detection; R-CNN; YOLO; SVM

Mentor(s):

Fengqing Zhu (Purdue University); Soudabeh Taghian Dinani (Purdue University); Carla Zoltowski (Purdue University); Edward J Delp (Purdue University)

Other Acknowledgement(s):

Bryce Jensen Dietrich (Purdue University)

Poster Presentation Abstract Number: 1614

Presentation Time: Session 4: 1:30-2:30pm

Searching For Precursor Lightcurve Data Using ZTF Forced Photometry

STEM

Authors(s):

Lauren M Burch† (Science); Sam Brody Waymire† (Science); Jacob Nicholas Rytczak† (Science); Amit Valluri† (Polytechnic)

Abstract:

Mass loss in stars is an extremely important driver of core-collapse supernovae, yet it is not well understood. Being able to observe potential mass loss could provide an early warning of supernovae, as well as strengthen our understanding of the early core-collapse process. The Zwicky Transient Facility (ZTF) is an optical astronomical survey that has been responsible for the detection of thousands of supernovae. We utilize ZTF forced photometry data for these detected supernovae, enabling a deeper analysis of existing supernova light curves. This provides the ability to search for new mass loss candidates, however this large amount of data makes manual analysis impractical. Our research aims to find a method to identify precursor data in these light curves so that they can be studied further. We aim to develop a model to identify the initial rise in magnitude of supernova light curves occurring before the explosion. These light curves will then be categorized as potential supernovae that display precursor data, where they will then be analyzed to gain a greater understanding of stellar mass loss and its role in the supernovae process.

Keywords:

Precursor Data; Forced Photometry; Type IIn Supernovae; Mass Loss; Light Curves

Mentor(s):

Danny Milisavljevic (Purdue University); Dylan Scott Caudill (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1615

Presentation Time: Session 4: 1:30-2:30pm

Characterization of Expanded Polypropylene Beads for Concrete

STEM

Authors(s):

Han Burgess† (Engineering)

Abstract:

Expanded polypropylene (EPP) beads have the potential to enhance concrete by improving mechanical strength and acoustic dampening properties. This study examines the properties of EPP beads to assess their suitability for integration into cementitious materials. Bead pullout tests were conducted to quantify adhesion forces between EPP beads and the cement matrix, providing insight into interfacial bonding behavior. The internal cellular structure of the beads was analyzed to determine size distribution and its potential impact on material performance. These findings contribute to the optimization of EPP bead incorporation in concrete formulations for improved durability and sound attenuation. Future work will focus on evaluating the mechanical and acoustic properties of EPP-modified concrete.

Keywords:

Concrete; Expanded Polypropylene Beads; Materials Engineering; Cement; Sustainability

Mentor(s):

Nicholas M Christ (Engineering); Akul Seshadri (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1616

Presentation Time: Session 4: 1:30-2:30pm

Ozempic: Saving or Breaking Lives?

Humanities

Authors(s):

Emily Sophia Burrow† (HHS|JMHC)

Abstract:

As society continues to evolve, we are creating more ways to provide quick fixes and immediate results, specifically through the use of new drugs and medicine. These new inventions are used to solve various worldly issues, including the increasing rate of obesity. According to the CDC, the US now has a 40% obesity rate among our population, proving this a crucial issue to be addressed. A popular drug that is gaining awareness is Ozempic, a GLP-1 agonist which is used to mimic glucagon and signal satiety in the brain (University of California). This drug has been cleared by the FDA to treat type 2 diabetes, but not to treat weight loss. In this exploratory research project, I assess the dangers and benefits that Ozempic can provide for individuals using it for weight loss. The findings from this research have the capability of supporting whether this drug is beneficial or harmful for weight loss and can provide an understanding of what GLP-1 drugs are able to account for. People across the US are looking for easy solutions to major issues in all aspects of their lives. Providing evidence to whether these quick fixes really work is the start to understanding how people can obtain healthier lifestyles.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1617

Presentation Time: Session 4: 1:30-2:30pm

BetteR Bets: A Decision Support Tool for Sports Betting

Business Case Study

Authors(s):

Albert Joseph Burton† (DSB); Russell John Cohen† (DSB); Ryan Andrew Katz† (DSB); Ethan Brian Kobylinski† (DSB)

Abstract:

This study designs and develops an R-shiny application that allows end users to train and evaluate various predictive models to estimate the probability of sports outcomes based on historical sports betting data, then allows them to create a betting allocation strategy to maximize expected returns while managing risk. The motivation for this study is that sports betting is a rapidly growing industry, but many bettors rely on intuition rather than data-driven recommendations that can predict outcomes, as well as allocate a betting portfolio based on a user's risk and other preferences. Our tool provides an objective, rather than subjective, approach to betting decisions that leverages machine learning and optimization techniques, which has potential for improved decisions making.

Keywords:

Sports; Gambling; Asset Allocation; R-Shiny; DSS

Mentor(s):

Matthew Lanham (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1618

Presentation Time: Session 4: 1:30-2:30pm

Predicting March Madness Fan Brackets: Leveraging Data for Sponsorship Insights

Business Case Study

Authors(s):

Michael Lance Whitfield† (DSB); Filippa Maria Rodriguez Pinzon† (DSB); Chalen Alexander Jack† (DSB); Varsha Raj† (DSB|JMHC); Albert Joseph Burton‡ (DSB)

Abstract:

The National Collegiate Athletic Association (NCAA) hosts an annual basketball tournament known as March Madness, which attracts significant public interest as fans nationwide submit predictions regarding game outcomes. The primary objective of this project is to accurately predict regional variations in fan projections for March Madness winners by leveraging location-based demographic data and historical game statistics. The expectation is that this project will enable the NCAA and associated colleges to effectively identify and attract potential sponsorship opportunities tailored to regional fan interests.

Employing robust predictive methodologies, the project utilizes machine learning models including XGBoost, Random Forest, and Logistic Regression. Key methodological processes involve comprehensive data collection and merging, rigorous preprocessing and feature engineering, detailed model tuning, and analysis of feature importance to enhance prediction accuracy.

The anticipated results will predict fan-submitted brackets, particularly focusing on forecasts for semifinalists and the eventual national champion. Additionally, our findings will incorporate detailed demographic visualizations, institutional geographic analysis, prediction heatmaps, and prediction probability distributions, thus providing nuanced insights into regional fan biases and preferences.

The broader implications of this study underline the necessity and value of employing diverse predictive modeling approaches, recognizing that while no single model consistently achieves flawless accuracy, integrating multiple techniques can substantially enhance predictive outcomes. Consequently, this project demonstrates not only practical applications for sports sponsorship and marketing strategies but also highlights avenues for future methodological improvements in predictive analytics within sports contexts.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
NCAA; Bracket; Predictions

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1619

Presentation Time: Session 4: 1:30-2:30pm

Understanding Consumer Preferences for Sustainability in Purchasing Decisions of Everyday Products

STEM

Authors(s):

Adrian Arnaldo Calderon† (Polytechnic); Joon Kang‡ (Polytechnic)

Abstract:

Sustainability and environmental awareness continue to become a major facet of today's society. Despite increased awareness, consumers continue to hesitate when purchasing sustainable products over environmentally harmful ones (Luchs, Brower, Chitturi, 2012). Previous studies indicate three primary factors affect this choice specifically with regards to food products - confidence in product functionality, cost to self, and social responsibility or guilt (Goldsmith, Roux, and Wilson 2019). The following study seeks to examine potential to reduce electronic waste by determining the extent a consumer will prefer an environmentally sustainable product. Students of Purdue University were evaluated through use of a survey. The survey includes a description of conceptual products along with different thresholds of functionality, price, and environmental impact. Students can rate on a scale of 1 to 5 how likely they are to purchase the product. Based upon the survey, the study seeks to determine which specific, numeric thresholds of these factors lead to highest consumer preference for conceptual headphone products, which in turn can be applied to a broader range of electrical products.

After the survey is completed the results will be reviewed for correlations through use of statistical diagrams. A product will be designed based upon these correlations.

Keywords:

Sustainability; E-Waste

Mentor(s):

Gaurav Nanda (Purdue University)

Other Acknowledgement(s):

Madhumathi Ponnusamy (Polytechnic)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1620

Presentation Time: Session 4: 1:30-2:30pm

Using PhiV10 NanoLuc to Detect E. coli O157:H7 in Pediatric Fecal Samples

STEM

Authors(s):

Katherine Grace Camden† (Agriculture)

Abstract:

Hemolytic uremic syndrome (HUS) occurs often in children and is most often caused by infections with Shiga toxin-producing strains of E. coli, including E. coli O157:H7. Due to the serious nature of HUS, rapid diagnosis and treatment are essential. Current diagnostic methods begin with fecal samples stored in Cary-Blair medium for transportation to a testing laboratory for identification, which can be time-consuming. The purpose of this study is to investigate the viability of phage-based detection of E. coli O157:H7 in fecal samples from pediatric HUS patients to speed diagnosis. The bacteriophage to be used, ?V10 NanoLuc (?V10nluc), has been engineered to produce a bioluminescent signal upon successful infection of E. coli O157:H7. Transmittance of the bioluminescent signal was comparable between lysogeny broth (LB) and the Cary-Blair media, showing that the use of Cary-Blair media as opposed to LB does not have an impact on the readings of the luminescent signal. Future objectives are to assess whether the addition of glucose and trace elements to the Cary-Blair medium enhances bacterial enrichment, thus increasing the accuracy of detection. ?V10nluc will be added to E. coli O157:H7 inoculated artificial feces samples to evaluate if luminescent detection can occur, thus establishing a possible new method for rapid E. coli O157:H7 detection in stool samples. This could potentially pave the way for continuous detection during sample transport.

Keywords:

E. coli O157:H7; Shiga Toxin; Phage

Mentor(s):

Bruce M Applegate (Purdue University); Michael F Oats (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1621

Presentation Time: Session 4: 1:30-2:30pm

Scalable Nanomanufacturing of Tellurene Nanowire Based Sensors for Pulse Monitoring

STEM

Authors(s):

Tobias Mikael Cars† (Engineering)

Abstract:

Wearable sensor technology plays a vital role in monitoring physiological and mental workload (MWL), offering real time cognitive and emotional analysis. Reliable MWL monitoring is crucial in high stress environments where excessive cognitive demands can negatively impact job performance and increase error risk. However, sacrificing ergonomics and comfort for better performance can reduce the effectiveness of these sensors over long periods, as users may misuse them or abandon the devices altogether. This study optimizes manufacturing processes to develop Tellurene Nanowire-based (TeNW) wearable sensors that provide performance and improved comfort. By sandwiching Tellurene nanowires between multiple layers, the triboelectric effect can be boosted, improving output. Techniques such as spin coating Ecoflex and implementing silver nanowire layers also enhance sensor durability and conductivity. Additionally, filler materials such as graphene oxide improve the dielectric constant, enhancing signal output. Through these methods, we can fabricate sensors providing stable signal outputs to conduct comparative analysis between TeNW-based sensors incorporating different materials and layouts to evaluate performance under certain conditions. This study provides a clear path to the scalable production of wearable sensor technology for industrial safety and health industries, as well as providing technical improvements related to signal quality, energy efficiency, and environmental robustness.

Keywords:

Wearable Sensors; Health Monitoring; Tellurene Nanowires; Pulse Monitoring

Mentor(s):

Tuhina Saxena (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1622

Presentation Time: Session 4: 1:30-2:30pm

Improving Pose Estimation for Antelopes

STEM

Authors(s):

Shaan Jitesh Chanchani† (Engineering); Claire Seol Kim† (Engineering); Joshua C Mansky† (Engineering); Zian Pan† (Engineering); Medhashree Parhy† (Science); Parth Thakre† (Science|Graduate)

Abstract:

Our research aims to increase the robustness and efficiency of antelope pose estimation models through refining the ground-truth labels of keypoints and compressing the training dataset by filtering for similar species.

We focus on AP10k, a prominent animal pose dataset, which we observe to have inconsistent keypoint definitions across images, hindering model performance. To address this, we create two distinct keypoint definitions. First, in an effort to have more consistently labeled images, we create a “Visible” keypoint definition, in which we choose the most visibly apparent features, enabling easier and more consistent labeling. Second, we focus on the biologically accurate point for keypoints, which would be harder for labelers, but could allow the model to better generalize on the features.

We utilize three methods to compress an off-the-shelf pose estimation model’s training data to only include species morphologically similar to antelopes. We evaluate morphological similarity of animals with three metrics: the normalized variance of each keypoint’s distance from the animals’ centroid, the animals’ normalized limb lengths, and the visual feature embeddings extracted by Meta’s DINOv2 transformer model.

Through our efforts to improve model performance in keypoint estimation for specifically antelopes, we contribute to improving keypoint estimation for all animals.

Keywords:

Computer Vision; Pose Estimation; Keypoint Estimation; Feature Extraction

Mentor(s):

Amy R Reibman (Purdue University); Haoyu Chen (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1623

Presentation Time: Session 4: 1:30-2:30pm

Quantitative Comparison for Automatic Music Transcription

STEM

Authors(s):

Ojas Chaturvedi† (Science|JMHC|Graduate); Kayshav Bhardwaj† (Science); Tanay Hemant Gondil† (Science); Ankur Senapati† (Engineering); Sanshray Kumar† (Science); Yuting Xiao† (Science); Mithun Mahesh† (Science)

Abstract:

Automatic Music Transcription (AMT) is a process in which audio is notated in symbolic representations, namely sheet music or MIDI. Normally time-intensive for human transcribers, AMT has the potential to accelerate the transcription process, streamlining music creation, education, and research while saving time and enhancing accessibility. Beyond music, AMT's potential extends to assistive hearing technologies, addressing the "cocktail party problem" by isolating individual sound sources from overlapping noise.

Techniques used to distinguish instruments by their acoustic traits could be adapted to separate human voices, improving hearing aids, speech recognition systems, and communication in complex auditory environments. Building on this, we conducted an extensive literature review surveying existing automatic music transcription software, with one of the most promising being Google's MT3 model. Most transcription software we explored had several key issues. For instance, many display an inability to transcribe multi-instrumental or polyphonic music. Additionally, many hallucinated instruments were originally absent from the audio, and the melody could not be isolated from the accompaniment.

In response to these limitations, we are preparing an AMT competition in April 2025. Participants will submit computer programs to convert audio recordings in classical music styles to MIDI. A submitted computer program has to convert 100 recordings, each containing at most three musical instruments. Submissions, as Github repositories storing the transcription models, will be ranked on multiple factors, including accuracy of instruments, pitches, onset, and offset. Future work will involve creating a model that is based on the results of the competition and outperforms current leading automatic music transcription models.

Keywords:
Automatic Music Transcription; Artificial Intelligence; Research; Multi-Pitch Estimation; Deep Learning

Mentor(s):
Yung-Hsiang Lu (Purdue University); Yeon Ji Yun (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1624

Presentation Time: Session 4: 1:30-2:30pm

The Effects of Oil Contamination on Baby Products

STEM

Authors(s):

Christopher Felipe Chavarria† (Exploratory Studies|Other); Samuel Andrew Spears‡ (Engineering)

Abstract:

During Thanksgiving 2021, about 20,000 gallons of jet fuel leaked out of a fuel storage facility and went directly into Oahu's water system in Hawaii, which serves 93,000 people. Oil contains high levels of hydrocarbons, the most common ones being benzene, toluene ethylbenzene, and xylenes (BTEX). Hydrocarbons are dangerous to the human body and can cause serious health problems over time. The Oahu Military Water Response Resident Resources sent out a flier telling residents how to clean all kinds of objects that were contaminated. The products included baby products, such as baby bottles and pacifiers. These baby products will be contaminated to match the same conditions as the products in Oahu, washed according to the flier sent out to residents, and tested to evaluate the effectiveness of the techniques provided by the Oahu Military. Our lab expects our results to prove that the techniques are not effective.

Keywords:

Hydrocarbons; Benzene; Toluene; Ethylbenzene; Xylenes

Mentor(s):

Andrew Whelton (Purdue University); Cristiane Grossi Ferrarezzi (Engineering); Paul Babu (Engineering); Dina Nukenova (Polytechnic)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1625

Presentation Time: Session 4: 1:30-2:30pm

Peptides for Cell Penetration

STEM

Authors(s):

Marianna Chicas† (Science)

Abstract:

Antimicrobial resistance is a growing global health crisis. Furthermore, numerous bacteria have evolved to reside within cells. Cell penetrating peptides have been utilized to target intracellular bacteria by taking advantage of strategically placed catatonic and hydrophobic residues. This work will expand upon the development of cell penetrating peptides by synthesizing peptides using solid phase peptide synthesis. Our LRR-14 peptide was characterizing with MALDI-TOF mass spectrometry and the secondary structure probed by circular dichroism. From the circular dichroism data, it was concluded that the peptide LRR-14 exists as a random coil. Next, the cell penetrating ability of LRR-14 peptide was determined using flow cytometry and confocal microscopy. The LRR-14 peptide outperformed a previously studied peptide (P14LRR) from our lab by having great internalized fluorescence within cells. In the confocal image, LRR-14 was found to accumulated within the lysosome near the mitochondria. From the determined cell penetrating ability, the LRR-14 peptide will later be tested against bacteria in vitro.

Keywords:

Cell Penetrating Peptides; Flow Cytometry; Circular Dichroism; Antibacterial Resistance

Mentor(s):

Jean A Chmielewski (Purdue University); Andrew Reich (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1626

Presentation Time: Session 4: 1:30-2:30pm

Integrating PyTorch with a custom accelerator

STEM

Authors(s):

Vihaan Reddy Chinthakindi† (Engineering)

Abstract:

In the world of AI and LLM's, efficient matrix multiplications are essential for accelerating deep learning workloads. To address these challenges, the SoCET team is developing the Accelerated Matrix Processor (AMP), a domain-specific accelerator that leverages innovative engineering techniques. This project focuses on integrating PyTorch, a machine learning framework, with the custom processor by translating high-level operations into custom instructions tailored for the hardware. For this task, our approach uses PyTorch's compilation stack, which includes converting Python code to computation graphs, optimizing these graphs, and lowering them to machine code. As part of this process, we alter the different intermediate representations (IRs) of PyTorch operations, lowering them to operations that our processor can execute. The aim is to allow the efficient use of machine learning workloads with the custom accelerator. Additionally, the team has explored computational graph optimizations, such as operator fusion, which reduces memory access overhead by merging compatible operations (graph nodes). A deeper understanding of these optimizations will inform better hardware design, while knowledge of the hardware enables us to perform further software-level refinements. This work seeks to lay the groundwork for a robust software ecosystem around the processor.

Keywords:

[no keywords provided]

Mentor(s):

Timothy Francis Hein (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1627

Presentation Time: Session 4: 1:30-2:30pm

Unveiling Food Waste Patterns at Purdue University

STEM

Authors(s):

Katherine Sophia Chiparus† (Science)

Abstract:

Ever wondered how much food waste is generated at Purdue University? This project aims to find out by studying food waste behavior across campus. Data will be collected from students, staff, and visitors to analyze the composition and quantity of food waste from dining courts, retail options, and packaged meals. A survey has been developed to gather information on demographics and behaviors, and to analyze the waste through AI photo deconstruction into the volume of individual constituents.This survey was refined through interviews and facility tours with the campus community. The survey will be administered through Expiwell – software created by Dr. Louis Tay – to a sample size of at least 150 participants.

To date, the project has primarily focused on survey creation and administrative approval. The future goals of this project center around using the data gathered to reduce the environmental impact of food waste, potentially through composting or other benign conversion methods, based on a thorough understanding of the waste's quantity and composition.

Keywords:

[no keywords provided]

Mentor(s):

Abigail Engelberth (Purdue University); Louis Tay (Purdue University); Valentina Negri (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1628

Presentation Time: Session 4: 1:30-2:30pm

SCALE HI-AP Fabrication and Modeling of RRAM for 3D Monolithic Integration of an In-Memory Computing 1T1R OSFET Memory Cell

STEM

Authors(s):

Geetika Chitturi† (Engineering|JMHC); Jou-Ting Lai† (Engineering)

Abstract:

As AI algorithms become larger and more complex, it is imperative that hardware systems develop simultaneously to achieve greater computational efficiency and lower data latency. To meet this demand, there has been a push to innovate beyond classical silicon CMOS technologies into a new era known as CMOS+X. One area of interest is in-memory computing using Resistive Random Access Memory (RRAM), an emerging memory technology, and Oxide Semiconductor Field Effect Transistors (OSFETs), which exhibit ultra-low current leakage characteristics. Fabricating these devices using back-end-of-line (BEOL) processes allows for monolithic 3D integration of compute and memory, enhancing energy efficiency by vertically stacking layers. We explore this by designing and fabricating a 1T1R memory cell with RRAM integrated onto an existing OSFET device. To realize the cell, we are constructing and demonstrating a process flow for RRAM fabrication at Birck Nanotechnology Center and modeling RRAM in TCAD. Our expected outcome is the realization of a highly energy-efficient cell that can serve as a basis for future innovations in CMOS+X semiconductor technology.

Keywords:

Semiconductor; In-Memory Computing; RRAM

Mentor(s):

Haitong Li (Purdue University)

Other Acknowledgement(s):

Gabriella Maria Schr Torres (Centers & Institutes)

Poster Presentation Abstract Number: 1629

Presentation Time: Session 4: 1:30-2:30pm

VIP Birck AP/HI ALN team

STEM

Authors(s):

Chengyu Chiu† (Engineering); Isabel Alejandra Arias Zambrano† (Engineering); Jenna Marie Marquette† (Engineering); Varun Rajesh† (Engineering); Anusha Gambheera† (Engineering|JMHC)

Abstract:

Advanced Packaging & Heterogeneous Integration (APHI) is an integrated circuit (IC) fabrication technique that is gaining prominence in modern technology, which aims to minimize the size and weight of microelectronic systems. This is particularly important in the aerospace industry. The HILEOS (Heterogeneously Integrated Low-Earth-Orbit Sensors) project focuses on designing and developing a 2.5D packaging solution by heterogeneously integrating a photosensor and a D-latch memory using various substrate materials.

For this project, the Aluminum Nitride (AlN) sub-team plans to use AlN as the carrier substrate due to its distinct properties as a ceramic material. It has excellent electrical insulation, high thermal conductivity, and low dielectric loss. It is also suited for high-power radio frequency applications such as radars and transceivers. These characteristics make AlN an ideal carrier substrate when integrating two chiplets into compact, lightweight packaging.

To achieve this, the team developed a process that begins with using a fiber laser to create through-holes in the AlN substrate. A silicon handling wafer, AZ10XT photoresist coated, is then temporarily bonded onto the chiplets and AlN substrate to enable the subsequent steps. A seed layer of Cr/Ti and Au is sputtered on the chiplets and substrate to enable electroplating. As an alternative, polymer backfilling can be used. In either case, electroplating and polymer backfilling serve to stabilize and encapsulate the chips within the AlN interposer. The next steps include photolithography, metallization, and lift-off processes to ensure communications between the device and the outside world.

Keywords:

Heterogeneous Integration; Advanced Packaging; Semiconductors

Mentor(s):
Peter Bermel (Purdue University); Saeed Mohammadi (Purdue University); Tiwei Wei (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1630

Presentation Time: Session 4: 1:30-2:30pm

The relationship between American Bullfrog tadpole mouthpart surface area and shedding rate

STEM

Authors(s):

Kendall Anne Claymon† (HHS|JMHC)

Abstract:

Pathogenic fungi within aquatic systems can detrimentally affect animals such as tadpoles. Infected tadpoles are impacted by a pathogen, Batrachochytrium dendrobatidis (hereafter referred to as “Bd”) which infects the keratinized areas of tadpoles’ mouthpart, harming foraging abilities and tooth integrity. Organisms infected by Bd shed the pathogen into their surroundings, transmitting the pathogen to nearby hosts. In past research, it was assumed that there is a positive relationship between pathogen shedding rate (number of infectious zoospores shed per day) and infection load (number of infectious zoospores found on the mouthpart). Many physiological factors may impact this assumed relationship such as mouthpart size. The purpose of this study is to understand how American Bullfrog tadpoles’ mouthpart surface area affects the relationship between shedding rate of Bd and mouthpart infection load. We hypothesize that increased mouthpart surface area allows for more infectable tissue for potential zoospore release. We predicted that an increase in mouthpart size would increase both shedding rate and infection load. In this study, we individually inoculated tadpoles with Bd and waited for infection to develop for 6, 12, 18 and 24 days. Tadpoles were then placed in fresh well water and allowed to shed Bd zoospores for 24 hours. The well water was then filtered and quantitative-PCR (qPCR) was conducted to quantify zoospores shed. Tadpoles were euthanized followed by mouthpart measurements with digital calipers under a microscope. This was then used to calculate mouthpart surface area. Extracted mouthparts and tadpole shed filters were processed through qPCR.

Keywords:

Aquatic Physiology; Disease Ecology; Wildlife Biology; Cellular Biology

Mentor(s):

Catherine L Searle (Purdue University); Kurt Robert Lutz (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1631

Presentation Time: Session 4: 1:30-2:30pm

EngStarter: A Microelectronics Kit for STEM Education in Fragile Contexts

STEM

Authors(s):

Stephanie Close† (Engineering); Darren Soo ahm Hwang† (Engineering)

Abstract:

Since 2015, the Localized Engineering in Displacement (LED) program has employed engineering education methodologies to equip learners in fragile contexts- such as low-income and displaced communities- with STEM-based frameworks for problem-solving and technical skill acquisition. As part of this initiative, we developed EngStarter, a modular, microelectronics-based educational platform designed for hands-on engineering training and real-world prototyping.

EngStarter integrates a configurable hardware system with embedded field sensors and communication interfaces, enabling first-time electronics users to engage in circuit design, data acquisition, and system integration. The platform supports applications in resource-constrained environments, addressing challenges with agriculture, water, and energy. We use a design-based research approach with iterative development cycles, incorporating user observations and feedback to improve hardware usability and curriculum effectiveness.

A key implementation of EngStarter is its deployment at Trinity Haven, Indiana's first transitional housing program for LGBTQ+ youth experiencing housing instability. Through structured learning modules and guided exercises, participants employ EngStarter to conceptualize, design, and deploy technology-driven solutions tailored to their community needs.

Our findings highlight the scalability of EngStarter as a versatile educational tool in diverse socio-technical settings. Future work will focus on refining hardware-software interoperability, expanding sensor integration for broader application scope, and developing adaptive pedagogical frameworks to enhance accessibility and impact in marginalized learning environments.

Keywords:

Microelectronics; Fragile Contexts; Field Sensors; STEM Education; Prototyping System

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Dhinesh Balaji Radhakrishnan (Purdue University); Jennifer J DeBoer (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1632

Presentation Time: Session 4: 1:30-2:30pm

Topological Qubits: The Future of Quantum Computing

STEM

Authors(s):

Freya Jayden D'Souza† (Science)

Abstract:

The prospects associated with quantum computing have proven to be promising. Still, there are some hurdles that scientists have yet to overcome. One of these obstacles is their susceptibility to undergo decoherence, or quantum state destruction, due to external perturbations. This instability can lead to errors. Researchers are exploring topological qubits as a potential solution. This topological theory relies on the concept of non-Abelian anyons. Since this proposal, while several groups of scientists have conducted experiments, the existence of non-Abelian anyons has not yet officially been confirmed. Despite this, tech company Microsoft has recently claimed to have achieved this through the Majorana zero mode (a type of non-Abelian anyon). Due to this claim of having created the world's first QPU built with a topoconductor, the future of quantum computing is now a hot topic of discussion, sparking several questions. How impactful can these topological methods be? Do they actually have the potential to further the field of quantum computing? The research I have conducted attempts to address these questions. This will include a discussion regarding factors such as economic feasibility, possible engineering obstacles, large-scale implementation, and proximity to commercialization. Analysis of these factors serves to provide a basis for comparison against the standard qubit.

Keywords:

Topological Qubit; Quantum Computing; Quantum Bit

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1633

Presentation Time: Session 4: 1:30-2:30pm

Analysis of Ultramicroelectrode Stimulation on Animal Models

STEM

Authors(s):

Deniz Eksioglu† (Engineering|JMHC); Brinna M Porat† (Engineering)

Abstract:

Neural stimulation therapy involves using electrical currents to modulate neuronal activity in specific neural regions, such as the brain and spinal cord. This therapy offers significant benefits for patients with neurological disorders affecting motor and sensory functions, often serving as a key component of neuroprosthetic devices. However, upon implantation of neural stimulators, the patient's immune system responds, triggering glial cells to congregate around the device. This glial scarring increases impedance at the electrode interface, reducing the efficiency of electrical signal transmission to surrounding neurons and ultimately compromising therapeutic efficacy. Therefore, to combat the foreign body response, I researched how decreasing the size of the electrode sites can decrease the foreign body response experienced. This study involved conducting behavioral experiments on animal models to determine the current threshold required for sensory perception and how much it is affected over time. Initially, rodents were conditioned to respond to an auditory stimulus, with their response thresholds measured in decibels. Following this, electrode arrays were implanted in their somatosensory cortex, and the same behavioral experiment was repeated, replacing the auditory stimulus with electrical current pulses. The current threshold at which the rodents responded was then measured to assess their perception of the stimulation. These experiments were conducted several times to capture the trend of perceived stimulation threshold and how the foreign body response affects it. This presentation will provide the results of an analysis examining the reliability of in vivo neural stimulation over time.

Keywords:

Neural Stimulation; Ultramicroelectrode; Foreign Body Response; Impedance

Mentor(s):

Elizabeth Marie Olivo (Engineering); Kevin John Otto (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1634

Presentation Time: Session 4: 1:30-2:30pm

The Next Era of Dentistry

STEM

Authors(s):

Cohl Cortland Erwin† (Science)

Abstract:

Dentistry has been around for centuries, and the profession (along with the necessary tools) has evolved. Today, as artificial intelligence, advanced robotics, and 3D printing revolutionize workplaces, dentistry faces a pivotal question: How will the profession adapt? This study examines the evolution of dentistry with a focus on technological advancements, and profession's trajectory in the future. This article draws from decades of dental innovation and data. Key studies like Schwendicke (2020) will provide a dentist's perspective on how AI should be integrated with human oversight to improve patient care and reduce costs. This article will also analyze findings from Liu (2023), which provide a comprehensive review of robotics in dentistry. Their research focuses on the development of automated systems for tooth preparation, orthodontic adjustments, and surgical procedures. The advancement of AI and robotics, coupled with human expertise, will shape the future of dental care, improving quality and accessibility.

Keywords:

Dentistry; AI; Robotics; Innovation; Automation

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1635

Presentation Time: Session 4: 1:30-2:30pm

Polyformer

STEM

Authors(s):
Ethan C Espinoza† (DSB)

Abstract:
[Abstract Redacted]

Keywords:
[no keywords provided]

Mentor(s):
Steven R Dunlop (Purdue University); Stewart F Bauserman (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1637

Presentation Time: Session 4: 1:30-2:30pm

Remember? Understand? Coding an Exam's Difficulty

STEM

Authors(s):

Piper Jade Feese† (Pharmacy); Natalie Corrine Marraccini† (HHS); Ciara N Worthey† (HHS)

Abstract:

Undergraduate Anatomy and Physiology (A&P) courses are required for students in various majors and are known for their rigorous course material. To better understand how students are assessed, a codebook was developed to categorize summative assessments. We coded the unit in the course and whether the questions were about anatomy and/or physiology. We used Bloom's Taxonomy to classify the cognitive demand required to answer multiple-choice and extended-response assessment questions. For example, at the lowest end "remember" questions involve students recalling facts, definitions, and basic concepts. At the higher end, "analyze" questions require students to use multi-step thinking to organize, judge, and conceptualize information. Preliminary data indicates that the majority of questions assess lower-order cognitive skills, mostly in the "remember" category of Bloom's Taxonomy. We will present the codebook and examples of coding thus far. Using this codebook to analyze assessments will potentially reveal patterns of question type that can help the instructional team ensure the assessments are supporting students in achieving the learning objectives in the course. An analysis of student responses on assessment questions could reveal important trends in the types of questions students commonly struggle with and need additional or different ancillary curriculum materials to narrow any learning gaps.

Keywords:

Bloom's Taxonomy; Anatomy; Physiology; Assessment Questions; Cognitive Demand

Mentor(s):

Stephanie M Gardner (Purdue University); Michele L Holcombe (Science)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1638

Presentation Time: Session 4: 1:30-2:30pm

Effects of Acute Ketamine Treatment on Learning Dependent Neural Plasticity in FXS Mice Models

STEM

Authors(s):

Mia Anne Fehlinger† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Fragile X Syndrome; Ketamine; Neural Plasticity; Behavior; NMDA Receptors

Mentor(s):

Alexander A Chubykin (Purdue University)

Other Acknowledgement(s):

Sanghamitra Nareddula (Science)

Poster Presentation Abstract Number: 1640

Presentation Time: Session 4: 1:30-2:30pm

3D Printed Flexible Sensors

STEM

Authors(s):

Ethan Scott Fuller† (Polytechnic); Theodore Kessid Wicker† (Polytechnic)

Abstract:

Flexible sensors play a crucial role in wearable electronics and motion-tracking applications. This work explores the fabrication of strain sensors using 3D-printed conductive Thermoplastic Polyurethane (TPU), evaluating the influence of different printed geometries on mechanical flexibility and electrical response. Various sensor designs were tested under controlled deformation conditions to assess their conductivity, durability, and sensitivity to strain. These results serve as a reference for comparison with a novel TPU-Carbon Nanofiber (CNF) composite, providing insights into the impact of geometry and material properties on sensor performance. Additionally, the study highlights the feasibility of using commercially available conductive TPU for low-cost, customizable sensor applications. The findings contribute to the advancement of flexible electronics, paving the way for more efficient and accessible wearable sensing technologies.

Keywords:

Thermoplastic Polyurethane (TPU); TPU-Carbon Nanofiber (CNF)

Mentor(s):

Diana Alejandra Narvaez (Polytechnic); Brittany A Newell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1641

Presentation Time: Session 4: 1:30-2:30pm

Actuaries and AI

STEM

Authors(s):

Scott William Fusco† (Science)

Abstract:

How will artificial intelligence change the field of actuarial science? Its' potential effects on the profession of actuarial science can best be described by the ideas of doomsday and training day. Doomsday is the idea that AI will take over our jobs by being able to mimic humans' abilities such as creativity and judgement which are both crucial in the field of actuarial science. Training day is the idea that actuaries will move towards training AI alongside doing their normal duties in the hope that AI can bring the profession to the next level. Preliminary analysis of the topic has pointed more towards the idea of actuaries and AI working together since AI is still incapable of reliably mimicking the human element of the job. This research will aim to better analyze and summarize the opinions of other actuaries and major groups such as the Society of Actuaries and the Casualty Actuarial Society to better predict how actuaries will be affected by artificial intelligence. By understanding how actuarial science will be affected by AI, actuaries can be better prepared for this future heavily influenced by AI and avoid unemployment by coexisting with this technology.

Keywords:

Artificial Intelligence; AI; Actuarial Science

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1642

Presentation Time: Session 4: 1:30-2:30pm

Extracting supernova explosion anisotropies in the power spectra of the type Ia supernova remnant SN 1006 at late times

STEM

Authors(s):

Roy Michael Galazka† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Supernovae; Molecular Clouds; Computational Astrophysics

Mentor(s):

Abigail Polin (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1643

Presentation Time: Session 4: 1:30-2:30pm

The effects of omega-3-polyunsaturated fatty acid (PUFA) supplementation on asthma-prone racehorse performance

STEM

Authors(s):

Alyson Renae Galey† (Agriculture|JMHC)

Abstract:

The purpose of my research project is to analyze the effect of omega-3 polyunsaturated fatty acid (PUFA) supplementation (fish oil) on the performance of asthma-prone racehorses. I will be analyzing racing performance data that was collected in 2021-2022 from four racetracks in different states: California (Santa Anita Park), Florida (Gulfstream Park), Indiana (Indiana Grand Racing), and New Mexico (Ruidoso Downs Racetrack). I will then be analyzing data that consists of the placing the horses earned, the money earned, and the speed figure assigned to the horse's performance before and after fish oil supplementation in comparison to horses receiving a placebo consisting of corn oil supplementation (omega-6 PUFA). I will be asking the question how does the usage of omega-3 fatty acid feed supplementations affect the Equibase speed figure, race place, and race earnings? More specifically, how do the outcomes before fish oil supplementation compare to those outcomes as seen after supplementation, and how do the effects of performance in horses that were supplemented fish oil compare to horses that were supplemented with corn oil instead?

Keywords:

Equine; Omega-3 Polyunsaturated Fatty Acid; Asthma

Mentor(s):

Kathleen M Ivester (Purdue University); Laurent L Couetil (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1644

Presentation Time: Session 4: 1:30-2:30pm

Predictive Modeling of Liver Cancer Risk

Business Case Study

Authors(s):

Ethan Thomas Garcia† (DSB); Jakub John Jasinski† (DSB); Cooper J Keillor† (DSB); Shenghua Wu† (DSB); Meenakshi Radhakrishnan† (DSB)

Abstract:

Our research addresses the critical need for early and accurate identification of patients at risk of developing liver cancer by constructing an ordinal classification model. The central research question investigates how demographic, genetic, and medical history factors contribute to patient risk stratification for liver cancer. This topic holds significant relevance because early detection of liver cancer facilitates timely interventions, substantially enhancing patient outcomes, healthcare resource optimization, and targeted preventive strategies.

To achieve our research objectives, we systematically preprocess the dataset through meticulous handling of missing values, encoding categorical variables, and standardizing numerical features. Our methodological framework employs ordinal logistic regression, decision trees, and ensemble methods to effectively categorize patients into risk tiers. Rigorous cross-validation procedures are employed to optimize model performance and mitigate overfitting risks. To further ensure interpretability and clinical applicability, feature importance analyses are conducted utilizing LASSO regression and SHAP values, emphasizing high sensitivity for identifying patients in high-risk categories.

Preliminary findings have accurately identified critical predictive factors, including lifestyle behaviors (such as alcohol consumption and smoking), existing medical conditions (notably hepatitis and diabetes), and socioeconomic elements such as healthcare access. Our results demonstrate the model's robust capacity to classify patient risk levels accurately, particularly in identifying individuals at high risk for liver cancer.

The implications of our research are profound. It provides valuable insights for pharmaceutical research by pinpointing specific risk factors that may inform targeted therapeutic developments. Additionally, healthcare institutions can leverage this predictive capability to allocate resources more effectively, ensuring prioritized support for patients with

elevated risk profiles. This study underscores the potential for improved patient outcomes through proactive, data-driven healthcare interventions.

Keywords:
Liver Cancer; Predictive Analytics; Healthcare

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1645

Presentation Time: Session 4: 1:30-2:30pm

Investigating the function of Cellulose Synthase Genes in Double Fertilization

STEM

Authors(s):

Alaina Rose Gartner† (Agriculture|Engineering)

Abstract:

The interaction between male and female gametes during double fertilization is critical for successful seed development. In Arabidopsis thaliana, the Cellulose Synthase complex (CESA) is responsible for cell wall formation. Although plant gametes lack organized cell walls, sperm and egg cells express several genes involved in primary cell wall biosynthesis. We hypothesized that the complementary contribution of CESA transcripts from each gamete to the fertilized egg cell is required to trigger the assembly of CESA complexes and biosynthesis of a cell wall around the zygote, preventing polyspermy. To test this hypothesis, we first generated high-order mutants by crossing specific gamete-expressed CESA members. We crossed these lines with sperm cell mutants that challenge the egg with an excess number of sperm cells to define the contribution of cell wall formation to polyspermy block. The progeny of these crosses was examined for ploidy levels, embryo sac cellular morphology, pollen tube growth, ovule targeting, and fertility defects. This work is expected to contribute to the discovery of new regulatory factors that prevent polyspermy in double fertilization and promote successful seed development.

Keywords:

Cellulose Synthase; Polyspermy Block; Double Fertilization

Mentor(s):

Leonor Maria de Fatima Chagas Boavida (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1646

Presentation Time: Session 4: 1:30-2:30pm

Targeted recruitment of immune effector cells for the treatment of the influenza virus

STEM

Authors(s):

John Oliver Richard Gase† (Agriculture)

Abstract:

Despite numerous available therapies, the influenza virus is still prevalent and extremely dangerous. Influenza has more fatalities than acute myelogenous leukemia, hemorrhagic stroke, AIDS caused by HIV, and ovarian cancer. In the United States between 2010 and 2024, there was an annual average of 30,500 deaths, 405,000 hospitalizations, and 28.7 million illnesses due to the influenza virus. This is the result of 3 main issues: the effectiveness of current vaccines ranges from 19% to 60%, available therapies remain ineffective in later stages of viral disease states, and the rise of new strains of influenza resulting in antiviral drug resistance. To combat these issues, extended research has led to the development of zanDR, a bispecific small molecule that binds and inhibits viral neuraminidase expressed on both free virus and virus-infected cells. ZanDR recruits naturally occurring anti-rhamnose and anti-dinitrophenyl (DNP) antibodies with a rhamnose and DNP dual-hapten, which in turn recruits immune effector cells. This ligand-directed drug utilizes current methods of protection against the influenza virus, yet a single intranasal dose in lethally infected, late-disease stage mice yields 100% protection and reduces lung viral loads faster and ~1000x more thoroughly than current therapies. In addition to influenza, this drug structure can be modified to target other diseases, such as various cancers.

Keywords:

Influenza Virus Immunotherapy; Antiviral Therapeutics; Recruitment of Antibodies; Influenza Virus

Mentor(s):

Kanduluru Ananda (Purdue University)

Other Acknowledgement(s):

Imrul Shahriar (Purdue University)

Poster Presentation Abstract Number: 1647

Presentation Time: Session 4: 1:30-2:30pm

Feeding behavior and dry matter intake associated with feeding two concentrations of an Asparagopsis armata containing product in dairy cows

STEM

Authors(s):

Brianna Lynn Gast† (Agriculture|JMHC)

Abstract:

Supplementation of Asparagopsis armata (A-A) has been reported to reduce enteric methane emission from cattle; however, less is known about how seaweed products impact feeding behavior and diet palatability. We hypothesized that cows fed a higher concentration of A-A will have a lower dry matter intake and altered feeding behavior compared with cows fed a diet with no A-A or diet with lower concentration of A-A. Nine non-lactating, non-gestating Holstein dairy cows averaging 48 ± 11 mo of age and 690 ± 83 kg of BW at study initiation were enrolled in a replicated 3×3 Latin square with each period lasting 21d. Diets included a control diet with no A-A (CON), low A-A diet (LA-A; bromoform concentration 6 mg/g of DM), and high A-A diet (HA-A; bromoform concentration 9 mg/g of DM). Immediately after feeding, cows were observed for 15-min and scored every min using a feeding behavior ethogram. Intake was assessed after 1h and after 23h access to feed each d of the study. Data was analyzed using SAS v 9.4 with the fixed effects of square, day of treatment, and treatment, and the random effect of cow and period. There were no differences between treatments for 1h intake ($P=0.19$); however, daily intake was 0.6 kg/d lower for HA-A compared to LA-A ($P<0.05$). There were no differences for feeding behavior ethogram results for the proportion of time spent eating during the first 15-min of offered feed ($P=0.11$). There was a treatment by day of treatment effect for 1h intake ($P<0.05$) with cows consuming 0.9 kg less feed in the first hr new feed is offered compared to the second day feed is offered. Overall, A-A did not affect the palatability of the diet to the extent that it reduced feed intake relative to control, but the higher dose of A-A did have reduced daily intake compared to the lower dose of A-A. Regardless of diet, cows consumed a significantly lower amount of feed on the first day a novel diet was presented.

Keywords:

Palatability; Seaweed; Feeding Ethogram

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Jacquelyn P Boerman (Purdue University); Madison Lynn Simonds (Agriculture)

Other Acknowledgement(s):
Audrey M Searing Hettel (Agriculture); Lauren Raye Brown (Agriculture)

Poster Presentation Abstract Number: 1648

Presentation Time: Session 4: 1:30-2:30pm

Assessing N-terminal methylation in the yeast stress response

STEM

Authors(s):

Kody Glithero† (Pharmacy); Audrey Elizabeth Ortman† (Pharmacy)

Abstract:

The purpose of this study was to understand and identify the role of methylation on protein N-termini and its effects on cellular function and stress in Saccharomyces cerevisiae yeast cells. N-terminal methylation, a post-translational modification, is known to play a crucial role in overall cellular regulation but the system-wide understanding is unexplored. Our hypothesis is that mutations in the n-terminal sequence of proteins can affect the cell's overall response to stress.

To approach this, we utilized a CRISPR-based mutagenesis library generated by Inscripta, which consisted of 1,000 different mutations with unique amino acid substitutions. These substitutions can increase, decrease, or abolish methylation by modifying the recognition and binding affinity to the N-terminal methyltransferase. The N-terminal methyltransferases, are a specialized class of enzymes that are responsible for catalyzing the addition of one or more methyl groups to the N-terminus of their substrate proteins. Mutations in the N-terminal sequence directly impact the ability of these enzymes to recognize and modify the substrate, affecting protein function. We assessed the cellular function effects of N-terminal methylation by using a screening-based approach, randomly selecting 900 different strains, each with a specific mutation, onto agar plates containing various chemicals. These chemicals included but were not limited to benomyl (BM), hydrogen peroxide (H2O2), acetic acid, and methylglyoxal (MGO). For example, 10 strains were sensitive to MGO exposure (1.1%). This implies that specific n-terminal mutations can influence cellular growth in response to stress conditions. Thus, N-terminal methylation might have a direct impact on yeast at the cellular level as well. However, additional experiments are needed to confirm that mutations correlate with methylation status. By analyzing these effects, we aim to provide evidence on how N-terminal methylation can influence cellular processes, with the goal of expanding our understanding of post-translational regulation occurring in eukaryotic cells.

Keywords:
Mutagenesis; N-Terminal Methylation; Post-Translational Modification; High-Throughput Screening; Stress Response

Mentor(s):
Tony Hazbun (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1649

Presentation Time: Session 4: 1:30-2:30pm

Effect of shock-induced compressive and shear work on the reactivity of hotspots in polymer-bonded explosives

STEM

Authors(s):

Jacob Hayes Goehring† (Engineering|JMHC)

Abstract:

RDX, the explosive part of C-4, is a “high explosive” because it requires a strong impact to induce detonation. Violent mechanical distortions of this kind, known as shock loadings, result in exotic phenomena such as increased plasticity and chemical reactions. Defects, such as pores, within the material’s microstructure concentrate energy from the shockwave into hotspots, which may ultimately induce a deflagration. This understanding has been achieved by leveraging molecular dynamics, among other techniques. However, RDX isn’t kept in a pure form, but is rather intertwined with a polymer binder like polystyrene. The influence of polymer adjacent to pores on the compressive and strain work done during the shock-induced collapse of porosity remains unclear. We simulate shocked systems of RDX, polystyrene, and voids to better understand how the polymer affects the reactivity of the system. Our work is part of the quest to understand large-scale phenomena as consequences of pure physics, and it increases the fidelity of our zoomed-out models of energetic materials.

Keywords:

Materials Science; Molecular Dynamics; Shock Loading; Polymers; High-Explosives

Mentor(s):

Jalen Riley Macatangay (Engineering); Alejandro H Strachan (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1650

Presentation Time: Session 4: 1:30-2:30pm

Contrasting the ratios of neural mechanisms to photoreceptors: Animals employ different color processing strategies

STEM

Authors(s):

Paraj Goyal† (Science|JMHC)

Abstract:

Color vision researchers use perceptual models to generate predictions about what an animal can see. One of the perceptual models assumptions is about the number of neural mechanisms involved in color processing (i.e., cone opponent channels contrasting color signals) based on the number of photoreceptors (n) an animal has. Three mutually exclusive strategies for comparing cone signals that have been proposed. We can test the manifestation of these strategies by calculating the ratio of neural mechanisms and photoreceptors. The first strategy is that information in each neural mechanism is linearly independent and optimally efficient; therefore, animals should have n-1 neural mechanisms. The second strategy is that symmetrical mechanisms that convey the same information occur; so, animals should have a range of neural mechanisms [n to n^2-(n+1)]. The third strategy is that increasing the number the neural mechanisms will refine the ability to discriminate color; so, animals should have n^2-n neural mechanisms. We estimated the ratio of neural mechanisms to photoreceptors in 32 species and compared this to the predicted ratios of these three major strategies. In general, the predicted values of strategies 1 and 3 did not fall into the confidence intervals of the observed ratios. However, for trichromats and tetrachromats, the predicted range of strategy 2 did fall in the confidence intervals of the observed ratios, suggesting that neural mechanisms may be redundant. However, when looking the percentage of species falling into the different strategies, we found representation of species mostly in strategies 1 and 2. This discrepancy may be attributed to interspecific variation in phylogeny, behavior, visual system configuration between major vertebrate classes.

Keywords:

[no keywords provided]

Mentor(s):

Esteban Fernandez-Juricic (Purdue University); Carlay L. Teed (Science)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1651

Presentation Time: Session 4: 1:30-2:30pm

Assessment of cardiac geometrical remodeling during chronic hypertension in murine pregnancy with 2D and 4D ultrasound

STEM

Authors(s):

Sarah Elizabeth Grev† (Engineering); Jake Anthony Castro‡ (Engineering); Samantha Stebbings‡ (Engineering|JMHC)

Abstract:

Chronic hypertension in pregnancy is associated with fatal complications of pregnancy and has doubled in prevalence since last decade to impact more than 2% of pregnancies [1]. Previous studies have observed changes in cardiac function through normotensive pregnancy, but cardiac remodeling in chronic hypertension during pregnancy is understudied. Current research shows that both pressure and volume overload affect cardiac remodeling during chronic hypertensive pregnancies. We assessed the geometrical changes within a hypertensive pregnancy (n=1) and chronic hypertension control group (n=1). To understand the physical changes of the heart, we measured murine left ventricle wall-thickness and diameter from 2D anatomical M-mode and 4D ultrasound images using VevoLab software. Preliminary wall-thickness and diameter results at diastole of the experimental group (n=1) at baseline to one day postpartum are 0.98mm to 1.09mm (upper wall), 1.18mm to 1.18mm (lower wall), and 5.16mm 6.03mm (diameter). In the control group (n=1), results are 0.89mm to 1.20mm (upper wall), 0.89mm to 1.99mm (lower wall), and 5.06mm to 6.33mm (diameter). These initial results suggest that the wall-thickness is maintained in the experimental group but increases in the control group. Diameter increased for both groups. Further 2D analysis will continue to solidify these findings. Future work involves analysis of histology of cardiac tissue samples. Overall, the results from this study provide insight into cardiac function and physical remodeling occurring during hypertensive pregnancies. Potential broader outcomes include a better understanding of clinical management of hypertensive pregnancies.

[1] A. N. Battarbee, et al., AJOG, 2019.

Keywords:

Hypertension; Pregnancy; Cardiac Remodeling; Geometry; Ultrasound

Mentor(s):
Elnaz Ghajar-Rahimi (Engineering); Craig Goergen (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1652

Presentation Time: Session 4: 1:30-2:30pm

SCALE HI-AP Experimental Design & Facilitation of Thermal Grease Reliability and Performance in Large-Scale Computer Applications

STEM

Authors(s):

Nolan Parker Gronowski† (Engineering)

Abstract:

This work aims to create a universal testing apparatus comprised of multiple micro-controllers with high power density chips that can reach equivalent chip temperatures seen in data centers, computer clusters, and AI-training facilities. With this testing fixture, several types of Thermal Interface Materials (TIMs), which are commonly used inside electronic packages as an interface between the processor die and the heat spreader or between the heat spreader and a cooler, can be applied to the CPU of the micro-controllers to test their reliability and performance in data centers over long periods, on the scale of several months. To test these TIMs, Python scripts were developed and implemented in the micro-controllers to artificially induce CPU loading, either randomly generated or following a predefined load distribution over some time, to heat the chip and analyze the reliability and performance of TIMs over several months by taking frequent temperature measurements. Academic institutions and companies could replicate this testing fixture to conduct their long-term reliability rather than using short-term accelerated testing as is frequently done to analyze the performance of TIMs. This poster will focus on the experimental design, preliminary results, and future steps.

Keywords:

Thermal Interface Material; Python Scripts; Heat Transfer; Data Center; Electronics Cooling

Mentor(s):

Ritwik Vijaykumar Kulkarni (Engineering); Amy M Marconnet (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1653
Presentation Time: Session 4: 1:30-2:30pm

Biomedical Drone for Narcan Delivery

STEM

Authors(s):

Natasha Rajendrara Gundapaneni† (Engineering); Kanav Atre† (Science); Hanqin Zhai† (Engineering); Shreyansh Tehanguria† (Science); Nathan James Arnold* (Engineering); Yash Agnihotri* (Engineering); Bhaskar S Patke* (Engineering); Hailey Danae Manuel* (Polytechnic|JMHC); Harshavi P Birla* (Engineering); Nikolai Lyubomir Tesla Auclair* (Polytechnic); Parth Kailash Dubal* (Engineering); Shelby Grace Britton* (Engineering); Ty Dean Frederick* (Engineering); Victor Ionut Ene* (Engineering)

Abstract:

Opioid overdose is a growing public health crisis in Indiana and across the United States. Approximately 81,000 overdose-related deaths were reported in 2022. Narcan is an effective emergency treatment to treat opioid overdose patients but timely administration is critical as brain damage can occur within six minutes of an overdose. Rapid drone delivery is an effective solution to combat this problem but real-time path planning is essential to ensure safe and efficient navigation in dynamic environments.

Our research proposes a simulation framework for evaluating autonomous drone-based emergency delivery using the RRT* algorithm for path planning. The simulation integrates ROS2, PX4 Autopilot, and Gazebo and uses the PX4 X500 drone model. We plan to design realistic routes mimicking scenes from rural Indiana to assess the algorithm's ability to generate time-efficient and collision-free trajectories. The performance of the drone is evaluated based on delivery time, obstacle avoidance, and successful landing. Our goal for this semester is to validate RRT* in simulation. In the future, we aim to deploy the algorithm on a physical drone for real-world testing.

Keywords:

[no keywords provided]

Mentor(s):

James Michael Goppert (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1654

Presentation Time: Session 4: 1:30-2:30pm

Preference-based Reinforcement Learning with Multimodal Feedback from Foundation Models

STEM

Authors(s):

Arjun Sandeep Gupte† (Engineering)

Abstract:

Human-robot collaboration leverages the complementary strengths of humans and robots to tackle complex tasks across diverse applications. A key aspect of this collaboration is the robot's ability to understand and adapt to human preferences, enabling efficient and effective assistance tailored to individual needs. However, a significant challenge in preference learning is providing accurate and detailed feedback to the robot, as suboptimal feedback often leads to noisy preference comprehension, hindering effective learning. Foundation Large Language Models (LLMs) and Vision-Language Models (VLMs) are increasingly used as feedback sources in Preference-based Reinforcement Learning (PbRL) to reduce dependence on costly human expert demonstrations. Although current methods show promising results, they are limited as they rely exclusively on either LLMs or VLMs, failing to exploit their combined potential. To address this, we propose a novel hybrid framework that fuses the complementary strengths of LLMs and VLMs to act as synthetic teachers for the RL agent. Our approach introduces a feedback shift, where VLMs deliver high-level guidance, followed by LLMs providing low-level, fine-grained feedback to fine-tune the RL agent's decision-making. By fusing these capabilities, our system establishes a robust initial preference foundation for the RL agent, reduces the need for extensive human-labeled preference data, and harnesses the creative potential of foundation models to generate assistive multimodal feedback, enhancing the comprehension of human preferences.

Keywords:

Human-Robot Collaboration; Preference Learning; Reinforcement Learning; Foundation Models; Multimodal Feedback

Mentor(s):

Byung-Cheol Min (Purdue University); Ziqin Yuan (Polytechnic); Ruiqi Wang (Polytechnic)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1655

Presentation Time: Session 4: 1:30-2:30pm

Direct Ligand Exchange of Thin-Film Photovoltaics of CuInS2 Using Molecular Precursors

STEM

Authors(s):

Kamran Hajibayli† (Engineering)

Abstract:

Although crystalline silicon dominates today's commercial photovoltaic (PV) market, thin-film solar cell alternatives such as CuIn(SySe1-y)2 (CISSe) and CdTe have recently achieved significant interest due to their efficient material utilization, cost and performance. To achieve this, solution-processed thin films is a platform for the fabrication of the thin films. However, native carbon impurities from the reactive solvents slow down the progress in the power conversion efficiency of these materials. This research project explores a carbon?free approach to fabricating CuInS2 (CIS) precursor films by substituting the carbonaceous ligand with the inorganic and volatile H2S. Building on recent advances in direct synthesis and ligand engineering for carbon?free, solution-processed nanoparticles, the study aims to eliminate residual carbon impurities that negatively affect film quality and device efficiency. The experimental approach for this project involved varying the temperature of annealing the substrate during coating phase from 200°C to 300°C in presence of the carbon free ligand. To validate our results, several characterization techniques will be used, including X-ray Diffraction (XRD), X-ray Fluorescence (XRF), Raman spectroscopy, profilometry, and photoluminescence measurements (PL), to assess changes in phase purity, elemental composition, surface morphology, and optical properties. By comparing films produced with and without H2S, the research aims to fabricate carbon-free molecular precursor thin films to enhance the performance for solution-processed CISSe photovoltaics.

Keywords:

Photovoltaics; Solar Energy; CIGS; Ligand Exchange

Mentor(s):

Juan Sebastian Alban Dominguez (Engineering); Rakesh Agrawal (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1657

Presentation Time: Session 4: 1:30-2:30pm

Cdc14 Targeted Antifungal Drug Discovery

STEM

Authors(s):

Nathan Michael Henderson† (Agriculture)

Abstract:

Pathogenic fungi are a serious global health concern, claiming an estimated 3.8 million lives annually. New antifungal therapeutics and targets are needed to address this problem. The Cdc14 phosphatase family has been proposed as an attractive target for new antifungal drug design. Cdc14 is required for C. albicans virulence in a mouse model of invasive candidiasis, whereas mammal Cdc14 orthologs appear dispensable for post-natal growth and development. In addition, the Cdc14 active site is highly conserved in fungal pathogens and has a unique and strict substrate specificity, making it a potentially effective and broad-range target. The overall objective of my project was to identify and characterize small molecule Cdc14 inhibitors from chemical libraries as an initial step in the antifungal drug development process. All Cdc14 enzymes have a highly reactive cysteine catalytic residue in the active site, and therefore, we screened for covalent inhibitors from commercial chemical libraries. Through absorbance spectroscopy, the screen measured the ability of library compounds to inhibit the Cdc14-catalyzed conversion of pNPP to pNP. 16,606 compounds were screened against Aspergillus fumigatus Cdc14. And 20 inhibitors were identified that exhibited at least 40% inhibition, with the highest displaying 85% inhibition. We are focusing on the 7 most potent and reproducible inhibitors; characterizing affinity, mechanisms of action, range of activity against other Cdc14 orthologs, and specificity for Cdc14 among other pyrophosphatases. Future directions include structural analysis of Cdc14 orthologs with their inhibitors and in vivo studies aimed at assessing effect on virulence.

Keywords:

Antifungal; Drug Discovery; Cdc14; Inhibitor; Candida

Mentor(s):

Mark C Hall (Purdue University)

Other Acknowledgement(s):

Kevin Gabriel Velazquez-Marrero (Agriculture)

Poster Presentation Abstract Number: 1659

Presentation Time: Session 4: 1:30-2:30pm

How AI-Driven NPCs Simulate Human-like Social Interactions in Crowded Environments

STEM

Authors(s):

Rachel Wingyan Ho† (Engineering); Mihika Sharma† (Science); Niril Jestus† (Engineering); Chun-Yu She† (Engineering); Chengxuan Li† (Science)

Abstract:

This project intends to explore how AI-driven non-playable characters (NPCs) navigate and adapt to external stimuli in crowded environments and how randomizing NPC attributes influences crowd behavior and inter-NPC interactions. By analyzing movement patterns and group dynamics, we aim to understand how NPCs transition between acting independently and forming collective behaviors in response to stimuli. We will use Unreal Engine 5's Environmental Query System (EQS), Behavior Tree, and Blueprint systems to create NPCs with varying personality and physiological traits that adjust behaviors based on perceived stimuli. A crowd is made up of many different individuals, and we seek to replicate this by randomizing each NPC's perception capabilities conforming to a normal distribution, ie. degree and range of vision cone, for an agent-based simulation strategy. NPC movement data is tracked and logged by outputting time-stamped locations to a CSV file, enabling post-simulation analysis of crowd behavior. We will structure this data to be GIS-compatible, allowing external geographic information systems (GIS) software to analyze how varying NPC perception attributes influence overall crowd dynamics and site usage. Our research aims to improve NPC simulations to be a more accurate representation of real-life crowds and use the data to analyze how the decision-making process in AI NPCs can be extended to real-world scenarios. Our research can be used in game development and urban planning applications, primarily based on how AI NPCs navigate as both individuals and crowds through spaces, and exhibit situational behaviors based on external stimuli and unique personality traits.

Keywords:

[no keywords provided]

Mentor(s):

David Michael Barbarash (Agriculture)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1660

Presentation Time: Session 4: 1:30-2:30pm

Patellar tendon biomechanical and morphological properties in young and older adult women

STEM

Authors(s):

Aidan Thomas Hopwood† (Agriculture|Engineering|JMHC); lauren Mitevski‡ (Agriculture|JMHC)

Abstract:

The loss of estrogen associated with menopause is a significant clinical problem affecting many women every year. A central area of concern is the impact of altered tendon properties with menopause that could increase the risk of injuries and reduce quality of life. The precise changes in tendon properties across the female lifespan have not been extensively characterized. Tendon morphology and biomechanical properties in premenopausal and postmenopausal women were analyzed using ultrasound and magnetic resonance imaging (MRI). This study was approved by the Purdue University IRB (#1812021481). Participants included sixteen premenopausal women (Age: 25+-3 years, BMI: 22+-2) not using oral contraceptives and twenty-eight postmenopausal women (Age: 64+-5 years, BMI: 27+-4) not using hormone therapy. The cross-sectional area (CSA) of the patellar tendon was greater in postmenopausal women (113.7+-20.8 mm2) compared to premenopausal women (95.1+-23.1 mm2) ($p<0.05$). Patellar tendon modulus was lower in postmenopausal women (0.72+-0.26 GPa) compared to premenopausal women (1.07+-0.26 GPa) ($p<0.05$). Quadriceps muscle volume was lower in postmenopausal women (585+-107 cm3) compared to premenopausal women (962+-233 cm3) ($p<0.05$). One repetition maximum was lower in postmenopausal women (42.84+-2.32 kg) compared to premenopausal women (61.50+-7.41 kgs) ($p<0.05$). Fibril disorganization, measured by T2* relaxation time, was higher in postmenopausal women (7.349+-1.900 AU) compared to premenopausal women (5.9+-0.9 AU) ($p=0.14$). The greater T2* relaxation time indicating greater fibril disorganization in postmenopausal women compared to young, which may account for the lower modulus even with greater CSA. Further experimentation and studies are needed to better to understand the relationships between menopause and tendon health.

Keywords:

Women; Musculoskeletal Research; Tendon

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

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Other Acknowledgement(s):
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Poster Presentation Abstract Number: 1661

Presentation Time: Session 4: 1:30-2:30pm

The Aggregation Tendencies of the Signal Peptide Regions of Prone and Not Prone to Aggregate Proteins

STEM

Authors(s):

Natalie Grace Horgan† (Pharmacy|JMHC); Anabela Djurovic-topalovic‡ (Pharmacy|JMHC)

Abstract:

Signal peptides are sequences of peptides located at the N-terminus of proteins and determine their secretion and destinations. The N-region is positively charged and influences the orientation of translocation. When linked to proteins, signal peptides protect against misfolding events and amyloid fibril formation, which are associated with neurodegenerative and inflammatory diseases. An earlier study by our research group demonstrated the misfolding tendency of the synthetic signal peptide of serum amyloid A1 (SAA1), which originates from humans and other species. The current study investigates the misfolding propensity of fourteen different synthetic signal peptides from both prone-to-aggregate and non-prone-to-aggregate proteins using an in silico program and transmission electron microscopy (TEM). Among the six signal peptides from aggregation-prone proteins, all were confirmed to misfold through electron microscopy and Congo red binding assays. Specifically, signal peptides from human and feline islet amyloid polypeptides, SAA1, parathyroid hormone, transthyretin (TTR), and cathepsin K generated amyloid-like fibrils. Signal peptides from non-prone-to-aggregate proteins, including collagen type X alpha 1, human granulin, luteinizing hormone beta polypeptide, serpin peptidase inhibitor A7, serpin peptidase inhibitor E, serine protease 1, and UDP glucuronosyltransferase family 1 member A1, also misfolded. TTR signal peptide seeds accelerated misfolding of the TTR1-25 fragment peptide, as assessed by thioflavin T assays, and increased oligomer formation, as validated by photo-induced cross-linking of unmodified proteins assays. Overall, all prone-to-aggregate signal peptides and seven out of eight non-prone-to-aggregate signal peptides misfolded, as confirmed by TEM images. Studying signal peptide aggregation may provide key indicators of the mechanisms underlying protein misfolding.

Keywords:

Aggregation Prone; Amyloid; Fibrils; Misfolding; Signal Peptide Region

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
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Other Acknowledgement(s):
Taiwo Ademola Ademoye (Interdisciplinary & Special Programs)

Poster Presentation Abstract Number: 1662

Presentation Time: Session 4: 1:30-2:30pm

Improving Branch Prediction Accuracy and Minimizing Area for for a RISC-V based microcontroller

STEM

Authors(s):

Andy Hanjun Hu† (Engineering); Mary Francis† (Engineering|JMHC); Alexandra J Tauriainen‡ (Engineering|JMHC); Dhruv Roopchand Khatri* (Engineering); Aishwarya Saikrupa Anand* (Engineering)

Abstract:

CPUs implement conditional control using branch instructions which branch out of normal instruction sequence. They also use pipelining to execute multiple instructions per cycle by fetching and decoding new instructions before the previous one has completed. This potentially results in fetching instructions from the wrong address, as a conditional jump instruction has not been fully operated on. If the CPU operates on the wrong branch of a conditional, the CPU must wipe all active instructions and start from the correct instruction, wasting its previous computations. Thus, in pipelined CPUs, branch predictors are crucial to maintain the flow of the instruction pipeline by making accurate predictions that prevent stalls.

Recently, a dynamic 2-bit predictor was implemented in AFTx07, however it conflicts with existing performance-enhancing extensions within the chip. Compressed instructions allow for more instructions to be stored in the chip's already limited memory. Finding a way for the 2-bit dynamic predictor to work in parallel with the compressed instructions extension will greatly enhance the chip's overall speed while also reducing the memory footprint greatly.

Beyond the performance increase provided by the predictor, we must also consider its cost. A branch target buffer (BTB) is used to store previous branch targets, which takes up area on the chip apart from the predictor itself. Space on the AFTx07 chip is limited and we want to minimize the area used. Therefore, the team is exploring alternative branch prediction algorithms that use less space but offer similar performance improvements.

Keywords:

Branch Prediction; RISC-V; Microcontroller; Optimization

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1663
Presentation Time: Session 4: 1:30-2:30pm

Techniques for Secure Integration of Commercial Dies into Silicon Substrates for Heterogeneous Integration in Low Earth Orbit Applications

STEM

Authors(s):
Chun-Kang Huang† (Engineering); Pin-chen Su† (Engineering); Aadi Hsien-Lin Wu† (Engineering); Ying-Wei Lin† (Engineering); yoshiki takeuchi† (Engineering)

Abstract:
Our research project aims to prototype and refine specialized 2.5D Heterogeneous Integration (HI) processes for embedding millimeter-level modular commercial chiplets, specifically D-latch memory microchips and photodiodes, onto a silicon-based interposer for low-earth orbit satellite system applications. We pivot off the unique material characteristics of silicon and the advantages of 2.5D HI and to optimize our system in reducing interconnect lengths, lowering power consumption, and improving signal integrity. The process flow starts with building a foundation layer by pattern-etching of the carrier substrate, depositing the gaps with Cu to embed it, electroplating to grow the copper to secure the chiplets, and depositing an extra insulation layer to protect it. It is then followed by building an interconnection layer on top through depositing another layer of photoresist and copper to define the pattern for connections, metallization of conductive traces, and final lift-off to establish the connection pins. Through extensive prototyping, efficient identification of challenges, and realistic optimization, we aim to provide satellite manufacturers with a reliable and cost-effective microchip solution for space electronics, contributing to consistent and efficient space endeavors.

Keywords:
Heterogeneous Integration; 2.5D; Low-Earth Orbit Satellites; Semiconductors; Advanced Packaging

Mentor(s):
Peter Bermel (Purdue University); Saeed Mohammadi (Purdue University)

Other Acknowledgement(s):
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Poster Presentation Abstract Number: 1664

Presentation Time: Session 4: 1:30-2:30pm

The Role of Contextual Memory in Speech Sensorimotor Adaptation

STEM

Authors(s):

Taylor Marcia Irvin† (HHS|JMHC)

Abstract:

When we make movements, the central nervous system generates sensory prediction of the movements. If there is any discrepancy between sensory prediction and the actual sensory feedback, the system rapidly updates future movements to minimize such discrepancy and remain intelligible, a phenomenon called sensorimotor adaptation. Previous work in arm reaching sensorimotor adaptation has demonstrated that multiple contextual motor memories can be created and updated during adaptation depending on the environment/situation (i.e., cues, extent of sensory feedback alteration). The studies argue that multiple motor memories also play a role in re-adaptation (i.e., relearning of an adapted state) and de-adaptation (i.e., recovery to the baseline movements). In speech sensorimotor adaptation, however, it remains unknown whether multiple contextual memories are created/updated to inform future speech movements. Hence, the current study examined speech auditory-motor adaptation in which participants learn to change their speech upon hearing altered auditory feedback (i.e., increased formants).

In the current study, fifteen adults read simple words that appeared on a screen in a soundproof booth, while hearing their own speech production that was provided through earphones. In some trials, auditory feedback of their speech was altered and the words on the screen appeared with a different color and font style (i.e., visual cue). The formant frequencies in the speech production were analyzed and compared against previously published data from an experiment without any visual cues. We will discuss the effects of the visual cue on adaptation, re-adaptation, and de-adaptation, and whether these effects are consistent with the idea that multiple memories exist during speech sensorimotor adaptation.

Keywords:

Sensorimotor Adaptation; Contextual Memory; Speech Production

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Kwang Seob Kim (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1665

Presentation Time: Session 4: 1:30-2:30pm

Numerical Techniques for Efficient Full-Wave Modeling of Circuit Quantum Electrodynamic Devices

STEM

Authors(s):

In Jun Baek† (Science); Charles Spencer Bowles† (Engineering|JMHC); Tanvi Chukka† (Engineering); Arnav Jadhav‡ (Engineering); Christian Scheckel‡ (Engineering); Keshav Shylesh‡ (Science); Jinhoo Yoon‡ (Science)

Abstract:

The rapid advancement of quantum computers presents exciting opportunities for scientific and technological innovation. However, the engineering design of these revolutionary systems is in its early stages. Versatile numerical modeling tools have been instrumental in successfully designing most modern technologies; however, for quantum computers, the computational limitations of numerical design methods have prevented them from analyzing systems of useful scale. To address this limitation, this project is developing efficient and general-purpose tools for modeling the building blocks of quantum computers. In prior semesters, we developed a robust finite element method (FEM) implementation based on electromagnetic potentials to evaluate the electromagnetic eigenmodes of realistic 3D geometries to this end. This semester, we are improving this solver by incorporating local error estimation, which can be leveraged to efficiently generate high quality meshes using adaptive mesh refinement. Additionally, higher order basis functions are being implemented to reduce mesh density requirements, further enhancing efficiency. In parallel, we are creating CAD models of experimentally relevant geometries to test the underlying method and these improvements. Efforts in prior semesters also led to the development of a tool for characterizing open quantum systems using the Monte-Carlo method. This semester, we are exploring the use of polynomial chaos methods to accelerate the convergence of this approach, vastly improving its utility. By developing highly efficient modeling tools, our project aims to aid researchers in overcoming key challenges in quantum hardware design.

Keywords:

Finite Element Method; Circuit Quantum Electrodynamics; Open Quantum Systems

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):

Thomas Edgar Roth (Purdue University); Samuel Theodore Elkin (Engineering); Ghazi Khan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1666

Presentation Time: Session 4: 1:30-2:30pm

Caffeine and Diphenhydramine for Evaluation of Anxiety and Sleep Patterns in Zebrafish Larvae

STEM

Authors(s):

Ashilyn Joseph† (HHS|JMHC)

Abstract:

Zebrafish (Danio rerio) are a valuable model for studying neurobiological processes with key neurotransmitter pathways involved in anxiety regulation, like those found in humans. This study specifically investigated how caffeine (CAF), a stimulant, and diphenhydramine hydrochloride (DPH), an antihistamine with sedative effects, affect zebrafish larvae's anxiety-like behavior. An open field test (OFT) was used to evaluate exploratory and anxiety-like behavioral changes following chemical exposure. Based on earlier studies, fish were exposed to CAF 30 mg/L, CAF 40 mg/L, CAF 50 mg/L, DPH 0.45 mg/L, or DPH 0.60 mg/L and compared to a negative control (0 mg/L). According to chemical half-lives, the larvae were exposed to DPH for 30 minutes and CAF for 15 minutes prior to evaluation. The OFT was performed in 6-well plates, where larvae were filmed for 5 minutes. EthoVision XT 17.5 software was used to track and evaluate movement patterns. Multiple outcomes related to locomotor activity and anxiety were assessed (n=6, with 12 subsamples per treatment). The data was first analyzed for normality and homoscedasticity. Given non-normal distribution, statistical analysis was completed using Kruskal-Wallis test followed by Dunn's post-hoc test. In the two highest caffeine exposures, evidence of hypomotility was observed. DPH, on the other hand, had no discernible effect on zone preference, anxiety-related behaviors, or movement. Although more investigation is needed to further understand the underlying mechanisms, the observed anxiety-like behavior brought on by caffeine may be connected to changes in histaminergic and dopaminergic processes.

Keywords:

Zebrafish; Behavior; Caffeine; Anxiety

Mentor(s):

Jennifer Freeman (Purdue University); Wagner Antonio Tamagno (HHS)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1667

Presentation Time: Session 4: 1:30-2:30pm

Predicting Affective and Cognitive States Using Physiological Signals from skin-integrated wearable sensors

STEM

Authors(s):

YoonJae Jun† (Polytechnic)

Abstract:

Understanding human affective and cognitive states is crucial for the creation of mental health monitoring, human-computer interaction, and adaptive learning systems. Physiological signals from wearable sensors integrated into the skin provide an objective and continuous assessment of affective and cognitive states, offering advantages over self-reports and behavioral measures. However, despite advances in machine learning, significant challenges remain in accurately classifying physiological signals and predicting cognitive and affective states. Earlier research has explored numerous machine learning methods for physiological signal-based state estimation, yet challenges such as limited labeled datasets, high cross-subject variability, and the need for robust classification models persist. To address these challenges, we propose a system that utilizes established machine learning models to classify physiological signals and predict affective and cognitive states with high accuracy by modeling the probability of a given state based on observed physiological responses. Our approach utilizes sequential modeling techniques, such as Recurrent Neural Networks (LSTM) and potentially Transformer architectures, to increase prediction accuracy. Additionally, data augmentation strategies will be employed to address class imbalances and improve model robustness. This research aims to contribute to the task-specific adaptation of current machine learning techniques for physiological signal classification and cognitive-affective state prediction toward real-time mental state estimation applications.

Keywords:

Physiological Signal Classification; Cognitive and Affective State Prediction; Wearable Sensors; Machine Learning for Mental State Prediction; Sequential Modeling (LSTM, Transformer)

Mentor(s):

Nachiket Vatkar (Engineering); Wenzhuo Wu (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1668

Presentation Time: Session 4: 1:30-2:30pm

Glycine-N-methyltransferase is not necessary for age-dependent Drosophila photoreceptor survival

STEM

Authors(s):

Danny Mazen Kanj† (Agriculture|JMHC)

Abstract:

Age is a major risk factor for ocular diseases and the human population over the age of 65 is expected to double by 2050. However, the mechanisms underlying aging in the eye are not well characterized. One-carbon metabolism is a series of interlocking pathways that activate and transfer single-carbon units, and recent multi-omics analyses have revealed that it is perturbed within the aging Drosophila eye. Glycine-N-methyltransferase (Gnmt), an important enzyme in one-carbon metabolism, utilizes S-adenosylmethionine (SAM), the principal methyl donor, to produce S-adenosylhomocysteine (SAH) through the methylation of glycine to sarcosine. Gnmt regulates the SAM:SAH ratio which is crucial for various biological processes, such as DNA repair, methyltransferase activity, and epigenetic modification. Alterations in SAM metabolism and regeneration impact Drosophila lifespan and are a hallmark of the aging metabolome in the fly fat body; importantly, Gnmt overexpression is sufficient to decrease SAM and prolong lifespan. Within the aging Drosophila eye, our lab has observed an increased abundance of Gnmt; however, it is unknown whether Gnmt upregulation in aging fly eyes protects against age-dependent retinal degeneration. Considering this data, we hypothesized that Gnmt is necessary for maintaining eye health during aging. To test our hypothesis, we knocked down Gnmt via RNA interference (RNAi) in fly photoreceptors and profiled age-dependent photoreceptor health. Notably, no significant difference in retinal degeneration was observed with aging during live brightfield imaging. Based on these results, we can conclude that Gnmt is not necessary for Drosophila photoreceptor survival in a cell-autonomous manner.

Keywords:

Aging Eye; One-Carbon Metabolism; Glycine N-methyltransferase (GNMT); Drosophila

Mentor(s):

Vikki Marie Weake (Purdue University); Seth Daniel Lammert (Agriculture)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1669

Presentation Time: Session 4: 1:30-2:30pm

Engaging the Mind and Body: A Meta-Analysis of Interactive Learning in Education

STEM

Authors(s):

Manas Kathuria† (Engineering); Zhengyi Jiang* (Science); Aashvi Miten Majmundar* (Engineering)

Abstract:

Science, Technology, Engineering, and Mathematics (STEM) education disciplines are priorities for economic development in this technologically changing world, but the traditional education processes teaching our next generation of engineers and scientists are lagging behind. Educators have turned towards more interactive and embodied learning techniques with the potential for bridging this gap between abstract concepts and real-world applications. Past research has demonstrated the potential of interactive and embodied learning methods to enhance student engagement and understanding in STEM fields. Studies have shown that incorporating physical activity, virtual technologies, and gamified learning environments can improve spatial reasoning and problem-solving skills. Augmented Reality (AR) and Virtual Reality (VR) have been found to enhance spatial understanding, while embodied design approaches encourage students to actively construct knowledge through sensory-motor experiences. These findings highlight the need for innovative approaches that move beyond traditional lecture-based approaches. In our lab, we are exploring the integration of AR and gesture-based learning to enhance the teaching and understanding of fundamental statistics concepts, creating a more interactive and immersive learning experience. Our research begins with a series of in-depth interviews and observational studies to identify natural gestures that intuitively align with core statistical concepts. These gestures are carefully analyzed for their effectiveness in representing abstract ideas and their potential to improve comprehension. Preliminary findings suggest that students who engage with these immersive environments demonstrate improved ability to reason about concepts.

Keywords:

STEM Education; Interactive Learning; Augmented Reality (AR); Embodied Learning

Mentor(s):

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† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1670

Presentation Time: Session 4: 1:30-2:30pm

A Psychometric Evaluation of the PHQ-8A Among Adolescents in Military Families

Social Science

Authors(s):

Meha Raagani Kavoori† (HHS)

Abstract:

Youth in military families face unique psychological stressors during prolonged parental deployment in critical developmental years, which heightens their risk of mental health challenges, including depression. Given the high mobility, separation, and lifestyle demands associated with military life, a reliable and valid tool for assessing depression in this population is crucial. The Patient Health Questionnaire-8 (PHQ-8) is a widely used screening measure for depressive symptoms, though its psychometric properties have not been extensively evaluated in military-affiliated youth.

This study evaluates the reliability, validity, and factor structure of the PHQ-8 among children aged 11-16 years from military families who experienced parental separation due to deployment for six or more months at an early age. Using a national sample, we assessed the measure's distributional properties, internal consistency, and validity. Univariate analyses included score distributions, skewness, kurtosis, and standard deviation, along with histograms to explore depression score patterns. Additional methods include bivariate correlation analyses to examine relationships among PHQ-8 items and total depression scores, a multivariate confirmatory factor analysis (CFA) to assess the factor structure, and Cronbach's alpha to determine internal consistency. A correlation matrix was utilized to assess convergent and discriminant validity, comparing PHQ-8 scores with other psychological measures such as SCARED, a child anxiety assessment, and Peer Relationships.

Findings indicate that the PHQ-8 is a reliable and valid depression screening tool among adolescents in military families. These results emphasize the need for targeted mental health interventions for military youth further research on effective depression screening tools for at-risk populations.

Keywords:

Psychometric; PHQ-8; Depression; Adolescent; Military

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
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Other Acknowledgement(s):
Sharon L Christ (Purdue University); Aslesha Gupta (HHS); Douglas Andrew Sneddon (Purdue University)

Poster Presentation Abstract Number: 1671

Presentation Time: Session 4: 1:30-2:30pm

Metabolic Mechanisms Preventing Juglone Autotoxicity In Black Walnut

STEM

Authors(s):

Shoshana Sakara Keim† (Agriculture|JMHC)

Abstract:

Juglone is a phytotoxic compound produced by the black walnut tree (Juglans nigra). Juglone is secreted into the environment and inhibits the growth of nearby competing plants. This chemical is known to cause oxidative stress through redox cycling and spontaneously alkylates thiol groups. Juglone falls within the 1,4-naphthoquinone (1,4-NQ) class of molecules, which are involved in many important plant-biotic interactions. Despite juglone being heavily studied for its potential as a natural product-based herbicide and radiotracer experiments demonstrating that precursors for juglone biosynthesis stem from the shikimate pathway, the genes responsible for synthesizing juglone and preventing juglone autotoxicity remain unknown. The focus of our research is to determine the genes and mechanisms that prevent juglone autotoxicity in black walnut trees. Based on evidence from the literature, we hypothesize that biosynthesis of juglone requires that juglone, or one of its precursors, be reduced and glycosylated in order to prevent autotoxicity. Here, we conducted glycosyltransferase assays using crude black walnut protein extract. Assay conditions that are shown to conjugate a quinone to glucose can be used to test black walnut gene candidates for their ability to prevent autotoxicity. Phenylalanine ammonium lyase (PAL) assays were used to validate that the crude protein extracts contained viable proteins, and Ellman's assays were also used to give insight into quinone metabolism in vivo. This research lays the foundation for identifying the genes responsible for juglone metabolism.

Keywords:

Juglone; Allelopathy; Secondary Metabolism; Detoxification; Gene Discovery

Mentor(s):

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Other Acknowledgement(s):

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† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1672

Presentation Time: Session 4: 1:30-2:30pm

The Application of AI Tools in Cancer Research

STEM

Authors(s):

Roshan Khan† (Science)

Abstract:

In recent years, Artificial Intelligence (AI) has provided scientists with powerful tools for cancer research, diagnoses, and treatments. This study will examine the effectiveness of these applications by analyzing and comparing AI-driven methods to traditional approaches such as manual radiological assessments and histopathological analysis. I will focus on accuracy and impact on patient outcomes, particularly emphasizing brain tumors as a basis for comparison. Deep learning models have demonstrated high accuracy in detecting tumor lesions in magnetic resonance imaging (MRI) data. Similar models advise medicinal treatment by predicting patient responses to therapies, radiation doses, and surgeries. However, issues such as data bias, interpretability, and regulatory concerns remain as barriers to widespread clinical usage. This study synthesizes recent findings to discuss the contributions and limitations of AI tools in cancer research, highlighting areas where they have made the most significant impact and where further improvements could be made. By understanding AI's role in radiology, I aim to provide insight into its potential to improve cancer treatment and improve patient care.

Keywords:

Artificial Intelligence; Cancer Research; Brain Tumor; Radiology

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1673

Presentation Time: Session 4: 1:30-2:30pm

A Novel Testing Framework for Radiation Qualification of Commercial Microelectronics

STEM

Authors(s):

Sean Ross Klein† (Engineering)

Abstract:

Rising investments in the space industry have created greater demand for microelectronics usable in space vehicles. However, designing microelectronic components is challenging due to the harsh environment, along with stringent weight and size constraints. This work focuses on designing a test protocol for an off-the-shelf component, the FTLX8574D3BCV Multimode 10G SFP+ optical transceiver, to measure its susceptibility to ionizing radiation and charged particles. Preliminary results suggest that combining high atomic-number materials (e.g., tungsten) to shield gamma radiation with complementary layers containing boron for neutron moderation can reduce the total shielding mass, compared to previously published shield designs. These findings offer an alternative solution for designing space-capable transceivers to allow for high-speed data transmission at low bit error rates. By evaluating an off the shelf component for space applications, this research presents a cost-effective option that may help reduce testing costs and accelerate qualification time for new parts, which is greatly needed in the growing space industry today.

Keywords:

Radiation Hardening; Microelectronics; SCALE; Space Industry; Testing Protocol

Mentor(s):

Peter Bermel (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1674

Presentation Time: Session 4: 1:30-2:30pm

Quality Assurance of Macro Pixel Sub-Assemblies for the CMS Outer Tracker Upgrade

STEM

Authors(s):

Anna G. Klupshas† (Science)

Abstract:

To withstand the high density of charged particles expected at the High Luminosity-Large Hadron Collider (HL-LHC) upgrade, several components of the Compact Muon Solenoid (CMS) experiment will need to be replaced. Among them, a new Outer Tracker (OT) that will be assembled with 13,200 silicon modules. Macro Pixel Sub-Assemblies (MaPSAs) form a part of the assembled modules and consist of silicon sensors that are bump-bonded with dedicated readout chips. With MaPSA production expected to commence in the spring of 2025, extensive testing of the electronics is required to ensure quality of the modules. Utilizing a probe station, each MaPSA receives a series of electrical tests of the readout chip and a leakage current test of the device. Results are carefully analyzed to select the best performing MaPSAs for integration into full modules and placement into the OT.

Keywords:

MaPSA; HL-LHC; CMS; Outer Tracker; Silicon Sensors

Mentor(s):

Jan-Frederik Schulte (Purdue University); Ethan Michael Colbert (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1675

Presentation Time: Session 4: 1:30-2:30pm

The Efficacy of a Racemic Delta Opioid Agonist on Binge-Like Drinking in High Alcohol Preferring Mice

STEM

Authors(s):

Adrian Charlie Knoll† (HHS); victoria burke‡ (HHS|JMHC); Alexys Parker Davis‡ (Science); Khushi Duggal‡ (Science)

Abstract:

Alcohol binge drinking is a common form of alcohol misuse that can lead to alcohol use disorder (AUD). Current FDA-approved medications to treat AUD have limited efficacy. To better understand AUD, researchers have developed animal models that mimic human binge drinking patterns. In this study, we used a mouse model selectively bred to drink high amounts of alcohol and subjected them to a "drinking-in-the-dark protocol," during which mice consumed binge-like quantities of alcohol for a limited period. We explored the effects of an opioid receptor agonist (TAN-67) on binge-like alcohol drinking in male and female mice. Mice were allowed access to a 20% v/v solution of alcohol for two hours on days 1 through 7 and four hours on day 8. On the 8th day, the mice received either an injection of placebo (saline) or racemic 12.5 or 25 mg/kg TAN-67 treatment 30 minutes before the drinking session. Blood samples were taken immediately after the session to analyze and compare blood alcohol levels in all groups. We hypothesize that the TAN-67 treatment will reduce binge-like alcohol intake and corresponding blood alcohol levels. This study will inform the development of pharmacotherapy for alcohol use disorder and may reveal any differences between sexes.

Keywords:

Alcohol Use Disorder; Drinking in the Dark; Pharmacotherapy; Binge Drinking; Mouse Model

Mentor(s):

Julia Chester (Purdue University); Soyol Enkh-Amgalan (HHS); Marieliz Dieppa-Rodriguez (HHS)

Other Acknowledgement(s):

Ryan Alan Altman (Purdue University); Abdulrahman Arafat Mohammed Moursy (Pharmacy)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1677

Presentation Time: Session 4: 1:30-2:30pm

Glycoprotein Analysis of Aged Mice Brain Proteome

STEM

Authors(s):

Rishabh Kottakota† (Science); Malyka Ram‡ (Agriculture|Engineering); Priyanshu Datta Roy‡ (Agriculture|Engineering|JMHC)

Abstract:

Neurodegenerative diseases such as Alzheimer's disease are a major health concern, with approximately 1 in 9 people above the age of 65 suffering from Alzheimer's disease. Since aging is the primary risk factor for neurodegenerative diseases, understanding the biology of aging is critical for developing new therapies. To contribute to this goal, we recently performed a quantitative mass spectrometry to analyze the changes in protein abundances between adult and old mice brains. Our findings revealed that four proteins (Alg2, Mpi, Napa, and Rpn1), all involved in protein glycosylation, were significantly affected by aging. Alg2 and Napa were more abundant in aged mice compared to adult mice. Alg2 is an alpha-1,3-mannosyltransferase that acts in the synthesis of dolichol-linked oligosaccharides which are glycan precursors for N-linked glycosylation. In contrast, Mpi and Rpn1 were less abundant in aged mice compared to adult mice. Rpn1 is a subunit of the oligosaccharyl transferase complex which catalyzes the first step in N-linked glycosylation, and changes in its protein levels may indicate a potential dysregulation of protein glycosylation pathways. Building on these results, we will perform glycoproteomic analysis to further investigate alterations in protein glycosylation, aiming to understand their role in age-related changes in the brain.

Keywords:

Glycoproteomics; Proteomics; Glycosylation; Neurodegeneration; Aging

Mentor(s):

Uma K Aryal (Purdue University); Rodrigo Mohallem Ferreira (Vet Med); Punyatoya Panda (Vet Med)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1678

Presentation Time: Session 4: 1:30-2:30pm

Developing a Cost-Efficient Method to Quantify DNA using SYBR Gold

STEM

Authors(s):

Skyler Anna Kreunen† (Pharmacy)

Abstract:

The purpose of this study was to compare two DNA-staining dyes to maximize efficiency within the lab. Qubit vs Sybr gold fluorophore. DNA standards in varying concentrations decreasing from 5 ng to 0 ng were used to test the efficacy of both dyes. Before starting the experiment, the standards were all measured with a fluorophore in a spectrophotometer plate reader to ensure that the most potent standards were used for the experiment. The Qubit fluorophore dilution was prepared as specified by the manufacturer. A dilution was performed with the SYBR Gold dye until it yielded similar readings to the competing dye. From there, the concentration of the SYBR dye was decreased until it no longer held up to the results of the Qubit dye. Each plate was read twice. The results were then graphed by comparing DNA amounts 0 ng and 500 ng versus fluorescence intensity for each concentration 1000x, 5000x, and 10000x diluted of SYBR Gold. 10000x had the highest absorbance reading in this first repetition. The dye was tested at lower concentrations, and graphed again as described previously in concentrations 20000x, 30000x, 50000x and 1000000x diluted. 30000x diluted from stock yielded the best results (need to look for Qubit absorbance data). The cheaper fluorophore (Sybr Gold) did not provide superior results to the more expensive fluorophore (Qubit), but the results were comparable so that the cheaper fluorophore could be used for gel analysis and serve as an effective alternative.

Keywords:

DNA; Molecular Biology; Fluorophores; Lab Efficiency; Spectrophotometry

Mentor(s):

Stephen R Lindemann (Purdue University); Miguel Angel Alvarez Gonzales (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1679

Presentation Time: Session 4: 1:30-2:30pm

CogniPilot

STEM

Authors(s):

Arthur Wesley Kron† (Engineering); Abdullah F A Y Alsadi† (Engineering); Saif Ali Jalal† (Engineering); Vikramaditya Baid† (Engineering); Maxwell Christophe Sprague‡ (Engineering); Alexander Kmetko‡ (Engineering)

Abstract:

CogniPilot is a project constructed to build a mathematically proven aerial autopilot from the ground up. Within the code base of this project, the source code should be as minimal as possible to allow for a more reliable, maintainable, and verifiable system. Further, the estimator and controller intends to minimize the amount of branch statements when compared to previous autopilots such as PX4, ArduPilot, and BetaFlight. These controllers have thousands of branches, making the verification process much more arduous. CogniPilot originated on a more simplistic system, a rover, and in the future intends to work on planes, quadcopters, and submersibles. This semester the team focused on localization in the autopilot. The controls and software team designed an attitude and position estimator for CogniPilot. This estimator uses an extended Kalman Filter and results from Lie Theory to allow for more accurate prediction of state and uncertainty. The hardware team worked on getting the DMA transferring data from the accelerometer to ensure faster output from the sensors for localization. Once this is complete, it is the team's intention to compare this to a more traditional Kalman Filter to verify that the Kalman filter using Lie theory is more accurate. The overall goal to end this semester is to run a racing drone across an indoor track with our firmware installed and running.

Keywords:

UAV; Autopilot; Estimation

Mentor(s):

James Michael Goppert (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1680

Presentation Time: Session 4: 1:30-2:30pm

Improving Agent Communication Large Language Model-Based Multi-Agent Systems

STEM

Authors(s):

Parv Kumar† (Engineering); Lavangi X Yadava† (Science); Zackary Pieter Homrich† (Engineering); Parth Kapila† (Polytechnic); Rohan S Potta‡ (Science)

Abstract:

Modern Large Language Model-based Multi-Agent (LMA) frameworks, such as AutoGen, CrewAI, MetaGPT, and AgentCoder, are increasingly used in software development to automate tasks such as code generation, testing, and review. However, these systems face challenges in agent coordination, dynamic task allocation, and adapting to evolving requirements, limiting their effectiveness in collaborative software engineering. This study explores communication structures between agents across multiple frameworks to identify optimal strategies for improving multi-agent collaboration. By analyzing hierarchical task delegation, adaptive role assignment, and inter-agent communication, we evaluate productivity using code-specific metrics, including executability, cost, code statistics, code productivity, and human revision effort. Our research aims to enhance LMA frameworks' efficiency and scalability in real-world software development.

Keywords:

LLMs; Multi-Agent Systems; Software Engineering

Mentor(s):

James C Davis (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1681

Presentation Time: Session 4: 1:30-2:30pm

Robotic wearable textile triboelectric sensor for augmented tactile and proprioceptive perception

STEM

Authors(s):

Pranav Kumarasubramanian† (Engineering)

Abstract:

The development of flexible triboelectric sensors is crucial for advancing robotic hands with enhanced tactile and proprioceptive perception. Traditional robotic sensor systems face challenges in achieving human-like object recognition due to their rigidity and limited sensitivity. This study optimizes sensor performance by integrating polydimethylsiloxane (PDMS) as a tribonegative material and conductive fabric as a tribopositive material, forming a triboelectric sensor capable of detecting both object shapes and surface textures. Machine learning (ML) techniques will be employed to analyze multi-sensor data, allowing the robotic hand to recognize objects based on learned tactile and proprioceptive patterns. The ML model will be trained using sensor-generated data to improve object identification, grasping precision, and adaptive responses to diverse surfaces and materials. By integrating ML-driven processing, the robotic hand will achieve greater dexterity, enabling more refined robotic manipulation and enhancing human-robot interactions. The flexible and scalable sensor design offers significant potential for broader applications in automation and robotic systems that require precise tactile feedback and nuanced environmental interaction.

Keywords:

Triboelectric Sensor; Robotic Wearables; Tactile Perception; Proprioception; Robotic Manipulation

Mentor(s):

Hettiarachchige D Perera (Engineering); Wenzhuo Wu (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1682

Presentation Time: Session 4: 1:30-2:30pm

Fumarase and the DNA Replication Stress Response

STEM

Authors(s):

Maxine Katya Kushner† (Agriculture)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Ann L Kirchmaier (Purdue University); Travis Jon Lubbers (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1683

Presentation Time: Session 4: 1:30-2:30pm

Quantitative Analysis of Shape and Topological Differences in EVL Cells of Zebrafish Embryos during Epiboly

STEM

Authors(s):

Ian Kwan Yin Lam† (Science); Velan Arunmozhi‡ (Science)

Abstract:

Zebrafish embryos are widely used in development biology studies due to their transparency and high availability, allowing researchers to observe cellular responses to stimuli in real-time. However, 3D segmentation of individual nuclei from microscopy images is challenging due to their organic shapes and orientations. To address this, we employed NISNet3D, a convolutional neural network, to analyze 3D light-sheet microscopy images and distinguish nuclei through automated segmentation with high accuracy. However, the large image datasets strain GPU memory and storage, making the processing of whole-mount embryo data more challenging. As imaging resolution improved, we refined our processing pipeline by cropping 3D .tif images into sub-volumes, which optimized analysis speed while maintaining accuracy. We introduce overlapping adjacent chunks at cropping to reduce misalignment during reassembly. Beyond segmentation, we also enhanced image reconstruction by reducing unwanted visual discrepancies due to cell fragmentation at cropping boundaries. Cell labels across adjacent chunks have been unified to reassemble the sub-volumes. This study builds upon prior efforts to optimize and accelerate zebrafish embryo imaging data analysis through parallel sub-volume processing and suggests further refining convolutional neural network-based segmentation by minimizing chunk overlap to enhance efficiency without compromising accuracy.

Keywords:

[no keywords provided]

Mentor(s):

Linlin Li (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1684

Presentation Time: Session 4: 1:30-2:30pm

Predicting March Madness Finalists: A Data-Driven Approach to Understanding School Affinity

Business Case Study

Authors(s):

Drew Christophe Lawler† (DSB); Omar Haytham Al Husseini† (DSB); Kelly Ann Igo† (DSB); Benjamin James Wright‡ (DSB)

Abstract:

The project aims to predict outcomes for the final two rounds of the NCAA basketball championship while investigating how school affinity factors—including geographic proximity, conference loyalty, and historical team performance—impact fan bracket selections.

The methodology comprises rigorous data preparation procedures, including effective handling of missing values through interpolation and imputation methods, standardizing categorical variables such as conference affiliations, and normalizing relevant numerical attributes. Through strategic feature engineering, we incorporate essential variables such as proximity to schools, conference biases, regular season win percentages, and historical tournament success. To predict the outcomes, we implement several advanced statistical and machine learning models, including Logistic Regression, Random Forest, Quadratic Discriminant Analysis (QDA), and Artificial Neural Networks (ANNs).

Initial results demonstrate notable regional biases, with brackets disproportionately originating from the Midwest and East Coast regions, and teams like Connecticut receiving significant favoritism. These findings confirm the critical influence of geographical location and fan affinity on prediction behaviors. Additionally, the analysis uncovered significant data gaps, notably customer location information, underscoring an essential area for improvement in future data collection efforts.

This project not only enhances predictive accuracy in sports forecasting but also provides meaningful implications for businesses seeking to leverage fan behavior analytics. By clearly identifying the factors influencing bracket decisions, our findings offer valuable guidance for targeted marketing strategies and improved fan experiences, contributing substantively to the evolving field of sports analytics.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
NCAA; Predictive; Sports; Statistics; Bias

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1685

Presentation Time: Session 4: 1:30-2:30pm

Reducing Real-Time FPGA Streaming Latency via WebRTC Optimization

STEM

Authors(s):

Nana Lee† (Engineering)

Abstract:

ECELabs.io develops a web-based educational platform supporting FPGA simulation, circuit design, and signal processing. This study focuses on reducing real-time FPGA board streaming latency through WebRTC optimization. By improving data encoding, minimizing transmission delays, and optimizing synchronization between the physical board and the web interface, we aim to achieve a latency of 50-200ms, ensuring a seamless remote FPGA experiment experience. This reduction in latency will enable real-time feedback, allowing students to interact with FPGA-based experiments more efficiently and make immediate adjustments, ultimately enhancing their learning and problem-solving capabilities.

Keywords:

FPGA Simulation; Web-Based Education; Real-Time Streaming; WebRTC Optimization; Latency Reduction

Mentor(s):

Junfei Li (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1686

Presentation Time: Session 4: 1:30-2:30pm

2.5D Advanced Packaging: Fabrication of Silica Glass Interposers for Chiplet Integration

STEM

Authors(s):

Ho Jun Lee† (Engineering); Romy Kim† (Engineering); Cecilie Reingaard Wiuff† (Engineering); CHO-YI HSIEH† (Engineering); Jou-Ting Lai† (Engineering); Aditi Magesh† (Engineering|JMHC); Stuti Rastogi† (Engineering)

Abstract:

As Moore's Law for semiconductor chips slows down, the industry has instead aimed to package chips in a more compact and efficient manner to realize further capability improvements. In the past, the semiconductor world heavily utilized silicon and organic substrates. However, glass substrates offer advantages, such as excellent thermal stability, mechanical strength, and low dielectric constant, making them suitable for high-density interconnects and integrations for diverse chiplets. This research will further explore the fabrication process of 2.5D advanced packaging using silica glass as an interposer substrate by integrating a HILEOS model by embedding a photodiode and D-Latch chiplet-based memory. It focuses on the unique production development techniques on etching/patterning, bonding, and creating interconnects between the chiplets while maintaining the integrity of the glass. By highlighting these fabrication processes, this work aims to provide insights into the challenges and advancements in 2.5D advanced packaging with glass substrates, emphasizing their critical role in performance and reliability for the next generation of microelectronic devices.

Keywords:

Advanced Packaging; Nanotechnology; Glass Substrates; Semiconductor; Birck Nanotechnology Center

Mentor(s):

Peter Bermel (Purdue University); Saeed Mohammadi (Purdue University); Tiwei Wei (Purdue University)

Other Acknowledgement(s):

Feichi Huang (Engineering)

Poster Presentation Abstract Number: 1688

Presentation Time: Session 4: 1:30-2:30pm

Predicting Customer Ratings: A Data-Driven Approach to Optimizing EV Charging Stations

Business Case Study

Authors(s):

Yun jing Lin† (DSB); Cooper Jacob Wylie† (DSB); Theodore Christian Lewis† (DSB); Harleen Kaur Sohal† (DSB); Rick Lee† (DSB)

Abstract:

Our project addresses the critical business question: which specific features of Electric Vehicle (EV) charging stations most significantly influence customer satisfaction ratings? By accurately predicting customer ratings based on charging station characteristics, we aim to guide strategic business decisions on infrastructure improvement and prioritization of features. Given the rising demand for reliable EV infrastructure, understanding customer preferences becomes highly relevant to both user satisfaction and market competitiveness.

We begin by systematically cleaning and preprocessing a dataset comprising over 5,000 EV charging stations. This step includes careful handling of missing values, standardization of data formats, and comprehensive feature engineering such as calculating the age of stations and encoding categorical variables for analytical consistency. Subsequently, we conduct Exploratory Data Analysis (EDA), employing advanced visualization techniques to identify key trends and interactions among station metrics.

Our modeling strategy initiates with a baseline Linear Regression model, after which we progressively explore more sophisticated predictive approaches, including Decision Trees, Support Vector Machines (SVM), and K-Nearest Neighbors (KNN). Additionally, we evaluate the feasibility of Neural Networks to capture complex nonlinear relationships. Model performance will be rigorously assessed through cross-validation and established accuracy metrics such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and R-squared. To further refine predictive accuracy, we incorporate Bayesian Optimization techniques, systematically tuning hyperparameters and enhancing model interpretability.

Our expected results are that accessibility, reliability, pricing, and amenities as primary determinants of customer satisfaction at EV charging stations. Beyond immediate business applications, our project

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

contributes to predictive analytics methodologies by demonstrating the effective combination of diverse modeling approaches and advanced optimization techniques.

Keywords:
Predictive Analytics; EV Charging Stations; Customer Ratings; Bayesian Optimization; Exploratory Data Analysis (EDA)

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1689

Presentation Time: Session 4: 1:30-2:30pm

Predicting NCAA Bracket Participation: Analyzing Fan Engagement Through Data

Business Case Study

Authors(s):

Chi Lin† (DSB); Brianna Annie Yu† (DSB|JMHC); Shuhan Yang† (DSB); Kexin Han† (DSB); Joan Zhi Wei Lu† (DSB)

Abstract:

This project aims to predict the likelihood of fan participation in NCAA Division I Basketball Championship bracket challenges, utilizing comprehensive demographic, historical engagement, and behavioral data. Annually, millions of fans partake in these brackets, yet participation rates vary significantly. Clearly defining and understanding the factors influencing participation enables the NCAA and associated marketing professionals to refine their promotional strategies, enhancing overall fan engagement and tournament visibility. Our study leverages an extensive dataset incorporating geographical and market segmentation variables. Rigorous data preparation involved addressing missing values, removing statistical outliers, and standardizing data formats. Feature engineering was employed to develop meaningful predictors such as an engagement score derived from historical bracket participation, social media interactions, and social influence metrics. Predictive modeling techniques—including logistic regression, random forests, and gradient boosting—were systematically evaluated for effectiveness. Each model was assessed comprehensively based on accuracy, precision, F1-score, and error metrics, including Root Mean Square Error (RMSE) and Mean Absolute Error (MAE), to ensure robust and reliable predictions. The results highlight significant drivers of participation, notably age, geographic location, historical engagement, and social influence. The clear interpretation and analysis of these factors provide actionable insights for targeted marketing strategies, enhancing fan experiences and increasing bracket participation rates. This study not only advances understanding of sports fan behaviors through predictive analytics but also provides valuable implications for future research and practical applications within sports marketing and audience engagement domains.

Keywords:

Data Science; Machine Learning; Artificial Intelligence; Basketball; Competition

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1690

Presentation Time: Session 4: 1:30-2:30pm

Enhancing PPML with GPU Acceleration: Optimizing Secure Inference for Practical Use

STEM

Authors(s):

Chloe Lin† (Science); Sage Clysta Stefonic† (Science); Devansh Khandelwal† (Science|Graduate); Nicolas Shulga† (Science)

Abstract:

The growing popularity of machine learning necessitates the development of privacy-preserving machine learning (PPML) applications that ensure the secure handling of vast amounts of sensitive data. Machine learning is expensive to run as is, and incorporating cryptographic protocols further increases computational overhead. Existing CPU-based solutions cannot leverage GPU acceleration, the de facto platform for running machine learning jobs. By leveraging advanced cryptographic protocols and GPU acceleration on widely available platforms, we aim to create a faster PPML framework that is easily accessible to consumers and companies. Our primary objective is to develop a framework for PPML inference on GPUs, allowing clients to use proprietary models without exposing their private data, while simultaneously preserving the confidentiality of the server's model. Cutting-edge PPML solutions are built upon hybrid cryptographic protocols, applying homomorphic encryption (HE) to linear layers and oblivious transfer (OT) to non-linear layers. OT is crucial for secure multi-party computations, allowing private data exchange without revealing the data itself. Non-linear activation functions like ReLU are particularly challenging to evaluate privately and optimize, making them our primary focus. In addition to introducing a novel design for implementing non-linear layers on the GPU, our approach integrates additional optimizations to address and mitigate critical runtime bottlenecks. This project demonstrates the potential of harnessing GPUs, which are already integral to machine learning and neural network inference, for privacy-preserving computations. It reduces the tradeoff between security and processing time and makes privacy-preserving techniques more accessible to machine learning engineers.

Keywords:

Applied Cryptography; Machine Learning; Oblivious Transfer; GPU; Neural Networks

Mentor(s):
Zahra Ghodsi (Purdue University); Yi En Gan (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1691

Presentation Time: Session 4: 1:30-2:30pm

Evaluating the Role of RIG-I in Triple Negative Breast Cancer

STEM

Authors(s):

Madison Elizabeth Liu† (Agriculture)

Abstract:

The detection of double-stranded RNA (dsRNA) plays a crucial role in the innate immune system. The Retinoic Acid-Inducible Gene I (RIG-I) like receptors, MDA5 and RIG-I sense dsRNA and activate the type I IFN pathway, leading to the production of interferon stimulated genes (ISG). While both can recognize viral long dsRNA, only RIG-I can be specifically activated by short 5'-triphosphorylated dsRNA. In the context of cancer, activation of the type I IFN pathway can improve the efficacy of immunotherapies. As such, it is important to understand how dsRNA sensors like RIG-I are regulated in cancer and to identify agonists that can be used in combination with immunotherapies. Although the mechanisms of RIG-I activation and signaling have been extensively studied, the role of RIG-I in triple-negative breast cancer (TNBC) is less clear. To begin to study RIG-I in TNBC, we generated a RIG-I knockout line using CRISPR-Cas9 in MDA-MB-231 cells. Knockout of RIG-I had little effect on cell proliferation as measured by crystal violet staining. To assess the role of RIG-I in sensing of dsRNA, RIG-I knockout and control cells were transfected with Poly(I:C), a synthetic dsRNA, or a commercially available RIG-I agonist, and quantitative PCR was used to measure the expression of ISGs. While control and RIG-I knockout cells responded to poly(I:C) treatment by inducing ISG expression, there was little to no induction of ISGs in RIG-I knockouts transfected with the RIG-I agonist. These findings establish a direct correlation between RIG-I activation and ISG induction in TNBC, providing new insights into innate immune regulation in breast cancer. Currently, we are working to generate a novel RIG-I agonist to further aid the study of RIG-I in TNBC, and to eventually evaluate the effectiveness of RIG-I agonists in vivo.

Keywords:

RIG-I; TNBC; Breast Cancer; RNA; Innate Immunity

Mentor(s):

Kyle Aaron Cottrell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1692

Presentation Time: Session 4: 1:30-2:30pm

Determining If Lunar Magnetic Anomalies Can Shield Humans from Space Radiation

STEM

Authors(s):

Allison Michelle Loper† (Science|JMHC)

Abstract:

NASA's Artemis campaign marks a new age of space exploration by aiming to increase human presence on the Moon. To achieve this, it is crucial to understand the hazards of human spaceflight and develop effective mitigation strategies. In this context, radiation from solar particles and cosmic rays pose significant risks to human spaceflight, including damage to electronics, radiation sickness, degenerative diseases, and even death. While on Earth humans are protected from these effects by its magnetic field, the Moon no longer has a global field, and instead harbors magnetic anomalies on its surface. These anomalies may provide similar protection to a weak magnetosphere. To determine if magnetic anomalies can protect humans on the lunar surface from incoming space radiation, we used a magnetic pressure balance model estimated for planetary dynamos and magnetometry data from Lunar Prospector and SELENE/Kaguya to calculate the standoff distance, the radiation deflection boundary above the surface, for magnetic anomalies at various depths. The strongest anomalies, measuring approximately 10 nT at the surface, produced standoff distances up to 60 km above the lunar surface. Future work will calculate the expected radiation flux for these standoff distances at specific lunar anomaly sites. Of particular interest is the South Pole-Aitken Basin, a strategic location for future NASA missions, which has many magnetic anomalies that could overlap to provide extensive radiation shielding to humans. While weaker than Earth's magnetosphere, these anomaly-generated shields could decrease the currently suggested amount of protective material needed to maintain safety standards.

Keywords:

Lunar Magnetic Anomalies; Radiation Shielding; Space Radiation; Lunar Habitats; Planetary Science

Mentor(s):

Caue Sciascia Borlina (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1693

Presentation Time: Session 4: 1:30-2:30pm

Deciphering Sulfate Aerosol Formation and Processing: Integrating Observations and Modeling for Enhanced Atmospheric Predictions

STEM

Authors(s):

Katherine Ma† (DSB); Jayaditya Borah† (Engineering); David Zhou Erickson† (Science)

Abstract:

Sulfur compounds are central to atmospheric chemistry, affecting climate, air quality, and ecosystems. Sulfur oxides (SOx)—primarily SO2 and SO3—react with water vapor to form sulfuric acid (H2SO4), leading to acid rain that lowers water pH, depletes soil nutrients, and corrodes infrastructure. Sulfur aerosols from SO2 oxidation degrade air quality, pose health risks, and influence cloud formation and regional cooling. Additionally, SOx reacts with ammonia (NH3) and nitrogen oxides (NOx) to form secondary organic aerosols (SOA), increasing haze and respiratory issues.

Despite their impact, our understanding of sulfate aerosol formation remains limited. Key uncertainties include the contributions of gas-phase versus aqueous-phase oxidation, the effects of aerosol acidity on reaction rates, and the variability introduced by regional meteorological conditions—all of which compromise atmospheric model predictions and air quality management strategies.

We hypothesize that sulfate formation depends on cloud water pH, oxidant availability, and catalytic metal ions. Under acidic conditions, aqueous-phase SO2 oxidation accelerates, resulting in non-linear sulfate increases in high-emission regions with dynamic weather.

To evaluate this hypothesis, we use the AQCHEM model, integrating aerosol microphysics and sulfur isotope tracking with observational and remote sensing data. Insights gained will improve our understanding of sulfate impacts on climate and air quality. To date, we have installed the model on the Rosen Center's Negishi cluster and modified it to include sulfur isotope tracking. An R script is under development to analyze the data, with future work involving comprehensive simulations of sulfate formation processes.

Keywords:
Sulfate Aerosol; Atmospheric Predictions; Computer Simulations

Mentor(s):
Greg M Michalski (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1694

Presentation Time: Session 4: 1:30-2:30pm

Assessing Lunar Silicic Volcanism at the Compton-Belkovich Volcanic Complex

STEM

Authors(s):

Abigail Colleen Mackey† (Science)

Abstract:

The Compton-Belkovich Volcanic Complex (CBVC) is located on the far side of the Moon and exhibits multiple characteristics indicating highly evolved silicic volcanism. Terrestrial silicic volcanism is often associated with subduction zones and the presence of water. As the Moon does not display evidence for large-scale or sustained plate tectonics, the origin of silicic volcanism on the Moon remains an outstanding question in planetary science. Silicic volcanism is the focus of NASA's upcoming Lunar-VISE mission.

Recent observations of the CBVC indicate the presence of a subsurface geothermal source, proposed to be an igneous intrusive structure similar to a granitic batholith. Models suggest that the structure consists of a small upper body and much larger lower body. To test this hypothesis, we compared estimated densities of the proposed igneous bodies to the densities associated with various igneous materials from lunar basalts and terrestrial silicic products. We find that the density of the upper body is consistent with silicic materials, while the larger lower body is consistent with lunar basaltic densities. These findings support the presence of a volcanic plumbing system in which case the lower body would represent initial intrusion of basaltic magma instead of a granitic batholith. Following, we model the crystal-liquid fractionation of known lunar basalts to demonstrate the formation of lunar silicic magmas consistent with the density, composition, and mass fractions estimated for the silicic upper body and total extrusive material of the CBVC. We therefore propose that lunar silicic magmas result from extensive basaltic crystallization.

Keywords:

Igenous Petrology; Volcanism; Moon; Planetary Science

Mentor(s):

Tabb Prissel (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1695

Presentation Time: Session 4: 1:30-2:30pm

Optimizing X-ray Fluorescence Spectral Fitting: Transitioning Fortran Code to Python

STEM

Authors(s):

Vishal Madhudi† (Engineering)

Abstract:

Advancements in nuclear techniques have significantly enhanced our ability to analyze metal distribution in human tissues, providing insights into neurodegenerative diseases. This research focuses on optimizing spectral fitting algorithms for X-ray fluorescence (XRF) analysis by transitioning legacy Fortran code to Python. The new implementation employs least-squares optimization to improve computational efficiency and accuracy in spectral deconvolution. A primary application of this work investigates lead (Pb) deposition in bone, assessing their role in metal exposure-related neurodegeneration. Preliminary results suggest that improved spectral fitting enhances compatibility of the program to be used in different operation systems, contributing to refining nuclear analytical techniques and advancing research in environmental toxicology and human health. Future work aims to further optimize the Python implementation for increased performance and usability.

Keywords:

[no keywords provided]

Mentor(s):

Linda Nie (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1696

Presentation Time: Session 4: 1:30-2:30pm

How has the xenophobia trend towards Asians on social media since COVID-19 impacted consumers of such content?

Humanities

Authors(s):

Tisya Mahajan† (HHS|JMHC)

Abstract:

Since the onset COVID-19, xenophobia towards Asians has surged across social media platforms, fueling harmful stereotypes and discriminations. Terms like “Chinese Virus” and “Kung flu” have reinforced anti-Asian sentiment, while portrayals of India as an unhygienic country have further perpetuated prejudice (Jacques et al., 2). The rise in online hate has been linked to “widening health disparity, school bullying, stigmatization, fair housing violations, labor and consumer discrimination, and mental health issues” (Jacques et al., 2). Additionally, xenophobia on social media has escalated into real-world violence, as seen in the March 16, 2021, Atlanta shooting, where six Asian women were killed (He et al., 1). My research will explore the spread of anti-Asian sentiment on social media and the impact on consumers, particularly in Western countries as well as detailing the laws and policies made by the government to combat this. By analyzing scientific, primary, and popular sources, this exploratory study aims to understand the root causes of the surge in xenophobia against Asians and its broader social consequences. The aim of my research is to offer suggestions on how to stop the troubling increase in negative attitudes or actions towards Asian descent.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1697

Presentation Time: Session 4: 1:30-2:30pm

QUIP Waveguide affects.

STEM

Authors(s):

Mohit Manna† (Engineering); Thomas Allen Greer‡ (Engineering)

Abstract:

This project explores a textbook on Integrated Photonics by Michael Hochberg, and how optical properties affect waveguide behavior. The waveguide behavior will be tested on the parameters of different aspects, mainly concentrating on the bent nature of the wave, and its effects. This photonic component is similar to a Y-branch and requires a bend in its structure. A bent waveguide is affected by the degree of freedom of the bend, and this project will explore the various outputs each bend structure causes to a waveguide. A waveguide can also have multiple Y-branches, which function to split light into 2 waveguides, and how this and the given parameters affect the efficiency and function, is represented in this research. In this project, the parameters will be the wavelength, branching angle, and refractive index contrast. The 2 main outputs that will be studied are the transverse electric mode and the transverse magnetic mode. These 2 modes combine for waveguide behavior, and the different structures produced are a highlight in this research. Overall, this project will explore waveguide behavior based on the degrees of freedom of a bend, especially in a Y-shape, and will record the changes in each mode and output for the waveguide.

Keywords:

Waveguide; Photonics; Circuits; Bent

Mentor(s):

Jason Dwight McKinney (Purdue University); Vivek vasantrao Wankhade (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1698

Presentation Time: Session 4: 1:30-2:30pm

SoCET: AXI Project

STEM

Authors(s):

James Russell Mareachen† (Engineering); Nandan Varma Uppalapati† (Engineering); Andrew Joseph Cali† (Engineering); Duc Pham Minh† (Engineering); Avanish Karlapudi† (Engineering)

Abstract:

The Advanced eXtensible Interface (AXI) 5, a part of the AMBA protocol suite, offers improved performance and efficiency for modern system-on-chip (SoC) architectures. This project focuses on the reimplementation of AXI 5 as a student-led initiative to understand its design principles, functionality, and practical applications. The implementation covers key features such as pipelining transactions, priority based arbitration, and high speed data transfer. Verification strategies, simulation results, and challenges encountered during development are discussed. Through this process, insights into the complexities of interconnect protocols and their role in high-performance computing systems are gained.

Keywords:

[no keywords provided]

Mentor(s):

Mark Johnson (Purdue University); Jacob Chappell (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1699

Presentation Time: Session 4: 1:30-2:30pm

Evaluating Cross-Species Generalization Capabilities of Deep Learning Models in Laparoscopic Surgical Tool Segmentation

STEM

Authors(s):

Farren M Martinus† (Engineering)

Abstract:

The increasing availability of publicly accessible laparoscopic surgical video datasets has accelerated the development of deep learning models for surgical tool segmentation. These models hold the potential to enhance surgical training, optimize workflow efficiency, and support real-time decision-making. However, existing datasets are often limited in scope, focusing on specific procedures and species, which restricts the generalizability of these models across diverse surgical contexts. This study examines the efficacy of deep learning models trained on laparoscopic surgical videos from one species (e.g., human) and testing them on another (e.g., porcine) to address challenges in cross-species generalizability. Specifically, we are experimenting with two models: a U-Net-based model and the Transformers for Actions, Phases, Steps, and Instrument Segmentation (TAPIS) model. Transfer learning techniques will be incorporated into the training process to enhance robustness and adaptability across species. Model performance will be evaluated using both qualitative analysis and quantitative metrics, including mean average precision (mAP), Intersection over Union (IoU), recall, and precision. Our findings aim to demonstrate how training data diversity impacts model robustness and provide direction for developing domain-agnostic deep learning approaches for laparoscopic applications.

Keywords:

Laparoscopic Surgery; Surgical Tool Detection; Domain Adaptation; Cross-Validation; Transfer Learning

Mentor(s):

Fiona Kolbinger (Purdue University); Zheyuan Zhang (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1700
Presentation Time: Session 4: 1:30-2:30pm

Analyzing, synthesizing and comparing leaves using LLM

STEM

Authors(s):
Kareena Karimpil Mathews† (Polytechnic)

Abstract:
Understanding leaf morphology is important for botanical research and education, benefiting applications ranging from species identification to environmental monitoring. This study utilizes Large Multi-Model (LMM) training to analyze, synthesize, and compare leaf characteristics from images of 15 Midwest tree species. By leveraging Claude AI's API, we automate image analysis and data generation, enabling efficient large-scale analysis. The AI model is trained on diverse leaf datasets and compared to textbook references to evaluate its accuracy in species identification and trait recognition.

The results demonstrate that LMM-generated data generally align with textbook descriptions but exhibit variations in finer taxonomic details. These discrepancies suggest that AI models can support large-scale botanical analysis and distinguish subtle morphological differences. By systematically measuring these inconsistencies, we provide insights into the strengths and limitations of AI-driven trait synthesis and how tree leaf morphology varies under different conditions.

By integrating automated data generation with traditional botanical knowledge, this approach expands trait datasets and enables more efficient plant classification. Moreover, it serves as an educational tool to explain why a given leaf belongs to a particular tree species. Future work will improve model accuracy, refine functionalities, and incorporate additional environmental variables to enhance predictive and explanatory capabilities.

Keywords:
Large Language Model

Mentor(s):
Yingjie Chen (Purdue University); Songlin Fei (Purdue University); Zhuoyang Sun (Polytechnic); Jui-Cheng Chiu (Polytechnic)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1701

Presentation Time: Session 4: 1:30-2:30pm

How Should Parents Get Involved in Their Child's Education

Humanities

Authors(s):

Jenna Mesker† (Education|Liberal Arts)

Abstract:

With new generations entering the classrooms, schools are seeing students become less willing to actively participate in their education. This stems from parents being unaware of how to assist their children in school and outside of school and the lack of resources for families from low socioeconomic statuses and immigrant families. Children benefit from involvement in their education despite the challenges their parents may face. I am examining sources for the best methods of involvement. This way students can see a rise in their grades, test scores, social skills, and positive behavior. The study will include students of varying socioeconomic and cultural backgrounds, while considering students with learning or mental disabilities. By conducting a thorough research of scholarly articles and books, I will provide specific strategies for parents so they can be involved in their child's education. These strategies include technology use, psychological needs (BEAR model), and reading scaffolds.

Keywords:

Parent Involvement; Education; Academic Success; Scaffolds

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1702

Presentation Time: Session 4: 1:30-2:30pm

Fate of unregulated organic compounds at a 40-year dedicated municipal biosolids land disposal site

STEM

Authors(s):

Brandon George Miller† (Science)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Rodrigo Alvarez Ruiz (Purdue University); Youn jeong Choi (Purdue University); Linda S Lee (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1703

Presentation Time: Session 4: 1:30-2:30pm

Accelerator Matrix Processor (AMP) - Advanced Architecture

STEM

Authors(s):

Christopher Daniel Miotto† (Engineering); Joseph Alan Ghanem† (Engineering); Chase Yungmin Johnson† (Engineering)

Abstract:

With the rise of Machine Learning, demand for hardware acceleration has increased. This is largely achieved through hardware-based matrix multiplications using systolic arrays. This project extends a CPU core optimized for accelerated matrix multiplication by implementing tournament branch prediction and multithreading.

The current architecture relies on a “once seen taken” branch predictor, which struggles with dynamic programs, leading to frequent mispredictions and performance losses. A tournament predictor dynamically selects between local and global history, reducing mispredictions and improving instruction throughput. Additionally, the architecture currently processes a single thread at a time, limiting efficiency. Implementing multithreading enables overlapping execution, reducing single-thread latency while significantly increasing throughput by processing multiple threads simultaneously. Threads can be alternated based on stalls, hazards, or per cycle, theoretically achieving an Nx performance increase with N threads.

By integrating a tournament branch predictor and multithreading, the processor will see significant efficiency and throughput gains. The predictor reduces costly pipeline flushes, improving instruction flow, while multithreading keeps execution units active by switching between threads on stalls. These enhancements maximize resource utilization, minimize idle cycles, and improve cycles per instruction (CPI), leading to higher overall performance and better workload handling.

Keywords:

AI; Semiconductors

Mentor(s):

Mark Johnson (Purdue University); Anand Raghunathan (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1704

Presentation Time: Session 4: 1:30-2:30pm

Interpreting the Artemis Accords: A Case Study on Safety Zones and International Space Law Discourse

Social Science

Authors(s):

Lucia Aurora Morton† (Engineering)

Abstract:

As of January 2025, over 50 spacefaring nations, with the exception of China and Russia, have signed the Artemis Accords. This set of 13 non-binding provisions defines the terms of international collaboration in space with regards to the exploration and exploitation of the moon and other celestial bodies, as well as attempts to build on the framework from existing international space law to coordinate an adaptive governance model. At the same time, the regulatory environment has not yet caught up to the maturation of the commercial space sector. International debate regarding the appropriation of lunar resources is ongoing, as some nations argue that the agreement undermines multiple principles set by the original 1967 Outer Space Treaty. A preliminary assessment will be conducted to analyze the varying opinions on lunar mining and the formation of safety zones, which constitutes just one of many challenges addressed by the accords. The ultimate goal of the work is to curate a set of discussion questions and associated readings that guide students through issues likely to arise in future disputes. Efforts will be coordinated in partnership with Indiana University Bloomington Maurer School of Law. The safety zones case study will serve as the first review of the literature potentially applicable to the curriculum.

Keywords:

Space Policy; Artemis Accords; Moon Agreement; Outer Space Treaty; United Nations

Mentor(s):

Mark Janis (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1705

Presentation Time: Session 4: 1:30-2:30pm

Engineering Cells to Decrease Autoimmune Response in Relation to Hashimoto

STEM

Authors(s):

Augustine Levi Muskat† (Engineering)

Abstract:

Hashimoto's Thyroiditis (HT) is an autoimmune disorder in which the immune system attacks the thyroid gland, leading to hypothyroidism and systemic metabolic disruptions. Despite its prevalence, the exact etiology of HT remains unclear, and current treatments primarily manage symptoms rather than address the underlying autoimmune response. Although, a dysregulation of the FoxP3 gene has been correlated to autoimmune diseases. This research explores a "living therapeutic" approach to mitigate HT by modulating immune regulation at the cellular level. Our primary focus is on the regulation of the FoxP3 gene to suppress Nuclear Factor Kappa Beta (NFkB), a key driver of inflammatory responses. In our methods, we aim to identify and engineer a bacterium that will be prolific in creating the necessary compounds to inhibit genes that will cause the regulation of the FoxP3 gene. Complementary strategies, such as influencing the thyroid-gut axis, utilizing plant hormones (Daidzein/Equol), and developing aptamer-enzyme therapies to neutralize autoantibodies, were also considered. Our findings suggest that targeting these regulatory pathways may provide a viable therapeutic strategy to reduce thyroid inflammation and restore immune homeostasis. Future studies will focus on validating these mechanisms through in vitro and in vivo experimentation.

Keywords:

Hashimoto; Thyroid; FoxP3; Bacterium; Therapeutic

Mentor(s):

Leopold Noel Green (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1706

Presentation Time: Session 4: 1:30-2:30pm

Development of a SH-SY5Y Model to Mimic hiPCS Based Neuronal Differentiation for Toxicological Studies

STEM

Authors(s):

Navnoor Kaur Mutti† (HHS|JMHC); Joliene Ruth Munson* (HHS|JMHC)

Abstract:

Human induced pluripotent stem cells (hiPSC) are an ideal tool for experimental designs in the field of neurotoxicology; however, hiPSC's are resource-intensive, requiring prolonged differentiation timelines and extensive handling. To address these limitations, we aim to create a cost-effective and more time efficient alternative via the SH-SY5Y human neuroblastoma cell line where by using Retinoic acid (RA), a derivative of vitamin A, we will differentiate these cells to have neuronal morphology for an extended time. The study aims to optimize the differentiation protocol for SH-SY5Y cells in order to mimic aspects of hiPSC differentiation by modeling neuronal morphology. Preliminary results have indicated that precise adjustments in RA concentrations and cell density are necessary factors to consider when mimicking neuronal characteristics. By performing immunocytochemistry and bright field imaging of the cells on alternate days, we can analyze the effect of RA on the differentiation of SH-SY5Y cells to post-mitotic neuronal phenotypes. Immunocytochemistry will be performed by utilizing antibodies against well-known neuronal proteins such as MAP2, and Ki67. These markers should be able to confirm the acquisition of neuronal identity (increased MAP2, and decreased Ki67 staining) to provide critical insights for optimizing the use of RA in inducing neuronal characteristics. After optimization, this study could offer a differentiation protocol which can maintain SH-SY5Y cells in neuronal morphology for an extended time and hence may offer an alternative to hiPSC-based models. This protocol can evaluate the persistent toxicity effects of environmental toxicants over an extended period.

Keywords:

SH-SY5Y; Neurotoxicity; Retinoic Acid; Stem Cells; Neuronal Morphology

Mentor(s):

Ribhav Mishra (Purdue University); Aaron B Bowman (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1707

Presentation Time: Session 4: 1:30-2:30pm

How university students perceive and use data storage and repository tools, with a particular focus on Airtable's ease of use and ability to handle complex workflows in collaborative settings.

Business Case Study

Authors(s):

Anaey Gaurang Naik† (HHS|JMHC)

Abstract:

This study explores how university students perceive and use data storage and repository tools, with a particular focus on Airtable's ease of use and ability to handle complex workflows in collaborative settings. As digital tools become increasingly integral to academic and personal projects, understanding students' preferences and satisfaction with these tools is critical. This research investigates the factors that influence students' choices, such as ease of use, advanced functionality, collaboration features, and integration capabilities. A mixed-methods survey was conducted to assess students' familiarity with tools like Google Sheets, Excel, Box and Airtables, as well as their experiences with these tools in both simple and complex tasks. The survey also examines students' perceptions of Airtable's real-time collaboration features and its balance between user-friendliness and advanced functionality. By analyzing quantitative data and qualitative feedback, this study identifies key challenges students face when using data storage tools and highlights opportunities for improving tools like Airtables to better meet their needs. The findings aim to provide actionable insights for educators, tool developers, and institutions seeking to enhance students' data management and collaborative capabilities.

Keywords:

[no keywords provided]

Mentor(s):

Kristen Marie Bellisario (Purdue University)

Other Acknowledgement(s):

Advita Rayarikar (JMHC); Parth Thakre (Science)

Poster Presentation Abstract Number: 1708

Presentation Time: Session 4: 1:30-2:30pm

Advancing the use of X-Ray Fluorescence in obscured lead pipe detection

STEM

Authors(s):

Drew Thomas Novak† (Engineering|JMHC)

Abstract:

Aging infrastructure poses environmental risks, particularly from lead water lines, which are often difficult to locate due to excavation costs. The risk of lead exposure due to lead-infected water is a serious health concern for many communities that is often difficult to trace and has long term, wide spreading results. This study evaluates the capability of a high-energy X-Ray Fluorescence (XRF) device using a 140 kV X-ray tube and an H3D M400 CdZnTe detector to detect buried lead pipes through varying depths of topsoil with a theoretical max depth of 5 ft (1.5m). Controlled experiments were conducted by placing lead bricks and sample pipes under different soil depths with a goal of detection through at least 16 inches of topsoil. After this, field tests were conducted to determine the feasibility of detecting lead pipes through buried topsoil in real world applications. The resulting XRF signal strengths were analyzed and compared among the results at different depths and lengths of pipes to determine the feasibility of the implementation of the project. Our results are intended to show to the EPA that the XRF device can feasibly identify lead concentrations beyond the typical depth of buried lead pipes. This will drastically improve non-invasive lead detection methods which will aid infrastructure assessment and replacement efforts.

Keywords:

XRF; Lead Detection; Lead Pipes; X-Ray Fluorescence; X-Ray Spectroscopy

Mentor(s):

Aaron James Specht (Purdue University); Thomas Ray Grier (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1709

Presentation Time: Session 4: 1:30-2:30pm

An Attempt at Identifying Tidal Disruption Events through ZTF

STEM

Authors(s):

Cadance William Lucas Ormsby† (Science|JMHC); Vincent Xavier Velasquez† (Science); Tianhe Yang† (Science)

Abstract:

Tidal Disruption Events (TDEs) are powerful high energy events that occur due to gravitational interactions between stars and supermassive black holes at the centers of galaxies, causing the star to get ripped apart. Identifying these objects is challenging due to the similarities between the lightcurves of these events and other transients, specifically Active Galactic Nuclei (AGNs). In our research we attempt to discover new TDEs and AGNs through astronomical data collected by the Zwicky Transient Facility, an all-sky survey that discovers transients (new, temporary objects) in the night sky. The Antares data broker and devkit allows us to access these collected data in a comprehensive way. We will introduce the method we use to filter transients as TDEs or AGNs. This will include light curves of the objects discovered by ZTF along with their spectra (where applicable) of nearby cataloged objects that lead us to find more AGNs and TDEs . We will conclude with future steps that can be taken to identify more of these objects or increase our confidence level that the objects found were TDEs or AGNs. This kind of research can help us further our understanding of how supermassive black holes interact with their host galaxies including the mass, angular momentum, and electric field of black holes.

Keywords:

AGN; TDE; Time Domain Astrophysics; ZTF

Mentor(s):

Ziwei Ding (Science); Danny Milisavljevic (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1710

Presentation Time: Session 4: 1:30-2:30pm

Development of DNA linked Ser/Thr kinase activity sensing tool

STEM

Authors(s):

Jeffrey Park† (Science|JMHC)

Abstract:

Serine/threonine kinases are important regulators of cellular signaling, yet their activity remains challenging to measure with high sensitivity and specificity due to the limited efficiency of anti-phosphoserine (pSer) antibodies. To address these limitations, we developed two complementary approaches: a DNA-based assay using a peptide kinase substrate-derived probe conjugated to a DNA oligo for quantifying phosphorylation events via antibody pulldown and qPCR, and a novel DNA aptamer-based method for specific pSer recognition. For the aptamer approach, we performed systematic evolution of ligands by exponential enrichment (SELEX) using a highly diverse single-stranded DNA library (1x1014 distinct molecules) targeting phosphorylated EIN2 (Ser/Thr kinase Raf1 substrate) and Kemptide peptides (Protein kinase A optimal substrate). After nine rounds of selection using streptavidin-immobilized biotinylated targets and two different elution methods (boiling and anti-pSer antibody), next-generation sequencing identified one significantly enriched aptamer sequence (EIN2-1) showing approximately 7000-fold enrichment and specificity to phosphorylated EIN2. Microscale Thermophoresis (MST) assays confirmed that EIN2-1 at 50µM specifically bound to phosphorylated EIN2 but not to the unphosphorylated EIN2 or Kemptide. Additionally, a truncation study identified a shorter variant (N1) that maintained similar binding properties to the parent aptamer. This work establishes promising alternatives to traditional antibody-based pSer detection, with ongoing efforts focused on improving binding specificity and dissociation constants.

Keywords:

qPCR; DNA Aptamer; Ser/Thr kinase; Peptide Substrate

Mentor(s):

Dongwook Kim (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1712

Presentation Time: Session 4: 1:30-2:30pm

Analysis of nanoparticle effects via histology

STEM

Authors(s):

Neha Paruchuri† (HHS|JMHC)

Abstract:

This dosing study aims to establish whether or not iron nanoparticles affect brain tumor growth. If there is a correlation between iron nanoparticles and halting brain tumor growth, we hope to establish which dosage of iron nanoparticles is ideal.

QuPath is being used for positive cell detection with Ki67, Iba-1, Prussian Blue, Olig2, and CD204 markers to evaluate whether or not iron nanoparticles affect brain tumor growth in canines. Canines 1, 2, and 5 served as the controls, canines 3 and 4 received smaller dosages of iron nanoparticles, and canines 6 and 7 received higher doses. If successful, techniques can also be applied to other types of cancers, and in human subjects.

Keywords:

Iron Nanoparticle; Dosing Study; Brain Tumor

Mentor(s):

Matthew Louis Scarpelli (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1713

Presentation Time: Session 4: 1:30-2:30pm

PITCH Program Analysis

STEM

Authors(s):

Vishwajit Laxmanrao Patil† (Engineering); Sophia Moon‡ (Engineering); Jeevika Rajesh Purkar‡ (Engineering); Philip Hwanseo Lee‡ (Engineering)

Abstract:

Purdue Ivy Tech Chips Program (PITCH), a two-week summer program for high-school juniors and seniors, aims to encourage local participation from the Greater Lafayette area to raise awareness and interest in the semiconductor and microelectronics industry. One of the goals of this program is to provide opportunities to explore careers in the semiconductor and microelectronics industry, ultimately developing workforce for regional economic growth. Understanding the impact the program has on community is important to improve the program, and the first step to do that is by determining the characteristics of participant pool. Therefore, this research aims to understand what type of persons participated in the READI (former PITCH) and PITCH program in 2023 and 2024 and audiences who are missing. For this, qualitative data analysis was performed on artifacts from the program. Deductive coding was performed on data collected from application responses, surveys, and focus group transcripts from 54 consenting/assenting PITCH program participants. Data analysis was used for participant profile creation based on themes like experience, interests, and sub-themes. Based on the preliminary analysis, it is expected that there are a few themes like interest and experience that stand out and are present frequently among the personas. It is expected that participants with strong interest benefit significantly from the program. More importantly, this research also highlights the types of participants who miss out on these opportunities. These results are helpful to design interventions to broaden the participation of missed out participants to raise awareness and spark interest among them.

Keywords:

PITCH Program; Persona; Themes; Qualitative Analysis; Deductive Coding

Mentor(s):

Shauna Nicole Adams (Engineering); Yash Ajay Garje (Engineering);

Morgan M Hynes (Purdue University); Kerrie Douglas (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1714
Presentation Time: Session 4: 1:30-2:30pm

PASylation as a promising protein modification to prolong Interleukin 27 (IL-27) half-life

STEM

Authors(s):
Amanda Pawlecki† (Agriculture|Engineering); Aryaman Dewan* (Science)

Abstract:
Protein therapy is one of the most commonly used treatment options for various diseases due to its target specificity and minimal adverse effects. However, the short half-life of recombinant proteins poses several challenges for its effectiveness and administration. Poly-ethylene glycol (PEGylation) is a widely used protein modification, typically used to extend protein half-life. However, PEG can induce immunogenic responses, such as anti-PEG antibodies, which greatly restrict its application. To overcome this challenge, alternative introduction of a Pro-Ala-Ser domain (PASylation) can help lengthen protein half-life and, therefore, improve its efficacy. PAS domains are hydrophilic, uncharged biological polymers with properties similar to PEG. Interleukin-27 (IL-27) is a cytokine reported to aid in reducing tumor growth in various cancer models by activating signaling pathways such as STAT1, which trigger anti-proliferative and pro-apoptotic gene expression. However, IL-27's short in vivo half-life limits its clinical applications. In this study, we aim to modify IL-27 with PASylation to enhance its half-life and efficacy. Through in vitro studies, we were able to successfully transfect mouse muscle cells (C2C12) with an empty vector, IL-27, or PASylated-IL27 (PAS-IL27) vectors, to leverage skeletal muscle as a 'protein factory'. Also, equivalent STAT1 activation was detected in TRAMP-C2-Ras (TC2R), a murine prostate cancer cell line cultured with C2C12-conditioned medium transfected with IL-27 and PAS-IL27. An ongoing syngeneic mouse model will assess the efficacy of PASylated IL-27 in treating prostate tumors and help validate the effect of PASylation on this cytokine's half-life.

Keywords:
Protein Modification; PASylation; Prostate Tumor; Interleukin 27; Skeletal Muscle

Mentor(s):
Marxa Figueiredo (Purdue University); Ying Cheng Chen (Vet Med)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Omnia Mohammed Hamid Ibrahium (Vet Med); Raluca Ostafe (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1715

Presentation Time: Session 4: 1:30-2:30pm

Application of Purple Air Sensors: Determining Air Quality Over Different Time Intervals

STEM

Authors(s):

Paige Bailey Pierson† (HHS)

Abstract:

When living in a community with a lot of industry, a major concern for the residents is air quality, including fine particulates (PM2.5). The regulatory level for PM2.5 is 35 µg/m3 averaged over 24 hours or 9 µg/m3 averaged over one year. However, we hypothesize that averaging air quality data over longer periods may mask short-term peaks of high pollution levels which may still impact local communities. Low-cost, real-time air quality sensors, such as Purple Air sensors, are now available to test this hypothesis. Thus, we compared 24 hour vs. 10 minute averages of PM2.5 from 5 locations with Purple Air monitors; 4 sensors are in Lake County (A-D), and one is in West Lafayette (E). Data were downloaded from the Purple Air website. The data will be collected for a period of 2 weeks; currently data over a 3 day period, including N=432 measurements from each sensor, has been analyzed. Each monitoring unit has two sensors; these were averaged and then compared to regulatory levels. All sensors exceeded the annual average regulatory level for a substantial time period: 79.6% (A), 54.9% (B), 64.8% (C), 74% (D) and 57.4% (E). PM2.5 concentrations were usually, but not always higher in Lake County compared to West Lafayette. These early results do support our hypothesis. Data analysis, including comparisons with the 24-hour regulations, are ongoing.

Keywords:

Air Quality; High Pollution

Mentor(s):

Ellen M Wells (Purdue University)

Other Acknowledgement(s):

Jung Hyun Lee (HHS)

Poster Presentation Abstract Number: 1716

Presentation Time: Session 4: 1:30-2:30pm

The Lived Experiences of Asian/American Adolescents Through Qualitative Research.

Social Science

Authors(s):

Reese Caroline Pinkley† (HHS)

Abstract:

This research examines how Asian/American adolescents have developed their personal and cultural identity through the qualitative analysis of interviews conducted during the study. The interviews asked adolescents to discuss how they grew up and what role, if any, family members and the larger community played in helping adolescents connect to their Asian/American culture. Throughout these interviews, music has served as an important lens where adolescents have reflected on their past, emotional, social and personal connections in ways that cross individual and cultural backgrounds. Discussions on family roles/expectations, experiences, and even language. Whether it be language other than English or just the communication used in the household. This highlights how complex an Asian/American adolescents' personal identity can be. This study explores a deeper understanding of how Asian/American adolescents navigate their cultural identity—showing how peers, family, traditions, and values shape it.

Keywords:

[no keywords provided]

Mentor(s):

Stewart C Chang Alexander (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1717

Presentation Time: Session 4: 1:30-2:30pm

Imaging neurotoxicity: Visualizing PFOS retention and distribution in the rat brain using DESI-MSI

STEM

Authors(s):

Hurshal Pol† (HHS|JMHC); Matthew Thomas Corson* (HHS|JMHC)

Abstract:

Per- and polyfluoroalkyl substances (PFAS) are a group of persistent organic pollutants we are exposed to throughout life. Perfluorooctanesulfonic acid (PFOS), the most prevalent PFAS pollutant, crosses the blood-brain barrier and has potential links to neurological conditions such as depression and dementia. Previous research indicates that PFOS exposure impacts neurotransmitters and behavior but there is no characterization of deposition throughout the brain. We hypothesized that PFOS accumulation in the brain correlates with neurotransmitter systems affected by PFOS. Three-month-old male and female Sprague-Dawley rats were given an oral bolus dose of 10 mg/kg PFOS or 10% DMSO vehicle solution. Brain tissues were collected 1-, 3-, 7-, 28-, and 112-days post-treatment. PFOS (m/z=498.93) was visualized using DESI-MSI (desorption electrospray ionization - mass spectrometry imaging) in the negative ion mode which depicted the spatial distribution as well as relative intensities across the tissue.

Preliminary results confirmed region-specific PFOS accumulation in brain regions including the striatum, amygdala, and hippocampus with clear differences between males and females in the ventral striatum. The highest concentrations were found in the amygdala, a major emotional center, and dorsal and ventral striatum, regions impacted by motor function and psychological disorders, respectively. Furthermore, PFOS preferentially accumulated in grey matter over white matter, suggesting selectivity to cell bodies over axonal projections. This provides insights into the spatial distribution of PFOS in the brain, contributing to our understanding of PFAS-related neurotoxicity. These findings underscore the importance of further investigation into PFOS's chronic effects on brain function, and to clarify its role in neurological diseases and neuropsychiatric disorders.

Keywords:

PFOS; Neurotoxicity; DESI-MSI; Neurological Disorders; Persistent Organic Pollutant

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Jason R Cannon (Purdue University); Josephine Maria Brown (HHS); Christina R Ferreira (Purdue University); Fatema Mustafa Currim (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1718

Presentation Time: Session 4: 1:30-2:30pm

Project ADONIS (Astronomical Development and Operation of Neo-Moon Interstellar Systems)

STEM

Authors(s):

Adarsh Prathap† (Engineering); Shruti Subramaniyan† (Engineering); Emma Dannyelle Jobe† (Science); Atiksh Bhattacharya† (Science); Pranav Bulusu† (Engineering); Henry Joseph Ewald† (Engineering); Brasen Paul Garcia* (Engineering)

Abstract:

The purpose of Project ADONIS (Astronomical Development and Operation of Neo-Moon Interstellar Systems) is to address the problem of long-term lunar evolution to achieve sustainable habitation and renewable energy production. This is done by creating closed-loop systems, such as a repurposed SpaceX Starship for habitation, a self-sufficient energy system with Perovskite solar cells, producing and recycling food and water, and manufacturing Methalox propellant (liquid oxygen and liquid methane) from lunar resources. The mission consists of three semi- and fully autonomous stages, during which the necessary infrastructure will be built for long-term habitation. ADONIS' modular structure makes operations scalable, and the base can accommodate up to 100 people in the future. Eventually, ADONIS will be able to produce upwards of 19,500 kilograms of valuable resources like titanium, aluminum, and silicon alongside 20,000 kilograms of Methalox fuel per year. Additionally, the propellant can be used for a lunar refueling station, making long-distance space travel more feasible. The income generated by these two revenue streams means ADONIS will be profitable within 45 years of its launch in 2029. Based on the positive impact of ADONIS' findings, space agencies should prioritize investing time and resources into lunar habitation as a foundational step towards the settlement of other planets.

Keywords:

Lunar Habitation; Space Travel; Space Colonies; Low-Gravity Habitats

Mentor(s):

D. Marshall Porterfield (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1719

Presentation Time: Session 4: 1:30-2:30pm

Reassessing the Bakhshali Manuscript: A Critical Review of Its Translations and Knowledge Transmission

Humanities

Authors(s):

Vaishnnavi Purram† (Exploratory Studies|JMHC|Other); Parth Kailash Dubal* (Engineering)

Abstract:

The Bakhshali Manuscript, an ancient mathematical text discovered in 1881 in present-day Pakistan, is one of the oldest known records of numerical calculations, including an early representation of zero. Written on birch bark in the Sharada script, it contains arithmetic and algebraic problems, reflecting a sophisticated understanding of mathematical principles. However, it has long been misrepresented due to colonial biases and misattributions, particularly by the first scholars to study it, G.R. Kaye and Rudolph Hoernle.

These early European scholars evaluated the manuscript under assumptions of Greek influence, undermining its indigenous mathematical developments and misdating its origins. Oxford University's recent carbon dating revealed that the manuscript predates Kaye’s assumptions by centuries. Nevertheless, the narrative of Greek influence persists in modern academia.

This research conducts a systematic textual analysis to highlight discrepancies in past interpretations and examine the transmission of mathematical knowledge through Indian, Buddhist, and Jain traditions, ultimately influencing the Ancient West and beyond. By analyzing linguistic patterns, this study challenges Eurocentric views and recontextualizes the manuscript within the broader historical development of the Subcontinent’s mathematics.

Furthermore, by mapping and transliterating the manuscript from Sharada to Sanskrit and then English, this research aims to evaluate the text free of orientalist assertions and illustrate how zero and decimal-based calculations emerged independently in Indian traditions. Understanding the true origins of these fundamental concepts ensures a fuller appreciation of the cultures and scholars involved. By reexamining the manuscript with impartial methodologies, this project contributes to a more nuanced and equitable understanding of mathematical history.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
History; Mathematics; Interdisciplinary; History of Math; History of Science

Mentor(s):
Nissanka Subodhana Wijeyeratne (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1720

Presentation Time: Session 4: 1:30-2:30pm

Unveiling Fan Decision-Making: Predicting Sports Championship Outcomes Through User Prediction Strategies

Business Case Study

Authors(s):

Samyukta Rajaraman† (DSB); Kriti Bagchi† (DSB|JMHC); Brandon Michael Dries† (DSB|JMHC); Alexander Logan Kapala† (DSB); Christina Wan† (DSB)

Abstract:

This study aims to explore and predict fan choices in the NCAA basketball championship outcomes by analyzing user prediction strategies and identifying key variables that influence decision-making. The primary goal is to determine whether the predictors driving the selection of the championship winner are distinct from those influencing the choice of the challenger. By examining the decision-making process behind fan predictions, this project seeks to enhance the understanding of user behavior in competitive sports forecasting.

The methodology involves developing two predictive models: one to forecast the championship winner and another to identify the most likely challenger. The analysis leverages advanced techniques such as stepwise forward selection and decision tree pruning to identify the most impactful predictors, ensuring optimal model performance. A robust exploratory data analysis (EDA) is conducted to provide insights into the characteristics of users that influence their prediction strategies. The study also incorporates feature engineering, including variables like previous wins and last year’s winner, to enhance model accuracy.

Preliminary findings suggest that the predictors contributing to the performance of the winning model differ from those driving the challenger model, highlighting the complexity of fan decision-making. This research contributes to the broader field of predictive analytics by offering a nuanced perspective on user behavior and strategic thinking in sports forecasting. The implications of this study extend to businesses and organizations leveraging predictive models for marketing, engagement, and fan experience optimization, providing valuable insights into the cognitive drivers of user predictions.

Keywords:

Predictive Analytics; Decision-Making; NCAA Basketball; Fan Behavior; Feature Engineering

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1721

Presentation Time: Session 4: 1:30-2:30pm

Regulation of Nitrogenase in Metallo-Protease Inhibited Cultures of Cyanobacterium Crocosphaera subtropica ATCC 51142

STEM

Authors(s):

Malyka Ram† (Agriculture|Engineering)

Abstract:

Crocosphaera subtropica ATCC 51142, a unicellular marine cyanobacterium, carries out both photosynthesis and biological nitrogen fixation (BNF) within the same cell. However, nitrogenase, the key enzyme in BNF, is highly sensitive to oxidation by O2 and other reactive oxygen species generated during photosynthesis, making the two processes biologically incompatible. C. subtropica overcomes this deficit by uniquely separating photosynthesis and BNF into light and dark phases, respectively. This metabolic attribute makes C. subtropica an appropriate model to elucidate the regulatory mechanisms and energy efficiency required for such metabolic coordination. Our lab's previous proteomic analysis C. subtropica, under nitrogen-fixing conditions, revealed significant differences in nif gene expression between light and dark phases. For instance, the abundance of nitrogenase enzymes encoded by nifH was 450-fold higher in the dark compared to light. To further investigate the regulation and stability of nitrogenase enzymes in C. subtropica, we will determine the effect of metalloprotease inhibitor 1,10-phenanthroline on nitrogenase degradation.

C. subtropica cultures were grown nitrogen-fixing conditions with a 12h light-dark cycle for seven days. After this undisturbed growth, cells were treated with varying concentrations of 1,10-phenanthroline four hours into the dark phase and collected every four hours within the 24 hour light-dark cycle. Samples will be prepared for untargeted liquid chromatography-tandem mass spectrometry (LC-MS/MS) analysis. It is anticipated that the treatment of metalloprotease inhibitors will lead to an accumulation of nitrogenase in the light phase compared to untreated controls.

Keywords:

Cyanobacteria; Proteomics; Nitrogen Fixation; Metabolic Regulation

Mentor(s):
Uma K Aryal (Purdue University); Punyatoya Panda (Vet Med); Rodrigo Mohallem Ferreira (Vet Med)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1722

Presentation Time: Session 4: 1:30-2:30pm

Minimal Motion Metrics: Discriminating Gait Types with Acceleration-Based Analysis for Real-World Monitoring

STEM

Authors(s):

Sridevi Ramkumar† (Engineering|JMHC)

Abstract:

Monitoring the movements of at-risk populations, like older adults or individuals with Parkinson's disease, in everyday settings can reveal salient patterns not observable in brief clinical visits. However, natural environments present significant challenges: limitations on sensor choice and greater variability in the data than in controlled settings. These constraints necessitate optimizing measurement approaches to balance diagnostic value with practical limitations. Inertial measurement units (IMUs) are promising because of their non-intrusiveness and reliable linear acceleration measurements. Therefore, we investigated whether minimalist acceleration information could discriminate between gait types. We sought to identify key features that distinguish between walking speeds and provide clinically relevant insights outside laboratory settings.

But first, we must establish acceleration-based discriminating features. Therefore, we analyzed gold-standard motion capture data from publicly-available gait recordings of young individuals walking at slow, comfortable, and fast speeds on a treadmill. Ankle acceleration magnitudes were derived from position data and parsed into strides. We computed the across-stride average acceleration (reflecting movement intensity) and the spatio-temporal index (STI) by normalizing the acceleration data and summing the across-stride standard deviation at each time point.

As expected, intensity increased with speed. Additionally, STI was higher for slow walking compared to comfortable and fast speeds, a novel finding compatible with the known difficulty humans have in producing slow arm motions. The intensity metric shows promise as a reliable discriminator of walking speeds, while STI could assess deviations in gait variability. These findings position us to test similar approaches with IMU sensor data in healthy and pathological populations.

Keywords:

Human Gait; Wearable Devices; Sparse Data

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Satyajit S Ambike (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1723

Presentation Time: Session 4: 1:30-2:30pm

Expression of Inflammatory Genes in a Model of Post-Traumatic Osteoarthritis

STEM

Authors(s):

Amrita Rani Raparti† (Science)

Abstract:

Post-traumatic Osteoarthritis (PTOA) is a type of osteoarthritis caused by trauma to the joint. Individuals who suffer from PTOA experience swelling, cartilage degradation, stiff joints, and lack of joint mobility. In this study, we will initiate PTOA by inducing joint injury in murine models via non-invasive tibial compression to rupture the ACL (ACLR). Inducing PTOA will allow us to study the variability of inflammation markers present in late-stage PTOA. Furthermore, tissues have immune cells called macrophages that help our body regulate and attain homeostasis. There are two types of macrophages: M1 and M2. While both macrophages respond to a site with damaged tissue, M2 attempts to reduce inflammation, while M1 sustains inflammation. NOS2 and ITGAM are M2 macrophage inflammatory markers. Arg1 and Emr1 are M1 macrophage inflammatory markers. These inflammatory markers are the focus of my study.

Evaluating gene expression of inflammatory markers helps us understand and craft treatments for PTOA. Tools like reverse transcription-quantitative polymerase reaction (RT-qPCR) analyze and quantify RNA and gene expression. Hence, I will utilize RT-qPCR to determine variations in gene expression of inflammatory markers. In this study, GAPDH will serve as a housekeeping gene, ?Ct will help analyze gene expression differences, and ??Ct will help calculate fold-change. From a statistical standpoint, a paired t-test will be used to compare the significance among the six murine models. Upon completion of this experiment and data analysis, I expect PTOA joints to have higher M1 macrophages than M2 because inflammation is directly proportional to PTOA progression.

Keywords:

PTOA; Inflammatory Markers; RT-qPCR; M1 Macrophages; M2 Macrophages

Mentor(s):

Deva Chan (Purdue University); Ryan Michael Meister (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1724

Presentation Time: Session 4: 1:30-2:30pm

SCALE RH: Machine Learning-Based Optimization of Materials for Microelectronics

STEM

Authors(s):

Elana Simone Rhoge† (Engineering)

Abstract:

The discovery and optimization of materials with tailored properties are critical for advancing microelectronics. Predictive computational methods, including atomistic simulations and machine learning, accelerate material discovery and reduce reliance on costly experiments. This project combines LAMMPS-based atomistic simulations, generative AI, and active learning to characterize and optimize materials for microelectronic applications. Using nanoHUB as a platform, material property spaces are explored to identify optimal packaging and other applications compositions. Machine learning models guide the search process, enabling efficient exploration of material design spaces. This approach provides hands-on experience in atomistic simulations and machine learning tools while contributing to developing next-generation materials. Key outcomes include the identification of novel material compositions with enhanced properties for microelectronic packaging and integration. Future work may involve expanding the active learning framework to other material systems and exploring the co-optimization of materials and device architectures, paving the way for innovative solutions in the field.

Keywords:

[no keywords provided]

Mentor(s):

Alejandro H Strachan (Purdue University); Saswat Mishra (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1725

Presentation Time: Session 4: 1:30-2:30pm

Analyzing Research Trends: Exploring PICR Research Impact, Collaborations, and Expertise with Bibliometric Data

STEM

Authors(s):

Colin David Roberson† (Science); Lonnie Wayne Schwartz‡ (Agriculture); Vineeth Surya Narra‡ (HHS)

Abstract:

Understanding research output and collaboration patterns is essential for guiding institutional strategy and funding decisions. This study analyzes publishing trends among contributors to the Purdue Institute for Cancer Research (PICR) over recent decades, focusing on citations, interdisciplinary collaboration, data accuracy, and grant allocation. Using R's data analysis and visualization tools, it addresses the challenges of obtaining accurate bibliometric data, which often contains errors from platforms like Web of Science and Scopus. The goal is to enhance understanding of research trends to inform future strategic decisions for institutions. Key deliverables include a methodology for collecting and cleaning bibliometric data, along with advanced analysis and visualization presented in an intuitive web application. This approach can be extended to other domains and institutions to uncover valuable bibliometric trends.

Keywords:

Bibliometrics; Cancer Research; Data Analysis

Mentor(s):

Pete E Pascuzzi (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1726

Presentation Time: Session 4: 1:30-2:30pm

Reporting-Back in Environmental Health

STEM

Authors(s):

Kaitlyn Lea Robertson† (HHS)

Abstract:

In recent years, an increasing number of environmental health researchers have shared study findings with participants, or “reporting-back”. This project is a literature review to identify current issues and priorities surrounding the practice of “reporting-back” in environmental health research. A literature search was conducted using Google Scholar using the teams “reporting-back” and “environmental health,” including publications from 2020-2025. Studies using pre/post surveys to evaluate the report-back process were prioritized, focusing on those that address the influence of personalized report-backs. A total of N=10 studies were identified. In 50% (n=5) of the studies, pre/post surveys were used, 30% (n=3) focused on the benefits of databases and tools for individualized reports, and 30% (n=3) emphasized community engagement and its role in promoting action and change. Key strategies for reporting-back included simplifying information to support health literacy, presenting data in accessible formats, and engaging communities through meetings. To optimize reporting-back, researchers must clearly convey data and tailor communication based on participant feedback, a practice demonstrated by tools such as the Digital Exposure Report-Back Interface (DERBI) and Macro Compilation of Reports (MCR). This literature review suggests that effective reporting-back is important to promoting health literacy and behavioral changes relating to environmental health. Through this review, we identified that personalized data reports, using databases such as the DERBI and MCR, are effective tools for personalizing reports and communication strategies. These approaches promote equitable access, increased awareness, and encourage action to reduce exposures, making them successful methods of report-back that future research may wish to incorporate.

Keywords:

Reporting-Back; Environmental Health

Mentor(s):

Ellen M Wells (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1727

Presentation Time: Session 4: 1:30-2:30pm

Boosting Brand Visibility: A Strategic Marketing Approach for TruVant Realty in Lafayette

Business Case Study

Authors(s):

Lauren Lee Ryan† (DSB); Harry Hyunseung Moon† (DSB); Tyler James Vanderwoude† (DSB); Ashlee Elizabeth Laskowski† (DSB); Aadi Dipak Patel† (DSB); Kaitlyn Riley Ellison† (DSB)

Abstract:

TruVant Realty is a premier commercial real estate agency located in Lafayette, Indiana, specializing in the buying, selling, and leasing of commercial properties. The goal of the research study is to enhance TruVant Realty's visibility and expand its customer base within the Lafayette area. the study will develop targeted strategies that boost brand awareness and drive growth. By leveraging data-driven insights, the study will pinpoint key market segments and analyze competitors' advertising tactics to identify opportunities for TruVant Realty's success. Through a combination of secondary research, primary data analysis, and comprehensive surveys, incorporating both quantitative and qualitative approaches, the study will make recommendations to increase the agency's presence and effectiveness in the local market.

Keywords:

Commercial Real Estate; Brand Visibility; Marketing Research

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1728

Presentation Time: Session 4: 1:30-2:30pm

Creating Comprehensive Modeling Tools for Simulating the Dynamics of Multi-Qubit Superconducting Systems Embedded in Arbitrary Transmission Line Networks

STEM

Authors(s):

Annabelle Rose Schultz† (Engineering); Jack Thomas Willard† (Engineering|JMHC); Jinhoo Yoon† (Science); Tanvi Chukka† (Engineering); Annsh Santosh Navle‡ (Science); Christian Scheckel‡ (Engineering); Tylen Sean Fleming‡ (DSB)

Abstract:

A key step in the development of quantum computing is the creation of efficient and precise modeling tools that facilitate the design and optimization of quantum processors. This work aims to develop a combination of classical and quantum modeling tools that will enable users to effectively design superconducting quantum computers. In this regard, we are first building a classical microwave circuit simulator that can take arbitrary user-defined circuit layouts and accurately and efficiently evaluate key design parameters like the impedance response. Leveraging recently developed quantum theory, these classical impedance responses can be related to the key quantum property describing the interaction rate between different qubits. Building from this same circuit layout, we are also developing 1D Maxwell-Schroedinger methods to model the superconducting qubit dynamics that utilize the qubit-qubit interaction rates calculated from the earlier method. Together, these methods allow us to account for realistic experimental parameters such as the capacitances, transmission line lengths, and voltage sources while capturing their interaction with the superconducting qubits, allowing us to characterize qubit dynamics, readout, and gate fidelities accurately and robustly. The tool is flexible and extremely customizable allowing users to change device parameters to their needs, and run simulations for diverse tasks relevant to designing quantum computers. Further, we are using these underlying simulation methodologies to create three targeted educational applications on nanoHUB; one for showing the basics of qubit control by driving single qubits, one for demonstrating qubit readout methods, and one for generating entanglement by driving a two-qubit device. All of these tools will have an interactive GUI, that provides an easy and visual representation of the underlying concepts, allowing learners to explore complex quantum phenomena without requiring deep expertise in mathematical formalism. By lowering the

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

barrier to entry, these modeling tools foster engagement, encourage curiosity, and promote a deeper understanding of quantum computing principles, making quantum education more inclusive and effective.

Keywords:
[no keywords provided]

Mentor(s):
Thomas Edgar Roth (Purdue University); Ghazi Khan (Engineering); Samuel Theodore Elkin (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1729

Presentation Time: Session 4: 1:30-2:30pm

Comparative Neurobehavioral and Molecular Effects of Chlorpyrifos Exposure in Pon-1 (-/-) and Wildtype Rat Models

STEM

Authors(s):

Sofia Schumann† (HHS); Dia Dipen Jhaveri‡ (Science); Matthew Thomas Corson* (HHS|JMHC); Hurshal Pol* (HHS|JMHC)

Abstract:

Chlorpyrifos (CPF) is an organophosphate pesticide (OP) that has been used globally in agriculture. Research indicates that it has had adverse impacts on human health due to inhibition of acetylcholinesterase which leads to cholinergic effects. The EPA in August 2021 announced to ban the use of CPF in food production, but the ban got reversed and is still used widely in America today. Epidemiological and laboratory investigations have established a correlation between environmental exposures and the onset of Parkinson's Disease (PD). The impact of genetic variations in PD-related genes on dopaminergic neurotoxicity has not been thoroughly investigated.

Paraoxonase 1 (Pon1) is an enzyme that plays a crucial role in the detoxification of certain xenobiotics, like the CPF oxon which is neurotoxic. Pon1 acts to break the CPF oxon down into less toxic substances, reducing its harmful effects on the nervous system. Polymorphisms in Pon1 further increases PD risk from CPF exposure. A comprehensive understanding of potential interactions between genetic factors and environmental exposures is crucial for assessing the risk posed by CPF exposure in relation to PD.

To determine the impact of Pon1 knockout (KO) on the vulnerability to PD, we conducted a study on male and female 9-11 month-old Pon-1 KO and wildtype Sprague Dawley rats with the dosage group of 2.0 mg/kg and control (2 of each gender in each group). Neurobehavioral study included Postural Instability (PI), Vibrissae elicited forelimb placing (VEBT), and Spontaneous activity also known as the cylinder test. Following the study molecular experiments were conducted, including western blots and DAB staining of the Substantia nigra and Striatum. In DAB stains there were no changes in the striatum found, but there was a decrease in stained dopaminergic neurons in the Substantia nigra. Western Blots showed a decrease in tyrosine hydroxylase (TH) a biomarker for dopaminergic neurons in the midbrain.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Statical analysis results produced from the study showed that Pon-1 KO rats treated with 2mg/kg CPF performed worse in neurobehavioral studies PI and VEBT but there were no statistical differences for the Spontaneous Activity test compared to wildtype rats treated with 2mg/kg CPF. Future experiments of this project will be neurochemical analysis of the isolated brains and livers from this study.

Keywords:
Pesticide; Neuroscience; Neurotoxicology; KO Rat Model; Chlorpyrifos

Mentor(s):
Jason R Cannon (Purdue University); Reeya Tanwar (HHS); Fatema Mustafa Currim (Purdue University); Josephine Maria Brown (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1730

Presentation Time: Session 4: 1:30-2:30pm

ExbB + ExbD in Neisseria: a Proton Channel Protein Puzzle

STEM

Authors(s):

Molly Genevieve Seeser† (Science)

Abstract:

Multidrug resistance (MDR) is a growing threat for future pandemics. Gram-negative bacteria are among the most dangerous MDR pathogens; Neisseria gonorrhoeae and Neisseria meningitidis are two such bacteria that respectively cause gonorrhea, the second-most reported sexually transmitted disease in the US, and meningococcal disease, fatal if not treated promptly. Limited vaccination options have led researchers to find other methods of preventing Neisserial infections, such as targeting nutrient import. In N. meningitidis and N. gonorrhoeae, an intermembrane protein system facilitates uptake of iron from human hosts. The inner membrane complex, Ton, provides energy for this mechanism through a channel composed of proteins ExbB and ExbD. According to previous research in E. coli, a dimer of ExbD fits inside a pentamer of ExbB, with movement of ExbD within ExbB likely involved in the transfer of protons. The goal of this project is to determine the atomic structure of the Neisserial ExbB+ExbD complex using cryogenic electron microscopy (cryo-EM) and identify the mechanism by which ExbD moves to bring protons to the cytoplasm. Through plasmid design, transformation and induction in different cell lines, Ni-NTA affinity chromatography, and imaging with SDS-PAGE and Western blot, we have had varying success in expressing constructs with different arrangements of ExbB and ExbD. Little to no expression has been shown in constructs with histidine tags between ExbB and ExbD or constructs that code for a methionine between ribosome binding sites and start codons. These preliminary findings are the basis for refining the current protocols for producing the ExbB+ExbD complex for structural analysis.

Keywords:

[no keywords provided]

Mentor(s):

Nicholas Noinaj (Purdue University)

Other Acknowledgement(s):

Shubham Dubey (Science)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1731

Presentation Time: Session 4: 1:30-2:30pm

Just "Beet" it? A Comparison of Road Salt Effects on the Life History of Daphnia magna.

STEM

Authors(s):

Koby M Sellner† (Science)

Abstract:

In areas that experience snow and ice, de-icing reagents such as road salts are often used on roads to promote safer driving conditions. However, road salts run off into local vegetation, soil systems, and my focus, freshwater systems. The impacts of excess salt and chloride in freshwater have been studied extensively on different organisms under different conditions but rarely using different types of road salts. In this study, I used the indicator species Daphnia magna and three road salt compounds to compare the negative effects of road salt on D. magna reproduction and mortality across salt treatments in two different concentrations. Overall, there was no significant difference among salt treatments on the mortality and reproduction of D. magna. Additionally, the advertised “eco-friendly” salt with beet extract was no less impactful on these life history traits than its competitors, highlighting the need for manufacturers to provide evidence for these claims.

Keywords:

Daphnia; Ecotoxicology; Road Salts; Salinity Stress; Life History

Mentor(s):

Catherine L Searle (Purdue University); Kurt Robert Lutz (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1732

Presentation Time: Session 4: 1:30-2:30pm

Pushing the Boundaries of Biological Tissues used for Paleodiet Reconstruction: Maggot Preparation for Stable Isotope Analysis

STEM

Authors(s):

Trinity Eve Sevick† (Liberal Arts); Yadira Dominguez† (Liberal Arts)

Abstract:

[Abstract Redacted]

Keywords:

Nitrogen Isotopes; Maggots; Paleodiet Reconstruction; Isotope Preparation

Mentor(s):

Melanie M. Beasley (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1733

Presentation Time: Session 4: 1:30-2:30pm

Escaping a Virtual Recitation Room

STEM

Authors(s):

Benjamin Matthew Shatkowski† (DSB|JMHC); David Michael Brethen-Thompson† (DSB); Jaden Luke Polizzi† (DSB|JMHC); Logan Yu† (DSB); Marcelo Ignacio Balsamo† (DSB); Vishwadeep Singh† (DSB)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Saanvi Singh (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1734

Presentation Time: Session 4: 1:30-2:30pm

3D Food Reconstruction

STEM

Authors(s):

Ahmed Wael Shebl† (Engineering); Abdelrahman Hamdy Ghania† (Engineering); Zeyad Ayman El Afify† (Engineering)

Abstract:

Creating 3D models from 2D images is a challenging problem in computer vision with applications in food visualization, augmented reality, and nutrition analysis. Our project, 3D Food Reconstruction from 2D Images, explores how classical computer vision techniques can be used to generate 3D representations of food items from multiple images.

We use classical computer vision techniques such as camera calibration, Structure from Motion (SfM) for pose estimation, and feature detection algorithms like SIFT to identify key points across images. Point clouds are generated using techniques like back-projection and refined using Iterative Closest Point (ICP) to improve alignment. We also use Poisson Surface Reconstruction to help create smooth and continuous 3D surfaces.

This approach aims to produce accurate and realistic 3D food models . While the project is still in progress, we are working on improving reconstruction quality and optimizing computational efficiency. The outcome of this research could benefit various applications, including food visualization, interactive experiences, and nutrition analysis.

Keywords:

Computer Vision; SfM; Dense Reconstruction; Point Clouds; 3D Mesh

Mentor(s):

Edward J Delp (Purdue University); Carla Zoltowski (Purdue University); Fengqing Zhu (Purdue University); Soudabeh Taghian Dinani (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1735

Presentation Time: Session 4: 1:30-2:30pm

A Computational Model of the Inferior Colliculus

STEM

Authors(s):

Anushka Shome† (Science)

Abstract:

The inferior colliculus (IC) serves as a crucial auditory processing center, integrating excitatory and inhibitory inputs from various sources to shape neural responses. Deficits in temporal processing are correlated with poorer hearing abilities, even after hearing loss has been compensated. Building upon prior work, this study further refines the computational model by implementing an adapting firing model and synchrony to temporal modulation.

A computational model was developed using NEURON to investigate auditory processing mechanisms in the IC. Model parameters include modulation frequencies for excitatory and inhibitory inputs, age-related conditions (aged or young), and postsynaptic receptor conductances (NMDA, AMPA, GABA). Excitatory and inhibitory inputs from multiple anatomically distinct sources were applied to the neuron model, and spike times and counts were recorded for eight modulation frequencies (8-1024 Hz in octave steps). Mean spike counts were calculated for each frequency, and the data were plotted to illustrate the relationship between spikes and modulation frequency. Vector strength was calculated and validated using a custom function that generates spike trains with specified vector strength and other parameters. Two firing models, sustained and adapted, were implemented. Adaptation was modeled using a calcium-activated potassium channel, along with low- and high-threshold calcium channels and a modified hyperpolarization-activated cyclic nucleotide-gated (HCN) channel.

The computational model successfully elucidates the role of inhibitory and excitatory inputs, receptor conductances, and adaptation mechanisms in shaping neural responses in the IC. By comparing predicted changes in adaptation versus sustained firing models, this study provides insight into how these mechanisms influence IC spike activity.

Keywords:

Inferior Colliculus; Auditory Processing; Temporal Coding; Neuron; Computational Model

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Edward L Bartlett (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1737

Presentation Time: Session 4: 1:30-2:30pm

Auto ONNX Tester

STEM

Authors(s):

Christopher Michael Sigmund† (Engineering); Rohan Chandra Mudugere† (Engineering); Ivan Ni† (Science); Shrenick Sri Venkata Sai Gannamani† (Science); Lingyu Li† (Science); Donhyung Ko† (Engineering)

Abstract:

Converting deep learning models to ONNX can introduce errors that affect performance and reliability. Our research focuses on developing methods to automatically detect and diagnose these issues. We analyze common problems like mismatched operators, computational graph inconsistencies, and numerical differences, creating tools to help streamline debugging and ensure models function correctly across different frameworks. By improving error detection, our work makes AI model conversion more reliable and efficient.

Keywords:

[no keywords provided]

Mentor(s):

James C Davis (Purdue University); Purvish Jatin Jajal (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1738

Presentation Time: Session 4: 1:30-2:30pm

Multifunctional Materials in Aerospace Applications to Drone Landing Gear

STEM

Authors(s):

Pranav Singh† (Engineering|JMHC); Colby Strohl† (Engineering); Bella Irma Schaetzle† (Engineering); Clara Marie Anne Goffioul† (Engineering); Cassius Samuel Sampson† (Engineering); Simran Nadig‡ (Engineering|JMHC); Nathanael Adrian Lorincz‡ (Engineering); Tatiana Varela* (Engineering); Ananya Prasad* (Engineering|JMHC)

Abstract:

Multifunctional materials can strengthen a material's capabilities by incorporating multiple functionalities into a single component. This is beneficial in weight-conscious aerospace applications, such as quadcopter drones. This study investigates replacing the landing gear of a commercially available quadcopter with 3D-printed piezoresistive material. Piezoresistive materials change resistance as they are deformed, so measuring the resistance of the landing gear will give information about its strain state and therefore the condition of the component. Carbon nanofibers (CNFs) will be dry-mixed with PLA pellets and extruded into a piezoresistive CNF-PLA filament via screw extrusion. This filament will be used to print a dog bone specimen for piezoresistive characterization. Concurrently, landing gear for a quadcopter drone will be designed and 3D printed using the CNF-PLA filament. The piezoresistive landing gear will be fixed to the drone and used to measure resistance during takeoff and landing. Lightweight circuitry will be developed to measure these changes in resistance across the drone landing gear. The changes in resistance can be used to determine the strain experienced by the drone. The Arduino onboard the drone will use the voltage divider principle to calculate the instantaneous resistance of all four landing gear as a function of time. The resistance data will be transmitted to an Arduino on the ground via transceiver modules for analysis and storage.

Keywords:

Multifunctional Materials; Quadcopter Drones; Additive Manufacturing; Conductive Nanofillers; Structural Health Monitoring

Mentor(s):

Tyler N Tallman (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Lainie Jane Rapp (Engineering); Praneel Madhuvanesh (Engineering)

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Poster Presentation Abstract Number: 1739

Presentation Time: Session 4: 1:30-2:30pm

Inhibitory control is impaired during the exercise intervals but unaffected during the recovery intervals within a single session of high-intensity interval training.

STEM

Authors(s):

Neilan Narane Sivalogan† (Science|JMHC)

Abstract:

Purpose:

Although previous research has indicated impaired cognitive performance during intense physical exercise, how cognitive performance fluctuates between the exercise and recovery intervals within a single session of high intensity interval training (HIIT) remains unknown.

Methods:

Sixteen 18-25-years-old participants (male=5) completed a 30-minute session of HIIT (3 5-min high-intensity exercise [80% maximum heart rate] intervals interspersed with 3 5-min inactive recovery intervals) or a time-matched sitting on a cycle ergometer on two separate and counterbalanced days. During each of the 6 5-min intervals within both sessions, inhibitory control was measured using a flanker task involving equiprobable low- and high-demanding congruent and incongruent trials. A 2 (Condition: HIIT, sitting) x 2 (Interval: exercise, recovery) x 2 (Congruency: congruent, incongruent) ANOVA was conducted to analyze response time (RT) and accuracy (ACC) during the flanker task.

Results:

A significant Condition x Interval x Congruency interaction was found ($F=8.3$, $p=0.004$). While decomposition of this interaction showed no between-condition difference during recovery intervals, lower ACC was observed during the exercise interval in HIIT compared with sitting condition only for incongruent ($p<0.001$) but not congruent ($p=0.952$) trials. No significant effect related to Condition was found for RT.

Implications:

Although performance requiring the greater amounts of inhibitory control is impaired during HIIT, such impairment is selectively presented during

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

intervals involving intense exercise but not post-exercise recovery when metabolic demand is minimized, suggesting that decision-making during intermittent activities should better occur in less physically demanding situation to avoid impaired performance due to inhibitory control failure.

Keywords:
[no keywords provided]

Mentor(s):
Shih-chun Kao (Purdue University); Aaron C Kuznik (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1740

Presentation Time: Session 4: 1:30-2:30pm

Autopilot Integration for Lightweight Unmanned Fixed Wing Aircraft in PURT Testing Facility

STEM

Authors(s):

John Henry Slater† (Science|JMHC); Natalia Zagata† (Engineering); Lillian Ji† (Engineering); Jonathan George Cats† (Engineering); Anish Paspuleti† (Engineering); Braden Thomas Callaway‡ (Engineering)

Abstract:

This research focuses on the development and testing of autopilot systems for lightweight fixed-wing Unmanned Aerial Vehicles (UAVs) within a controlled environment, utilizing the Purdue UAS Research and Test (PURT) facility. We propose a simple fixed-wing UAV using predominantly off-the-shelf components, replicating the characteristics of the Windracers fixed-wing aircraft, for comprehensive testing under various conditions. The aircraft utilizes an active LED marker board that is powered by the central battery and distinguishes and identifies individual aircraft, efficiently facilitating simultaneous operation of multiple units within the facility. The autonomous routine capabilities of the system are integrated with a nelly-constructed PID controller, which is simulated inside the Gazebo robotics simulation environment with a new high-quality 3D model of the aircraft.

The integration of autopilot technology in lightweight unmanned fixed-wing aircraft holds significant potential for various applications, including surveillance, monitoring, and data collection in challenging environments. The results of this research contribute to the advancement of autonomous aerial systems, offering a platform for further developments in the field of unmanned aerial vehicles.

Keywords:

UAS; Computer Vision; Fixed-Wing; Motion Capture; Windracers

Mentor(s):

James Michael Goppert (Purdue University); Worawis Sribunma (Engineering); Chase Ja-ok Loeb (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1741

Presentation Time: Session 4: 1:30-2:30pm

Influence of Iron Concentration on Naegleria gruberi Survival in Pipe Biofilms

STEM

Authors(s):

Katie Nicole Smith† (Agriculture|Engineering)

Abstract:

Naegleria gruberi is a non-pathogenic amoeba closely related to Naegleria fowleri, a pathogenic amoeba that causes a deadly disease called primary amoebic meningoencephalitis (PAM). Also known as the brain-eating amoeba, this species is known to survive chlorine disinfection by associating with pipe wall biofilms. Disinfection requirements have been studied in large-scale water distribution systems, but there is a need for laboratory-scale experimental methods that can provide more specific results regarding biofilms. This study used controlled jar systems to investigate the impact of iron concentrations on N. gruberi persistence, DNA concentrations, and bacterial cell concentrations. Biofilms were cultured at 30 °C in jar systems containing shower hose material and nutrient solutions of varying iron concentrations before being inoculated with N. gruberi. These biofilms represent a “worst case scenario” that may be present in a number of recreational and drinking water scenarios, while iron is potentially a critical nutrient for Naegleria species. Cell concentrations were measured using flow cytometry. Biofilm was removed using an electronic toothbrush, and DNA was extracted from both the biofilm and water. Quantitative PCR assays were conducted to determine N. gruberi persistence. Analysis is ongoing. These findings will contribute to a deeper understanding of ideal conditions for Naegleria proliferation and validate new methods for Naegleria investigations.

Keywords:

Biofilm; Pathogenic Amoebae; Naegleria fowleri; Naegleria gruberi

Mentor(s):

Caitlin Rose Proctor (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1742

Presentation Time: Session 4: 1:30-2:30pm

Machine Learning in Motion

STEM

Authors(s):

Dean Snyder† (Engineering|JMHC); Arnav Daryani† (Science); Marisa Jean Fredrickson† (Engineering); Natalia Cadence Hombs† (Engineering|JMHC); Aryan Kaul† (Science); Abhik Mullick† (Polytechnic); Pratham Jigneshbha Patel† (Science); Sophia Elizabeth Steele† (Engineering); Hridhay Monangi‡ (Science); Aaron Parihar‡ (Polytechnic|JMHC); Mark Alexander Myers‡ (Polytechnic); Daitian Zhao‡ (Polytechnic); Kyle Patrick Fox‡ (Polytechnic); Wharton Yeh‡ (Polytechnic); James Geovanny Viana Fernandes‡ (Polytechnic); Sagi Ashkenov‡ (Polytechnic); Riley Wallace Frank‡ (Polytechnic); Michael S Tarquinto‡ (Polytechnic)

Abstract:

The use of technology in the performing arts has transformed the way artists express themselves. Introducing technology into dance performances has enabled a new degree of inventiveness, opening new dimensions and possibilities for choreography. Our research aims to capture and analyze the motion of human movement in space and create a visual and audio display that responds to movement. With a base model created in prior semesters, we have aimed to expand the project to respond to movement with sound, recognize faces of people in view of the camera, and implemented a Raspberry Pi chip to make our system mobile. Sound is important to the art medium of dance, and we aim to make the system more interactive by responding to movement with various sounds. To better track the subjects in the camera, we integrated a facial recognition model that uses MTCNN for precise face detection and ResNet models for feature extraction and classification. Utilizing the Raspberry Pi, we have benchmarked pose estimation on the AI chip for faster processing and integrated real-time audio-based reactions on movement. Additionally, we have created another model that uses a stereoscopic camera to obtain depth perception of the camera. This combination of machine learning and computer vision technologies offers a combined analytic and artistic approach to interactive performances and motion analysis by integrating frontend visuals/sound that interact with the data gathered from the model.

Keywords:

[no keywords provided]

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Renee Murray (Purdue University); Frederick C Berry (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1743

Presentation Time: Session 4: 1:30-2:30pm

Therapeutic Efficacy of Hemp Seed Supplementation on DSS-Induced Colitis in Mice: Impacts on Macrophage Polarization and Inflammatory Response

STEM

Authors(s):

Sophia Su† (Agriculture)

Abstract:

Inflammatory bowel disease (IBD), encompassing ulcerative colitis and Crohn's disease, poses significant healthcare challenges due to its rising prevalence and the limitations of current treatments, which can have substantial side effects and are not always suitable for long-term use. The anti-inflammatory properties of plant-derived supplements, particularly hemp seed—rich in essential fatty acids, proteins, and bioactive compounds—have garnered increasing interest for their potential therapeutic benefits. This study investigates the efficacy of hemp seed supplementation in ameliorating colitis in a dextran sulfate sodium (DSS)-induced mouse model, with a focus on reducing inflammation, and improving gut microbiota and intestinal barrier integrity.

Experimental methods included quantitative PCR to assess gene expressions of M1 (CD80, CD86) and M2 (CD163, CD206) markers, cytokine profiling (IL-6), and immunohistochemistry for macrophage identification (F4/80 markers).

Results demonstrated a significant reduction in M1 markers and an increase in M2 markers in the DSS + Hemp Seed group compared to DSS alone, indicating a successful shift towards anti-inflammatory macrophage phenotypes. Immunohistochemical analysis showed decreased macrophage infiltration in treated tissues. Additionally, IL-6 levels were markedly lower in the hemp seed group, correlating with lessened inflammation. Furthermore, hemp seed supplementation reduced systemic inflammatory markers, suggesting decreased intestinal permeability and bacterial translocation.

Keywords:

Immunohistochemistry; Inflammation; Inflammatory Bowel Disease; Gut Microbiota; Cytokine Profiling

Mentor(s):
Weicang Wang (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1744

Presentation Time: Session 4: 1:30-2:30pm

A Pilot Study in Real-time Mental Workload Measurement Tool for use in Robotic Surgery Training

STEM

Authors(s):

Alpamys Sultanbek† (Engineering); Jasmine Alyssa Luke‡ (Engineering)

Abstract:

Training in surgery is a long and difficult process. Medical school takes 4 years which is followed by a residency of 5-7 years before the surgeon is qualified to run their own practice. With the introduction of robotic surgery, which allows for minimally invasive procedures, this process has become even more difficult as surgeons are required to learn new tools. Determining the readiness of surgeons to progress to new skills is difficult; there are no objective metrics for instructors to look for when evaluating the quality of the cuts and stitches. This paper proposes a method of real-time mental workload (MWL) measurement to determine the ease with which surgeons in training perform their tasks. The method, which uses eye-tracking and electroencephalography (EEG), is taken from a previous paper completed by the researchers. To determine the effectiveness and reliability of this model, a pilot study was run with five participants. Subjects attempted multiple cognitively intensive tasks such as mental math, and n-back with varying levels of difficulty while having their MWL measured. The MWL score, which is given from 0 (low) to 1 (high), was then compared for the different task difficulties. It was found that participants had widely varied ranges of mental workload; even during complete relaxation some participants maintained a relatively high MWL score. There was also a low correlation between the task difficulties and the MWL score. Before application to robotic surgery, the MWL model needs to be refined for better accuracy.

Keywords:

Mental Workload; Mental Workload Modeling; Physiological Sensors

Mentor(s):

William Christian Zouzas (Engineering); Denny Yu (Purdue University)

Other Acknowledgement(s):

Jingkun Wang (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1745

Presentation Time: Session 4: 1:30-2:30pm

SCALE HI-AP: Impact of Slot Liner Compression on the Total Thermal Resistance of the Stator-Winding Assembly in Electric Motors

STEM

Authors(s):

Lindsay Kathryn Sutherland† (Engineering|JMHC)

Abstract:

The increasing demand for high-performance electric motors, driven by the rapid adoption of electric vehicles, necessitates effective thermal management techniques that improve their safety, efficiency, and reliability. Heat must be transferred from the current-carrying copper windings to the metallic stator body through an electrically-insulating material called the slot liner. However, little research has focused on the interactions between the slot liner and the windings. This study examines the impact of slot liner compression on the thermal resistance across the stator-winding assembly considering two common slot liners: Nomex® 410 and Kapton® MT+. A mock stator-winding assembly was developed by stacking a grooved copper piece that mimics the windings, a slot liner, a rigid silicon piece that imitates the stator, and a reference material used to quantify heat flow. Steady-state temperature gradients are induced across the stack, IR microscopy is used to capture the resulting two-dimensional temperature maps, and the total thermal resistance across the assembly is calculated. Tests are repeated at several levels of compression and with increasing compression, the area-normalized thermal resistance of the winding-stator interface with a Nomex® 410 slot liner decreases by 14.9% (from 94 to 80 cm2K/W) and with Kapton® MT+ decreases by 68.0% (from 50 to 16 cm2K/W). This research provides insight into the effects of slot liner material and compression level on the thermal management of electric motors. Reducing the total thermal resistance reduces temperatures within the windings, resulting in longer component lifespans and more efficient motors.

Keywords:

Electric Motors; Slot Liner; Thermal Resistance; IR Microscopy; Wire Packaging

Mentor(s):

Amy M Marconnet (Purdue University); Shanmukhi Sripada (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Gabriella Maria Schr Torres (Centers & Institutes)

Poster Presentation Abstract Number: 1746

Presentation Time: Session 4: 1:30-2:30pm

Accelerated Matrix Processor (AMP) - Scheduler Core

STEM

Authors(s):

Nick Taha† (Engineering); Pierce Yungjoon Johnson† (Engineering); Rishikesh Reddy Bathina† (Engineering); Argha Badhon Saha† (Engineering); Fan Jing Hoon‡ (Engineering)

Abstract:

The increasing demands of machine learning inference necessitate specialized hardware accelerators for efficient matrix computations. This project presents an accelerated matrix processor designed to significantly improve General Matrix Multiplication (GEMM) performance. Built upon a scoreboard architecture, our processor leverages a custom RISC-V-like Instruction Set Architecture (ISA) extended with matrix-specific instructions, including matrix load, store, and GEMM, to directly control a dedicated systolic array. A software-managed scratchpad memory optimizes data locality and minimizes memory bottlenecks. The processor implements out-of-order execution and dedicated matrix functional units to streamline instruction scheduling and maximize systolic array utilization. The GEMM instruction initiates matrix multiplication by dispatching tasks to the systolic array, enabling high-throughput processing of matrices. This architecture achieves superior performance compared to general purpose CPUs by tightly integrating a programmable core with a specialized hardware accelerator, offering a flexible and efficient solution for accelerating matrix-intensive workloads.

Keywords:

AI; Tensor; Processor Design; Assembly; RISC-V

Mentor(s):

Anand Raghunathan (Purdue University); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Nicholas William James (Engineering)

Poster Presentation Abstract Number: 1747

Presentation Time: Session 4: 1:30-2:30pm

Timing and Duration of Eating by Self-Report and Self-Taken Images and Its Link to Environmental Factors

Social Science

Authors(s):

Soneya Tamang† (HHS)

Abstract:

Limited information is available on the timing of eating, duration of eating, and factors that are related to timing. This investigation will help to address these knowledge gaps by determining both self-reported and time-stamped images before and after eating and the duration of eating-by-eating occasion type (meal, snack, etc.). Relationship of the duration of eating to the eating environment, including eating occasion, eating with someone, in front of a screen, and at a restaurant in which the eating event takes place will be investigated. This is a cross-sectional study that uses a sample of participants ages ? 18 years. The self-reported time of eating will be collected using a 24-hour dietary recall questionnaire. The participants will also use a mobile Food Record (mFR) application to take images of their meals with time stamps before and after consumption using the phone camera. Characteristics information will be collected using a survey. Correlation between the self-reported time of eating and the time stamps of the before eating images will be determined for the entire day and for each eating occasion. Duration of eating will be calculated based on the time before to after eating and then evaluated against the eating environment factors using regression. The results are expected to show medium correlation of self-reported time of eating with time-stamp pre-eating images and a longer eating durations for meals vs. snacks, and eating with someone vs. alone, in front of a screen vs. not, and eating at a restaurant vs. other places.

Keywords:

Duration of Eating; Speed of Eating; Mobile Device (mFR); Environmental Factors; Sensor Device (AIM)

Mentor(s):

Heather A Eicher-Miller (Purdue University)

Other Acknowledgement(s):

Fengqing Zhu (Purdue University); Lourdes Anali Morales (HHS); Olivia Ryan Romanovich (HHS); Yuning Huang (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1748

Presentation Time: Session 4: 1:30-2:30pm

SCALE HIAP Heterogeneous Integration of 5G Receivers Using SAWLIT Chiplet Technology: Antenna Design and Impedance Matching on Glass Substrates

STEM

Authors(s):

Ethan Xinghan Tan† (Engineering|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Saeed Mohammadi (Purdue University)

Other Acknowledgement(s):

Boyuan Chen (Engineering); Gabriella Maria Schr Torres (Centers & Institutes)

Poster Presentation Abstract Number: 1749

Presentation Time: Session 4: 1:30-2:30pm

Characterization of Branch Predictor Area for System-on-a-Chip Design

STEM

Authors(s):

Alexandra J Tauriainen† (Engineering|JMHC); Andy Hanjun Hu‡ (Engineering); Mary Francis‡ (Engineering|JMHC)

Abstract:

As state-of-the-art CPUs advanced from single-cycle to pipelined architectures, it became necessary for these CPUs to begin implementing a new acceleration technique called branch prediction, whereby a pipelined CPU pre-emptively predicts which branch of a conditional instruction will be taken, before operating on that instruction. For this technique to be effective, the branch predictor must be accurate, as mis-predicting which branch an instruction will take can result in several cycles worth of wasted calculations. There are many highly accurate branch prediction architectures, but many of these more accurate designs also require more area on a chip. When working with a limited chip size, this trade-off becomes critical, as the increased performance may come at the cost of other potential improvements.

Previous semesters of work on the AFTx07 chip have resulted in an array of different branch predictors, including static predictors, a “Backward Taken Forward Not Taken” (BTFNT) predictor, dynamic predictors based on a Branch Target Buffer (BTB), a Return Address Stack (RAS), and a 2-level Global Branch Predictor. While these branch predictors have been written and logically tested, they have not yet had other aspects of their design analyzed. As such, this project is focused on characterizing the area of the existing branch predictor designs for the purpose of identifying the branch predictor architecture with the highest percent accuracy that still fulfills the area requirements for AFTx07.

Keywords:

System-on-a-Chip; Branch Prediction; Digital Design; SoCET

Mentor(s):

Mark Johnson (Purdue University); Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1750

Presentation Time: Session 4: 1:30-2:30pm

Oxygen-18 Enhanced Atmospheric Chemistry Modeling: Improving Air Quality Predictions

STEM

Authors(s):

Thomas Preston Temperley† (Science); Nathan Nguyen‡ (Science)

Abstract:

Ambient air pollution contributes to millions of premature deaths annually while severely impacting climate, infrastructure, and ecosystems. Accurate modeling of atmospheric chemistry is crucial for improving air quality predictions and developing effective mitigation strategies. However, current chemical transport models often lack the resolution to track ultra-trace species and subtle reaction mechanisms. Our study addresses this gap by incorporating oxygen-18 O18 as a tracer into established chemical transport models such as the EPA's CMAQ. Unlike earlier assumptions that treated oxygen isotopes uniformly, recent high-precision measurements reveal that O18 exhibits distinct fractionation patterns, influenced by interactions with water, molecular oxygen, and other atmospheric constituents. These dependencies make O18 an excellent tracer for identifying and differentiating key chemical pathways, especially in processes like ozone formation and NO oxidation in both gas and aqueous phases. By integrating detailed reaction mechanisms into both gas and aqueous modules, our model captures the transformation processes affected by O18. Simulations conducted on Purdue's high-performance computing cluster, followed by rigorous statistical analysis in R, indicate that tracking O18 significantly refines predictions of isotope fractionation patterns. This improved understanding enhances source attribution and reaction pathway analysis, ultimately leading to more accurate air quality forecasts and better-informed environmental policy decisions.

Keywords:

Climate Change; Air Quality; Computer Simulation; Atmospheric Chemistry; Air Pollution

Mentor(s):

Greg M Michalski (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1751

Presentation Time: Session 4: 1:30-2:30pm

Degradation Kinetics of Thermal Interface Materials in Immersion Cooling Systems

STEM

Authors(s):

Mark Joseph Tereck† (Engineering)

Abstract:

This study addresses the evolving challenges in data center cooling, driven by increasing power density and the limitations of traditional cooling methods like air cooling, CRAH/CRAC, and cold plates. Liquid immersion cooling has emerged as a promising alternative, but there is a concern about the compatibility of thermal interface materials (TIMs) and other packaging materials with liquid coolants. The study explores the long-term degradation of TIMs, which is key to maintaining thermal performance and the overall efficiency of cooling systems. As part of this study, Infrared imaging of the selected TIMs will be completed to analyze the TIMs performance over time after simulating prolonged use by power cycling. IR images will be captured and analyzed to observe where the hot spots occur in these thermal compounds and how their location or distribution may change with testing. Additionally, these compounds will be tested before and after being exposed to liquid immersion coolants. The findings from the IR images comparing the performance of the TIMs before and after exposure to the coolant fluids will be vital to understand the interactions, degradations, and changes that occur between an immersion cooling system and the TIMs within it.

Keywords:

[no keywords provided]

Mentor(s):

Shubhra Bansal (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1752

Presentation Time: Session 4: 1:30-2:30pm

Integrating Crosstalk Analysis into SoCET's Design Flow

STEM

Authors(s):

Levi J Thompson† (Engineering)

Abstract:

The Tapeout subteam of the System on a Chip Extension Technologies (SoCET) research group is actively working to integrate crosstalk analysis into our current design flow. At present, no formal crosstalk analysis is being conducted within our system, posing potential risks for signal integrity and overall circuit performance. Our objective for this semester is to establish a fully functional crosstalk analysis methodology using Cadence tools and seamlessly integrate it into the existing workflow.

To achieve this, we are systematically evaluating the available Cadence tools to determine the most effective approach for analyzing and mitigating crosstalk effects. Our methodology includes configuring simulation environments, verifying tool compatibility with our current flow, and automating the integration process to ensure efficiency and reliability. The scope of our work involves post-layout analysis, allowing us to identify and address potential interference issues effectively in the design process.

By the end

Keywords:

SoCET; Design Flow; Crosstalk

Mentor(s):

Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1753

Presentation Time: Session 4: 1:30-2:30pm

Designing and Developing a UVM Environment to Verify a Digital Counter

STEM

Authors(s):

Parin Paresh Timbadia† (Engineering|JMHC)

Abstract:

The purpose of this project was to learn about and utilize Universal Verification Methodology (UVM) techniques to verify one of the System-on-Chip Extension Technologies (SoCET) designs. UVM is a methodology and structured procedure to verify the function of a design through creating efficient testbenches. These testbenches consist of modular components, such as a sequencer and driver to send test input signals to the Device-Under-Test (DUT), a scoreboard to keep track of whether the DUT outputs match the expected output, and more. This project specifically focused on re-verifying a digital counter using UVM, which had been updated since the previous time it was verified. Originally, the counter had been designed with a direction bit, but an update was made to simplify the design, thus requiring some changes. In its current state, the counter has three main functions: counting up to a certain limit, checking for overflow (and properly wrapping around), and the ability to reset both synchronously and asynchronously. The project followed a sequential timeline: first, training was done through the Siemens Verification Academy and guest presentations. Then, a test plan was developed for the digital counter, considering all of the possible assertion, de-assertion, invalid, and reset cases that the device would encounter. Lastly, the UVM RTL design and environment were built according to the test plan, and used to verify the operation of the counter. Future work may include verifying more designs incorporated in SoCET's AFT0x7+, especially those that are in development/have recently been completed.

Keywords:

[no keywords provided]

Mentor(s):

Isaac P Hagedorn (Engineering); Vishnu Chaithanya Lagudu (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1754

Presentation Time: Session 4: 1:30-2:30pm

Actuarial Science for Risk Mitigation and Economic Resilience in Developing Countries

Humanities

Authors(s):

Isaac Robert Timmer† (Exploratory Studies|Other)

Abstract:

This study explores the potential impact of actuarial science on mitigating risks and fostering economic resilience in developing countries. Inspired by my experiences on mission trips to Haiti and the Dominican Republic, combined with my educational background in actuarial science, this research aims to raise awareness of the economic challenges faced by developing nations. It examines how actuarial practices can be employed to enhance community resilience and improve the overall quality of life. The research will review existing studies on risk management and the application of actuarial expertise, identifying areas where actuarial interventions can stimulate economic change. By employing qualitative and statistical methods, the research will assess the effectiveness of actuaries in evaluating risks such as natural disasters, health crises, and financial instability to better prepare for future contingencies. Previous studies indicate that actuarial involvement is crucial for assessing and mitigating risks, enhancing preparedness for inevitable challenges, and improving community responses. To support progress in developing countries, future research will focus on creating actuarial models that address the unique needs of these economies, providing a basis for necessary actions. Overall, this research will help bridge the gap between actuarial practices and humanitarian efforts, illustrating the vital role that actuaries can play in assisting communities on a global scale.

Keywords:

Actuarial Science; Third-World Countries; Risk Management; Economic Resilience

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1755

Presentation Time: Session 4: 1:30-2:30pm

Mechanical Characterization of superabsorbent polymer gels by spherical indentation

STEM

Authors(s):

Reece Avery Tippery† (Engineering)

Abstract:

Superabsorbent polymer gels are widely used in the infant and personal hygiene industries for their ability to absorb and retain large amounts of water. Beyond the swelling ratio, other important material parameters include shear modulus, and water diffusivity, but these are difficult to measure for especially soft gels in their swollen states by traditional mechanical characterization techniques like rheometry and compression testing. Instead, we use indentation of the gel surface with a spherical probe to measure the elastic, viscoelastic, and poroelastic responses of gels to understand the relationships between synthetic parameters, gel structure, and material properties.

Keywords:

Materials Characterization; Superabsorbent Polymers

Mentor(s):

Kendra A Erk (Purdue University); Akul Seshadri (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1756

Presentation Time: Session 4: 1:30-2:30pm

VIP Semiconductors@Birck Statistical Process Control for Solar Cell

STEM

Authors(s):

Alexandre Chan Tome† (Engineering); Benjamin Anderson Tofil‡ (Engineering); Rakhmatillokhon Avazkhon u Abdubaev‡ (Engineering)

Abstract:

Solar cells play a key role in renewable energy and aerospace applications by converting sunlight into electricity through the photovoltaic efect. This project focuses on designing, fabricating, and analyzing silicon-based solar cells, providing hands-on experience in semiconductor processing and device physics. Our team starts with 300-micron-thick silicon wafers and performs several dozen fabrication steps to create a working solar cell. Our silicon substrates have a resistivity of 1-20 Ohm*cm to ensure proper PN junction formation. By doping P-type wafers with phosphorus, we create an N-type region, forming a built-in electric field that directs photogenerated electrons and holes to minimize recombination losses. To further boost efficiency, we introduce a heavily doped P++ region using boron, strengthening charge separation and improving performance. Our fabrication process involves photolithography for precise patterning, Rapid Thermal Annealing (RTA) for activating dopants, and Physical Vapor Deposition (PVD) to deposit titanium and aluminum contacts. We also use a Tergeo plasma cleaner to improve material adhesion by removing surface contaminants. Once fabrication is complete, we characterize our solar cells by measuring current-voltage (I-V) curves with a DC probe station and analyzing capacitance-voltage (C-V) data to assess junction quality. With each prototype, we refine our design through iterative improvements guided by feedback from faculty mentors. This process not only teaches us about semiconductor research and fabrication but also allows us to analyze and optimize each step for greater efficiency. Beyond solar cells, the knowledge and experience gained from this project are invaluable for developing the nanoelectronics devices that power our world.

Keywords:

Solar Cell; PN Junction; Semiconductor Fabrication; Semiconductor Device Physics; IV Curves

Mentor(s):

Peter Bermel (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1757

Presentation Time: Session 4: 1:30-2:30pm

HCV E1/E2 Chimeric Constructs and Their Impact on Host Cell Surface Expression

STEM

Authors(s):

Cora Tolan† (Science)

Abstract:

Hepatitis C virus (HCV) has caused approximately 50 million chronic HCV infections worldwide, leading to complications such as hepatocellular carcinoma and cirrhosis. Two proteins, HCV envelope glycoproteins E1 and E2, are targets of the antibody response and current subjects of vaccine development. Generally, E1 and E2 are retained in the endoplasmic reticulum (ER) due to trafficking signals found in their transmembrane domains (TMDs). Yet, these proteins are inaccessible for humoral immune surveillance while located in the ER. One approach to overcome ER retainment is a protein subunit vaccine using secreted E1/E2. Alternatively, an mRNA vaccine can be used to express E1/E2 heterodimers on cell surfaces. We hypothesized that chimeric constructs replacing E1 and E2 TMDs with Sindbis virus TMDs, which contain transmembrane signals resulting in plasma membrane (PM) trafficking, would promote cell surface expression when introduced in host cells. A di-acidic sequence in SARS-CoV-2 Spike protein has also been shown to enhance PM trafficking, which was expected to further promote surface expression when added to the construct. Six of these chimeric constructs were synthesized using molecular cloning and expressed in HEK293T host cells using transient transfection. They were then subjected to western blots to confirm E1/E2 presence and visualized with fluorescence microscopy. Additionally, molecular cloning to make secreted E1/E2 with a cleavable tag is being carried out. Through exploring E1/E2 trafficking and cell surface expression with these constructs, we have developed a better understanding of their trafficking mechanisms throughout host cells, contributing to future HCV mRNA vaccine design.

Keywords:

HCV; Vaccine; Trafficking; Cloning; Microscopy

Mentor(s):

Richard J Kuhn (Purdue University)

Other Acknowledgement(s):
Ryan George Peters (Science); Shishir Poudyal (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1758

Presentation Time: Session 4: 1:30-2:30pm

Leveraging Game Mechanics for STEM Education: Enhancing Engineering Skills Through the Pac-Man Robotics Challenge

Creative

Authors(s):

Christian R Tomao† (Engineering|JMHC); Gabrielle Elizabeth Layman* (Engineering|JMHC)

Abstract:

The purpose of this study was to examine the effects of game design on STEM education through a robotics competition called the Pac-Man Challenge. This study follows the schedule of a three-week camp where each week, about 80 new students will take part in the robotics portion of the camp which involves a section of robotics lectures and a robotics competition. Each week, the parameters of the competition and lectures were changed to invoke higher creativity from the students. The results were measured through observations as well as survey data. The survey data showed consistently positive results for the robotics program. For the response “Awesome” from Week 1 to Week 3, there was an increase of 8.78% in Engineering Organization, 0.325% for Robotics Fundamentals, 1.67%% for Robotics Design and Testing, and a 5.61% decrease for Final Robotics Demo. The study analyzed the students' favorite projects, including 3D printing, Arduino, Rollercoaster, and the Robotics Program. Between 1-4 with 1 being the favorite and 4 being the least, the Robotics project was the overall favorite and averaged a 2.271 in Week 1 and a 2.108 in Week 3, which is a 7.73% decrease. The difference between the runner-up and the robotics project in rating was 0.238 in Week 1 and 0.373 in Week 3. Educators in STEM may consider implementing competition-based projects to improve student learning. Educators in STEM may also want to pay close attention to competition parameters, as developing competitive parameters may result in students' stronger understanding of the topic.

Keywords:

Robotics; Education; Game Design; Competition; STEM

Mentor(s):

Jacqueline Linnes (Purdue University)

Other Acknowledgement(s):

Melissa E Hale (Purdue University); Suzanne C Walker (Engineering);

Jack Alexander Martin (Purdue University); Grady Andrews (Engineering)

Poster Presentation Abstract Number: 1759

Presentation Time: Session 4: 1:30-2:30pm

A Systematic Review of Lean Six Sigma Applications in the Semiconductor Lifecycle: From Design to E-Waste Management

STEM

Authors(s):

Shou-Fu Tseng† (Science); Brandon Anthony Farber† (Engineering|JMHC)

Abstract:

The semiconductor industry, a cornerstone of modern technology, faces extreme challenges in sustainability, efficiency, and supply chain coordination. The applications of Lean Six Sigma (LSS) methodologies can significantly improve this industry by eliminating waste, optimizing resources, and reducing variation in key processes. This paper explores how the current LSS applications in the semiconductor lifecycle work and what areas to improve. Through a systematic literature review, this study collects relevant academic journals and synthesizes the important findings, providing valuable perspectives on the current LSS applications, benefits, and gaps. Significant research was found on 10 areas that are categorized into 3 groups of operational efficiency and process improvement, supply chain and collaboration, and workforce, innovation, and sustainability. LSS methodologies have been widely adopted in semiconductor manufacturing, ATP, and e-waste management. However, their application in other phases of the semiconductor lifecycle, such as design, raw material sourcing, and tools and equipment management, remains limited. Further research is necessary to explore the combinations of LSS methodologies across the five phases of the semiconductor industry.

Keywords:

Lean; Six Sigma; Semiconductor; E-Waste Management; Semiconductor Process Improvement

Mentor(s):

Tho Le (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1760

Presentation Time: Session 4: 1:30-2:30pm

Crack Detection in Reinforced Concrete Structures Using Machine Learning

STEM

Authors(s):

Luke Steven Tuthill† (Science|JMHC); Aditya Mallepalli‡ (Science)

Abstract:

Regular inspections of concrete structures are important for ensuring structural integrity, but traditional inspection methods are costly and time-consuming. These inspections are typically conducted every couple of years, and with many structures the time and cost increases quickly. Inspectors often have to put themselves in dangerous situations, including entering confined spaces or high structures to find and classify cracks. This issue can be addressed using an automated crack detection system. Computer vision and deep learning provide an extremely viable tool to automate the crack detection, saving valuable time and resources that can be utilized to tackle any other critical damage in the structure. Our solution will use a VGG16 pre-trained model to detect cracks based on images taken by drones or other methods. VGG16 is a convolutional neural network with 16 layers, trained on the ImageNet database with over 14 million images. This will save much compute time and increase detection accuracy compared to training a model from scratch. The model will be trained on 3 additional datasets using transfer learning, each with over 10,000 images, and focus on model recall since false negatives could lead to missed damage. Our model is expected to be able to detect complex cracks and breaks in concrete anchors in real time when used on a UAV drone in order to optimize where to focus manpower. This could greatly benefit the field of concrete inspection by saving many man-hours and increasing detection rates, and preventing potential structural failures.

Keywords:

Machine Learning; Crack Detection; Transfer Learning

Mentor(s):

Deepak Suthar (Engineering); Luis David Fernandez Vasquez (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1761

Presentation Time: Session 4: 1:30-2:30pm

Visualizing microscopic shock physics

STEM

Authors(s):

Eylul Ustaoglu† (Engineering)

Abstract:

Shock wave is a supersonic wave characterized by an abrupt, nearly discontinuous change in pressure, temperature, and density of the medium. Gaseous shock waves are widely observed in high-speed aeronautics applications. Detailed measurements of shock waves are challenging due to their fast speed and small thickness. Numerical simulation and data analysis can thus help understand the physics of shock waves. In this study, we visualize the dynamics of molecules across a shock wave in gaseous hydrogen by processing a data set of molecular dynamics (MD) simulations available in Maeda Research Group. To comprehensively analyze the effects of the moving shock wave on molecular dynamics, velocities of individual molecules and their trajectories are color-coded and plotted in three-dimensional graphics using The Open Visualization Tool (OVITO). Snapshots of the graphics are compared with one-dimensional, continuum velocity and density profiles that were obtained by spatially averaging the local distribution of molecular velocity and number density. We discuss features of molecular collisions near the shock wave which are not obvious in the line plots. The results confirm the use of graphical visualization in extracting useful shock physics from the complex MD data sets.

Keywords:

Visualization; Shock Wave; Molecular Dynamics

Mentor(s):

Kazuki Maeda (Purdue University); Thibault Moli Maurel Oujia (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1762

Presentation Time: Session 4: 1:30-2:30pm

Autonomous Motorsports Purdue - Electrical Team

STEM

Authors(s):

Aditya Verma† (Engineering); Samuel Elijah Nadol† (Engineering); Jae Hun Oh† (Engineering)

Abstract:

The electrical team on Autonomous Motorsports Purdue focuses on creating an effective and robust electrical system for use on the AMP electric vehicle. This system is the interface between software and hardware, allowing the control software to interact with the mechanical hardware. Therefore, as this system ties all other systems together, it must be reliable and effective to enable the vehicle to work as a whole. Since a system already exists on the vehicle, the team is now focusing on iterative improvements and additions to the system. Three specific projects that the team is focusing on are: an anti-spark switch to reduce sparking when the battery is connected, a battery temperature sensor to improve safety of the overall system, and an STM32 status light to more accurately communicate the status of the vehicle. The anti-spark team focuses on mitigating overcurrent that results from connecting a voltage supply to the vehicle with large input capacitance, which may damage components. Currently, the team is fabricating a timing circuit board to limit this current during the charging of the capacitors, while also searching for potential off-the-shelf solutions should a home-made version not work. The battery management team realizes that the kart needs a high current to successfully create the torque required for high-speed racing. Higher currents increase heat dissipation, creating the need for temperature monitoring that protects the battery system from overheating and harming the vehicle. The status light team's project more adequately communicates the status of the vehicle, which, given its autonomy, is essential. Visual feedback to inform kart operators what gear the cart is in and whether the e-brake is on improves both safety and efficiency when testing and/or running the vehicle. The status light will be controlled by an STM32 microcontroller, because of its versatility and low operation cost. These custom, dynamic components being developed allow kart operators to fine-tune a wider range of parameters, unlike their mass-produced counterparts, leading to more effective vehicle operation. The team's components will enhance both the performance and safety of the vehicle, offering robust solutions that drive innovation for tomorrow's scene of autonomous racing.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
AMP; Anti-Spark; STM32 Microcontroller; Battery Temperature System; Autonomous Motorsports Purdue

Mentor(s):
Shreya Ghosh (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1763

Presentation Time: Session 4: 1:30-2:30pm

Generative AI in Narrative Medicine: Strengthening Patient-Physician Relationships in Rural Healthcare

Humanities

Authors(s):

Sophia Marielle Vina† (Liberal Arts|JMHC)

Abstract:

The integration of generative AI into healthcare systems presents both transformative potential and ethical challenges, particularly in rural healthcare settings where communication barriers and physician shortages impede quality patient care. This research investigates how AI-driven models can enhance narrative medicine, a patient-centered approach that leverages storytelling for improved clinician-patient communication, while ensuring ethical and equitable implementation. Through qualitative data collection, including interviews with rural healthcare providers in Indiana, this study examines the feasibility of AI-assisted patient history synthesis, early disease detection through linguistic pattern recognition, and streamlined electronic health record (EHR) documentation. It also explores the ethical implications of AI adoption, such as bias in-patient narratives, data privacy concerns, and the preservation of human empathy in patient interactions. By assessing the usability of generative AI in clinical workflows, this research identifies ways AI can address critical challenges in rural medicine, such as reducing administrative burden, mitigating physician burnout, and increasing healthcare accessibility. Ultimately, the findings contribute to a framework for the responsible deployment of AI in the context of narrative medicine practicing, ensuring that technological advancements enhance, and not replace, human-centered care in underserved communities and beyond.

Keywords:

Generative AI; Narrative Medicine; Patient-Provider Communication; Rural Healthcare; AI Ethics

Mentor(s):

Richard D Johnson (Purdue University); Thomas J Rickert (Purdue University)

Other Acknowledgement(s):

Adrianna Marie Deptula (Liberal Arts)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1764

Presentation Time: Session 4: 1:30-2:30pm

Accelerated Matrix Processor - Simulator

STEM

Authors(s):

Pranav Wadhwa† (Engineering); Kevin Luke Phlips† (Engineering)

Abstract:

Matrix-matrix multiplication is a fundamental operation in high-performance computing, necessitating specialized hardware accelerators. One such accelerator, developed by SoCET, is the Accelerated Matrix Processor (AMP).

Conventional development workflows for these accelerators - encompassing RTL design, verification, and benchmarking - are notoriously time and resource intensive. To address these challenges, we present a cycle-accurate, Python-based simulator for the AMP that faithfully replicates its SystemVerilog hardware design, including a systolic array, tournament branch predictor, scratchpad memory, and an out-of-order RISC-V–based scheduler core.

By providing a high-level yet cycle-accurate model, this simulator enables developers to conduct rapid design space exploration and performance evaluation of critical architectural parameters. For instance, varying floating-point precision, modifying systolic array dimensions, adjusting memory hierarchy configurations, or refining the out-of-order scheduling algorithm can be assessed systematically without incurring the overhead of RTL-level modifications.

Acting as a golden reference model, the simulator ensures consistency between prototype designs and their hardware implementations, thereby enhancing both verification rigor and development throughput. This approach ultimately reduces iterative prototyping cycles and accelerates design refinement.

Keywords:

AI; Semiconductors; Computer Architecture; Software; Accelerators

Mentor(s):

Mark Johnson (Purdue University); Anand Raghunathan (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1765

Presentation Time: Session 4: 1:30-2:30pm

Accelerated Matrix Processor - Systolic Array

STEM

Authors(s):

Charles James Wagner† (Engineering); Vinay Pundith† (Engineering); Saandiya KPS Mohan* (Engineering)

Abstract:

The AFTx07, a RISC-V processor developed by SoCET (system-on-chip extension technologies), struggles to efficiently run the hefty amount of matrix multiplications needed for artificial intelligence workloads. To overcome this, we are developing an Accelerated Matrix Processor specifically focused on offloading these matrix multiplications from the AFTx07 processor. We have developed a programmable systolic array architecture which serves as the main functional unit for the Accelerated Matrix Processor. This processor specifically accelerates general matrix multiplications (GEMMs) which are the main workload for artificial intelligence programs. The systolic array architecture exploits the parallel and iterative nature of GEMMs. We outline the design of the systolic array, which operates as an NxN grid of Multiply-Accumulate (MAC) units performing pipelined IEEE half-precision floating-point arithmetic. The systolic array supports pipelined matrix multiplications and has flexible matrix load timing for interfacing with memory. We explore the effects of the dimensions of the systolic array on utilization and performance. We also examine the optimal throughput and latency of our design to extrapolate these results to performance on artificial intelligence workloads. Finally, integration and testing with the rest of the Accelerated Matrix Processor will occur to benchmark the performance on the MNIST number dataset.

Keywords:

Computer Architecture; Digital Design; AI Hardware; Matrix Multiplication; Parallel Processing

Mentor(s):

Mark Johnson (Purdue University); Anand Raghunathan (Purdue University); Malcolm Lloyd Seib McClymont (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1766

Presentation Time: Session 4: 1:30-2:30pm

Customer Return Likelihood: Based on Demographics, Service Usage, and Customer Support Interactions

Business Case Study

Authors(s):

Charlotte Ann Warren† (DSB|JMHC); Lahari Krishna Bikkavilli† (DSB); Aksheet Sameer Paralkar† (DSB); Madeeha Sadiq† (DSB)

Abstract:

The primary objective of this project is to develop and validate a predictive model to accurately estimate the probability of customer churn within a three-month horizon, based on comprehensive customer data. The research question guiding this project is: "Which factors among demographic characteristics, service usage patterns, billing details, and customer support interactions most effectively predict customer retention?" The study employs extensive customer data, including demographic profiles, detailed service utilization histories, precise billing records, and systematic logs of customer support interactions. By applying advanced data mining and predictive analytic techniques, this model synthesizes multiple data streams into a reliable churn probability score for each customer. The interpretation of results will emphasizes accuracy and consistency, enabling targeted retention strategies that are critical to organizational success. By integrating these diverse data streams, the model aims to generate a churn probability score for each individual customer.

Keywords:

Customer Return; Demographics; Service Usage; Billing Information; Customer Support

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1767

Presentation Time: Session 4: 1:30-2:30pm

The Effect of Trauma on Adrenergic Receptors

STEM

Authors(s):

Isabelle M Weir† (HHS|JMHC)

Abstract:

This research explores the behavior of adrenergic receptors and how they change in response to traumatic experiences. The receptors being explored are ?-adrenergic receptors as they are critical for regulating the body's response to stress through various physiological processes including heart rate, blood pressure, and the fight-or-flight response. This study aims to examine how emotional trauma influences receptor density and function, giving way to underlying neurobiological mechanisms that drive changes in this adrenergic system along with the effects of this alteration. This will be done through exploring how the physiological changes effect neurobiological processes, altering psychological responses. This research analysis will be centered around reading and analyzing primary and secondary sources to collect information and analyses to provide a deeper understanding of this topic. By investigating the relationship between altered receptor activity and traumatic experiences, an insight can be provided into how trauma impacts the brain's stress response, allowing for a deeper understanding of disorders such as PTSD.

Keywords:

[no keywords provided]

Mentor(s):

Jessica A Weatherford (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1768

Presentation Time: Session 4: 1:30-2:30pm

Predicting Cryptocurrency Price Movements: A Data-Driven Analysis of Trading Volume Trends

Business Case Study

Authors(s):

Tyler Nathan Wichman† (DSB); Hunter McCormick Danton† (DSB); Robert Paul Bogdajewicz† (DSB); Sruthi Bhamidipati† (DSB); Shreya Maganti† (DSB)

Abstract:

Cryptocurrency markets are known for their extreme volatility, making accurate price predictions valuable for investors and financial analysts. This project aims to analyze the relationship between trading volume and key price metrics, such as high, low, mid, last, bid, and ask prices, to develop a predictive model for cryptocurrency price movements. By leveraging historical trading data, we seek to identify trends that can improve forecasting accuracy and support informed trading decisions. To achieve this, we incorporated feature engineering techniques, including rolling averages, volatility indicators, and lagged variables, to capture the time-dependent nature of cryptocurrency prices. Additionally, we implemented long short-term memory (LSTM) neural networks, which are well-suited for time-series forecasting, to improve predictive accuracy. Our methodology involved training and evaluating machine learning models using root mean squared error and mean absolute error as key evaluation metrics. After testing various model configurations, our best-performing model achieved a real-world MAE of approximately $5,819.22, an 81.6% improvement over previous models. Additionally, the RMSE has been reduced from $7.7 million to an estimated $1.495 million, highlighting the model's improved ability to minimize prediction errors, though further refinements remain necessary. The results of this study provide practical applications for investors, offering insights into how trading volume influences price fluctuations. Understanding these relationships aid in risk management, market timing, and algorithmic trading strategies, helping investors make more data-driven decisions. Beyond cryptocurrency trading, this research contributes to the broader field of financial predictive analytics, demonstrating the potential of machine learning models in forecasting asset price behavior across markets.

Keywords:
Investing; Cryptocurrency; Neural Network; Time-Series Forecasting; Financial Modeling

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1769

Presentation Time: Session 4: 1:30-2:30pm

SCALE HI-AP: Thermo-Mechanical Reliability of Bismuth Based Solders for High Temperature Packaging

STEM

Authors(s):

Kyle J Wiegand† (Engineering)

Abstract:

High-temperature alloys remain essential for practical applications, particularly within the semiconductor industry, where the demand for high-performance materials continues to grow. Bismuth-based solder alloys emerge as promising alternatives to traditional lead-based solders, which are subject to RoHS regulations due to their toxicity. These bismuth-based solders not only present environmental advantages but also exhibit excellent thermal and electrical conductivity, low toxicity, and improved mechanical properties, making them suitable for high-temperature applications, such as SiC and GaN-based power electronics that operate between 200 and 250 °C. This study explores the thermomechanical reliability of the 95Bi-5Sn solder alloy on Cu-OSP and ENIG under-bump metallurgy, with a comparative analysis against the eutectic 58Bi-42Sn solder. Microstructural characterization is conducted to assess intermetallic composition and thickness resulting from solder reflow on Cu-OSP and ENIG substrates. Additionally, hardness and modulus measurements are performed on both bulk solder and interfacial layers before and after high-temperature storage tests at 125 °C for 500 hours. Despite the favorable properties of bismuth-based solders, challenges related to wettability—especially with common substrate materials like copper and nickel—pose significant concerns. Poor wetting can lead to insufficient adhesion and compromised joint integrity, resulting in unreliable solder connections and increased failure rates. This research aims to enhance understanding of the thermomechanical behaviors of these alloys, paving the way for their wider adoption in the electronics industry through tailored property modifications and ongoing research and development efforts.

Keywords:

Bismuth-Based Alloys; High-Temperature Applications; Thermomechanical Reliability; Wettability Challenges

Mentor(s):

Shubhra Bansal (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Faharia Hasan Bhuiyan (Engineering); Huilong Liu (Engineering);
Gabriella Maria Schr Torres (Centers & Institutes)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1770

Presentation Time: Session 4: 1:30-2:30pm

Interfacial Phase Behavior and Growth of Hexagonal Phase in Concentrated Lamellar Sodium Laureth Sulfate Solution and Cetostearyl Alcohol Crystal

STEM

Authors(s):

Evan R Williams† (Engineering)

Abstract:

Cetostearyl fatty alcohol is a common additive in consumer products and leads to an emulsifying wax giving creamy textures in some products. These products are typically well over 50 w.t.% water leading to current work focusing on reducing the amount of water. This paper investigates the phase behavior of inhomogeneous mixing of concentrated aqueous Sodium Laureth Sulfate (70 w.t.%) and molten Cetostearyl fatty alcohol. Cross polarized light microscopy, dynamic scanning calorimetry, and small angle x-ray scattering techniques were used to characterize this mixing behavior. When held at elevated temperatures, past melting of the alcohol, the growth of an interfacial inverse hexagonal phase was observed. The growth rate of the interfacial phase was measured for two different gap heights 40 and 150 µm, the rate was found to be linear with rates of 2.7µm/min and 4.9 µm/min respectively.

Keywords:

Surfactant; Phase; SAXS

Mentor(s):

Matthew Kaboolian (Engineering); Kendra A Erk (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1771

Presentation Time: Session 4: 1:30-2:30pm

Determining the Best Way to Teach Mathematics to High School Students

Humanities

Authors(s):

Lillian K Wong† (Science)

Abstract:

The PISA 2022 results placed the U.S. below the OECD Average with a score of 465, lower than our 2018 score of 478 and our 2008 score of 487. Over the years, the U.S. has seen a slow increase in the reading and science categories, but a decrease in the math category. What is happening isn't because of COVID-19; the decline started before 2020. One possible answer is teacher-student relations - how teachers teach and how students learn or behave in class. This study aims to determine what teaching methods are more effective at increasing motivation and test scores for high school students. Analyzing research articles that conduct qualitative experiments for pedagogical approaches concluded SCTM improved mathematical achievements, PBL was effective for students' comprehension of material, and TPS was effective for improving mathematics learning outcomes with emphasis on student motivation. Using these methods can help the U.S. improve student education in general, but these were the results to assist high school students in mathematics. By implementing these methods of learning into everyday teaching, students can motivate themselves to study and improve their mathematic achievements.

Keywords:

Academics; Mathematics; Teaching-Methods; Motivation; Standardized Tests

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1772

Presentation Time: Session 4: 1:30-2:30pm

Maximizing Revenue: Analyzing Hotel Rates and Booking Patterns

Business Case Study

Authors(s):

Xinyue Zhao† (DSB); Jackson McKinney† (DSB); Brody Lee Stevens† (DSB); Shih-En Wang‡ (DSB)

Abstract:

Optimizing financial performance in the hospitality industry requires careful balancing of pricing, staffing, and customer satisfaction. This project addresses this critical issue by analyzing hotel rates and booking trends to assist hotel owners in making informed, data-driven decisions aimed at enhancing revenue and operational efficiency. Using comprehensive datasets sourced from Kaggle, our analysis employs R and RStudio to identify and interpret key metrics including booking dates, duration of stay, and guest demographics.

Our findings enable hotel owners to strategically adjust room pricing and optimize staffing schedules based on accurate predictions of peak and off-peak demand periods. Furthermore, detailed insights into guest preferences and behaviors allow for the development of targeted promotional offers and tailored packages, thereby elevating customer satisfaction and loyalty.

From the customer's perspective, insights derived from historical booking patterns significantly enhance their booking experience. Customers gain the advantage of identifying optimal booking windows with the lowest rates and planning their stay lengths strategically to benefit from special offers and activities.

This comprehensive analytical approach not only maximizes operational efficiency and revenue for hotel management but also enhances overall customer experience. The clearly defined scope, robust analytical methods, accurate interpretation of data, and clear implications for future operations underline the relevance and importance of this project for all stakeholders involved, both corporate and individual.

Keywords:

[no keywords provided]

Mentor(s):

Davi Cordeiro Moreira (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1801

Presentation Time: Final Call Session: 10:00-11:00am

Camera Lidar Fusion Perception Pipeline

STEM

Authors(s):

Justin Zijie Gan† (Engineering); Yu-Shing Chen† (Polytechnic); Greer Thomas McDevitt† (Engineering)

Abstract:

In this study, we present a comprehensive approach to enhancing object detection and localization accuracy through sensor fusion of camera and LiDAR data. Building upon advancements in perception software, our work focuses on the integration of the YOLOv5 model with LiDAR point clouds to create a real-time 3D representation of the environment, optimized for autonomous navigation systems.

Our methodology involves the calibration of camera-LiDAR systems to project LiDAR points onto 2D camera images, allowing for precise alignment with YOLOv5's 2D object detections. By validating YOLOv5's performance and merging its output with LiDAR data, we create a pipeline that facilitates single-frame 3D object localization. This process not only provides robust spatial data but also leverages LiDAR's range-measuring capabilities to address scenarios where camera data alone may falter, such as low-light conditions or visually occluded environments.

Our research aims to further refine this fusion model, leveraging insights from current literature on sensor fusion, including works from Ultralytics and other key contributions in the field. Future steps will focus on expanding the model's generalizability and exploring additional sensor fusion configurations to further enhance perception capabilities for autonomous vehicles.

Keywords:

[no keywords provided]

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1802

Presentation Time: Final Call Session: 10:00-11:00am

Development of an Experimental Setup to Investigate Commercial Refrigeration Systems with Low-GWP Refrigerants

STEM

Authors(s):

Ethan Ray Liao† (Engineering)

Abstract:

The American Innovation and Manufacturing (AIM) Act called on HVAC equipment manufacturers to reduce the environmental impact of traditional working fluids. Hydrofluorocarbons (HFCs) hold desirable thermophysical properties with low flammability at the expense of high Global Warming Potentials (GWPs). As a result, there is a pressing need to optimize thermal systems for the usage of new refrigerants with lower GWPs while maintaining or surpassing the performance of existing equipment. This research project aims to develop a flexible platform to evaluate commercial refrigeration systems with different low-GWP refrigerants. A unit operating with R404A (a commonly used HFC refrigerant with a 100-year GWP of 3,922) is employed to define baseline metrics ranging from the coefficient of performance to compressor isentropic efficiency, which may serve as reference points for analyzing the performance of future refrigerants. To conduct this experimentally, the baseline unit has been installed in a pair of psychrometric chambers to control temperature and humidity across different operating conditions. The vapor compression cycle has been equipped with sensors measuring temperature, pressure, mass flow rate, and power consumption. The data gathered is then processed and analyzed to calculate the thermophysical properties and performance metrics of a state-of-the-art R404A system.

Keywords:

Refrigerants; HVAC; Global Warming Potential

Mentor(s):

Davide Ziviani (Purdue University); John Alexandre Huby (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1803

Presentation Time: Final Call Session: 10:00-11:00am

Femtosecond laser annealing of HfZrO2 (HZO) thin films: Effects on Crystallization, Ferroelectricity and Optical Properties.

STEM

Authors(s):

Junwoo Jang† (Engineering)

Abstract:

This study investigates the influence of femtosecond laser annealing parameters and its effects on the ferroelectric properties of HfZrO? (HZO) thin films deposited on tungsten (W) and titanium nitride (TiN) substrates with capped and uncapped conditions. The aim of the project is to optimize the crystalline phases and electrical characteristics of the films by varying the laser annealing conditions with power and exposure time. Comprehensive material characterization will be performed using photoluminescence, Raman spectroscopy, and micro-Fourier-transform infrared spectroscopy (FTIR) to characterize and assess structural transformations, phase stability, and defect states induced during laser annealing. Special emphasis will be placed on correlating laser-induced modifications, enabling precise control over material properties to enhance the performance and scalability of ferroelectric-based electronic devices. Overall, the results aim to contribute to the fundamental understanding of laser-processed ferroelectric oxides and provide valuable guidelines for their integration into next-generation semiconductor devices, particularly focusing on improving the performance and reliability of HZO-based ferroelectric memory devices.

Keywords:

Femtosecond Laser Annealing; HZO Thin Films; Ferroelectric Properties; Material Characterization; Crystaline Phase Optimization

Mentor(s):

Anwarul Islam Akash (Engineering); Xianfan Xu (Purdue University)

Other Acknowledgement(s):

Neil Ghosh (Engineering); Monoranjan Debnath Rony (Engineering); Yikang Chen (Engineering)

Poster Presentation Abstract Number: 1804

Presentation Time: Final Call Session: 10:00-11:00am

Crack Detection in Reinforced Concrete Structures Using Machine Learning

STEM

Authors(s):

Aditya Mallepalli† (Science); Luke Steven Tuthill‡ (Science|JMHC)

Abstract:

Regular inspections of concrete structures are crucial for maintaining structural integrity, but traditional methods are costly and time-consuming. These inspections occur every couple of years, requiring improvements in efficiency to reduce risks and resource consumption. Inspectors often face hazardous conditions, such as working at great heights or in confined spaces, to manually detect and classify cracks. To address this challenge, I have developed a working classification model that automates crack detection using deep learning. My model, based on the VGG16 convolutional neural network—a widely used architecture for image classification—has been trained on 570 images and will be expanded using three additional datasets, each containing over 10,000 images. The system prioritizes recall to minimize false negatives, as undetected cracks can lead to catastrophic structural failures. When integrated with Unmanned Aerial Vehicle (UAV) drones, this approach enables real-time crack identification, optimizing manpower deployment and improving inspection safety. By advancing automated crack detection, my work contributes to the development of more efficient and reliable infrastructure monitoring solutions.

Keywords:

Crack Detection; Machine Learning; Transfer Learning; Segmentation

Mentor(s):

Deepak Suthar (Engineering); Luis David Fernandez Vasquez (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1805

Presentation Time: Final Call Session: 10:00-11:00am

MGMT 324 Trend Project

Business Case Study

Authors(s):

Sumantra Basu† (DSB|JMHC)

Abstract:

This project explores the rapidly growing trend of influencer marketing, a strategy in which brands collaborate with popular social media personalities to promote products through everyday content on platforms like TikTok and Instagram. Influencer marketing has proven especially effective for consumer products such as clothing, beverages, and cosmetics, leveraging the trust and admiration influencers build with their large follower bases—often numbering in the millions.

This study will examine the dynamics that make influencer marketing successful, including how partnerships are formed, the business arrangements behind paid promotions, and the strategic considerations that drive campaign effectiveness. With a foundation of personal observation and preliminary knowledge of the trend's growth, the research will delve deeper into the behind-the-scenes elements that enable influencer-brand collaborations to resonate with consumers and drive purchasing behavior.

By analyzing these mechanisms, the project will offer insights into why influencer marketing has become a dominant force in the digital marketing landscape and how brands can effectively harness its potential.

Keywords:

Influencer Marketing; Social Media Strategy; Digital Marketing Trends

Mentor(s):

Stephen R Leitch (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1806

Presentation Time: Final Call Session: 10:00-11:00am

Simulating Quantum Machine Learning: Anomaly Detection using Conditional Quantum Denoising Diffusion Probabilistic Models

STEM

Authors(s):

George John Ziavras† (Engineering|JMHC)

Abstract:

Diffusion algorithms in Machine Learning (ML) are an extensive field with a broad variety of applications, ranging from image generation to large language models. Furthermore, these models can excel at threat detection in areas such as cybersecurity, fraud in financial transactions, or symptoms in healthcare.

With the limitations of classical computing on training large machine learning models due to the massive amount of required energy and supercomputing, alternatives are being sought in the developing realm of quantum computing. A quantum computer's ability to speed up computation that could take a classical computer decades to solve seems promising in significantly cutting down the costs associated with training expensive models.

The power consumption of training such models is so considerable that many large tech companies have begun to look at constructing nuclear power plants specifically to produce enough energy to upkeep the production and research of new ML models.

Due to current hardware limitations, much of the research in quantum computing is conducted by modeling quantum computers through well-established tools and libraries such as Qiskit by IBM, TensorCircuit, and TensorFlow quantum as opposed to working on them directly, in preparation for a future where issues such as quantum decoherence, error correction, and scalability of quantum computers have been solved.

This research was spent building upon a Quantum Denoising Diffusion Probabilistic Model (QuDDPM) developed by Bingzhi Zhang et al. to be used as a Conditional Quantum Generative Diffusion Model (CQuDDPM). It will also cover future directions in extrapolating CQuDDPM for anomaly detection.

Keywords:

[no keywords provided]

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Vaneet Aggarwal (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1807

Presentation Time: Final Call Session: 10:00-11:00am

In Air Battery Swapping

STEM

Authors(s):

Clifford Walter Gamble† (Engineering); Jamie Chanadol Henson* (Engineering); Victor Ionut Ene* (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

UAV; Charging; Drone; Multirotor; Autonomous

Mentor(s):

Ran Dai (Purdue University)

Other Acknowledgement(s):

Yooseung Choi (Engineering); Anamano Editi Ikoh (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1808

Presentation Time: Final Call Session: 10:00-11:00am

Dynamic cortical pore tracking method for chronic kidney disease patients

STEM

Authors(s):

Irfan Firosh† (Science)

Abstract:

Chronic kidney disease (CKD) leads to bone fragility due to increased cortical porosity, yet current methods cannot effectively track these pores in 3D. This limitation hinders the development of target treatments. This research aims to address the need for a robust method to extract and quantify cortical pore characteristics from HR-pQCT images. This study will develop an approach using network theory to extract pore characteristics and generate 3D visualizations of the pore network from these images. The results from the proposed method will be validated by comparing the pore parameters of 3D-printed phantoms with predetermined volumes and areas, followed by scanning them to obtain data. The expected outcome is a validated procedure capable of accurately quantifying cortical pore distribution in 3D. This method will serve as a valuable tool for understanding CKD-related bone changes and assessing the efficiency of treatment targeting cortical porosity with potential application in other bone diseases. Future research direction includes refining the method and applying it to longitudinal studies of CKD patients, potentially leading to improved diagnosis and treatment strategies for bone fragility CKD.

Keywords:

Chronic Kidney Disease; HR-pQCT; Image Analysis; Network Theory; Bone Fragility

Mentor(s):

Wikum Roshan Ban Ranasinghe Mudiyanselage (Engineering); Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1809

Presentation Time: Final Call Session: 10:00-11:00am

Designing framework materials with open-shell configurations

STEM

Authors(s):

William Charles Clifford† (Science|JMHC)

Abstract:

Molecules with unpaired electrons exhibit unique magnetic and electronic properties that have potential applications in spintronics, organic electronics, and quantum devices. Owing to their “open-shell” electronic configuration, such molecules are often highly reactive and short-lived. The high reactivity of open-shell molecules typically requires that they be studied at low-temperatures, under air-free conditions, and in dilute concentrations. Consequently, they are challenging to study and difficult to incorporate into practical devices. Here we demonstrate a new approach to studying and utilizing open-shell molecules by installing them at discrete lattice sites within a crystalline lattice, preventing them from interacting with each other. We designed and synthesized a new quinoidal linker, “H8BPI-2Y”, through a six-step approach. We further demonstrate incorporation of the stable open-shell molecule into a permanently porous framework, Cu2(BPI-2Y). We present structural characterization of the resulting metal—organic framework (MOF) including powder X-ray diffraction, gas-adsorption analysis (BET), and 2-probe electrical conductivity measurements. We furthermore demonstrate proof-of-concept proton conductivity measurements in the protonated version of the MOF in a first attempt at designing mixed ion-electron conducting MOFs. These results represent successful materials design and pave the path towards the design of MOFs with high radical densities.

Keywords:

MOFs; Metal-Organic Frameworks; Porous Materials; Radicals; Quantum

Mentor(s):

Justin Lee Andrews (Purdue University); Avinash Kiran (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1812

Presentation Time: Final Call Session: 10:00-11:00am

Student Organizations Archives and the Role of Student Peer Information Consultants at Purdue University

Humanities

Authors(s):

HyunShu Kim† (Science)

Abstract:

At Purdue University campus, student organizations play a significant role in leadership development and community building. Despite their significance, many, and particularly Asian-interest student organizations on this campus struggle to preserve well-documented archives. This results in the erosion of institutional memory and cultural history. This study explores how the Peer Information Consultant (PIC) student staff, a partnership program between Libraries and School of Information Studies and the Asian American and Asian Resource and Cultural Center (AAARCC), can support these organizations to preserve their histories through structured methods and collaborations.

The significance of this research lies in addressing the under-documentation of student organizations, which impacts knowledge transfers to future student leaders and retention of diverse organizational memories. By taking an action-based archival approach, this research will analyze how PICs collaborate with student organizations to gather, categorize, and preserve records, including meeting notes, event documentation, photographs, multimedia content, and oral histories. While highlighting the value of maintaining student organization records, the study calls attention to identified barriers, such as gaps in archival knowledge, inconsistent documentation, and limited support from the institution.

This study aims to establish a clear framework for student organizations to effectively preserve important records, ensuring a structured and sustainable approach to student-led archiving. As PIC student staff work closely with archives/libraries and a cultural center, the partnership may strengthen student organization archiving efforts, ensuring that the rich histories and contributions of Purdue's student groups remain preserved and accessible for future generations.

Keywords:

Archival Practices; Asian-Interest Organizations; Institutional Memory

Mentor(s):
Pamela Sari (Purdue University); Jerilyn Pia Tinio (Purdue University); Mark Anthony Puente (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1814

Presentation Time: Final Call Session: 10:00-11:00am

Tracking the Demographic Differences Between Traditional Public Schools and Sectors of Charter Schools in Indianapolis

Social Science

Authors(s):

Anjali Devi Gupta† (Education|Science|JMHC)

Abstract:

Over the last two decades, federal and state educational policies have increasingly supported the expansion of school choice. As a result, the assortment of choice options has expanded substantially, particularly in urban areas. This study first categorizes Indianapolis choice schools into four sectors. The number of students in each racial and socioeconomic group from each sector were totaled from enrollment data from the Indiana Department of Education (DOE). T-tests were computed on the demographics of each sector through SPSS. These t-tests revealed a statistically significant difference between the number of Black students, LatinX students, and students receiving free/reduced priced meals in Indianapolis public and choice schools. These findings indicate an inequitable distribution of Black and LatinX students in IPS and choice schools, but more research is necessary to confirm and explore barriers in access to choice. Additionally, while both IPS and choice schools serve economically disadvantaged populations, IPS may serve a more economically oppressed population, but again, more research is necessary.

Keywords:

School Choice; Charter; Indianapolis; Public School

Mentor(s):

Bryan J. Duarte (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1816

Presentation Time: Final Call Session: 10:00-11:00am

Guardian Caps for Purdue Football

STEM

Authors(s):

Coleton Edward Vondersaar† (HHS)

Abstract:

This presentation will present findings to ensure that Purdue football players are best protected during games by using Guardian Caps.

Keywords:

[no keywords provided]

Mentor(s):

Catherine Jean Shukle (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1817

Presentation Time: Final Call Session: 10:00-11:00am

Comparison of orientation of hexagonal Boron Nitride nanoplatelets in biodegradable films

STEM

Authors(s):

Jose Prieto Innes† (Engineering)

Abstract:

Millions of people live in hot climates in improvised or rudimentary housing with no access to proper air conditioning, making affordable passive cooling solutions a crucial area of research. Inspired by radiative cooling paints, this study explores the development of biodegradable radiative cooling films using a polymeric matrix, reinforced with hexagonal boron nitride (hBN) nanoplatelets. By optimizing the concentration of this reinforcement, we aim to maximize the reflection of incoming solar irradiation and the heat emitted outwards through radiation. Monte Carlo simulations, -a statistical method that uses random sampling to approximate complex physical problems-, indicate that a 60% concentration of reinforcement results in the highest reflectivity and while maintaining low absorptivity. However, the simulation model is less accurate in predicting the films' properties in the solar infrared range than in the visible range. To improve predictive accuracy and determine the ideal reinforcement concentration, incorporating varying nanoplatelet orientations in future simulations is suggested. This research contributes to the ongoing optimization of radiative cooling materials for sustainable and scalable passive cooling applications.

Keywords:

Radiative Cooling; Monte Carlo; Films; Paints

Mentor(s):

Ioanna Katsamba (Engineering)

Other Acknowledgement(s):

Xiulin Ruan (Purdue University); Andrea Lorena Felicelli (Engineering)

Poster Presentation Abstract Number: 1818

Presentation Time: Final Call Session: 10:00-11:00am

Climatology of Tropical Tornadoes Over Puerto Rico

STEM

Authors(s):

Marco Alejandro Monrouzeau Vazquez† (Science|JMHC)

Abstract:

Since the 1950s, over 25 tornadoes, primarily classified as EF0 or EF1, have been documented in Puerto Rico. The strongest on record was an EF1, which impacted the municipality of Arecibo. However, no existing studies specifically investigate tornadoes in tropical environments. Therefore, this study analyzes 16 confirmed tornado cases to identify recurring synoptic, mesoscale, and microscale patterns. Analyses of soundings, ERA5 reanalysis data, radar, and satellite imagery identified five common atmospheric setups: (1) air mass thunderstorms, (2) TUTTs with weak upper-level dynamics, (3) strong upper-level dynamics, (4) TUTTs with strong upper-level dynamics, and (5) Influence from Easterly Waves. Results indicate key low-level forcing mechanisms include, orographic lifting, sea breeze convergence, and daytime heating, while upper-level influences involve TUTTs, subtropical jets, and frontal boundaries providing divergence, moisture pooling, and temperature gradients. Additionally, it was found tornadoes are predominantly concentrated in the island's northwest region. This research seeks to improve tornado forecasting and early warning systems, reducing risks to Puerto Rico’s vulnerable communities and infrastructure.

Keywords:

Tornadoes; Tropics; Climate

Mentor(s):

Daniel R Chavas (Purdue University); Andrea Elise Orton (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1819

Presentation Time: Final Call Session: 10:00-11:00am

Characterization of a Potential Role for PKL in Replication in Arabidopsis thaliana

STEM

Authors(s):

Joshua Paul Kaluf† (Agriculture); Joshua T Stephenson* (Agriculture)

Abstract:

[Abstract Redacted]

Keywords:

Chromatin; Replication; Plants; PICKLE; Epigenetics

Mentor(s):

Joseph P Ogas (Purdue University); Jiaxin Long (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1820

Presentation Time: Final Call Session: 10:00-11:00am

A monotonicity-inspired optimization for the three-way merge in Mergeable Replicated Datatypes

STEM

Authors(s):

Kartavya Vashishtha† (Science|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Distributed Systems; Databases

Mentor(s):

Suresh Jagannathan (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1821

Presentation Time: Final Call Session: 10:00-11:00am

Characterization of Thermal Conductivity in Thermoplastic Potato Starch Aerogels

STEM

Authors(s):

Eittan Israel Shaham† (Engineering); Sevinch Pasilova‡ (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Thermal Conductivity; Polymer Aerogel; Supercritical Dryer; Thermoplastic Starch (TPS); Sustainable Materials

Mentor(s):

Andres Tovar (Purdue University); Jacob Scott Staker (Science)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1823

Presentation Time: Final Call Session: 10:00-11:00am

Do Green Choices Pay Off? Evidence from Reusable Packaging in Food Delivery

Social Science

Authors(s):

Savelii Vitalievich Spiridov† (DSB); Wenyin Jiang† (Science|Graduate)

Abstract:

This study investigates the economic impact of a pro-environmental policy that allows restaurants to offer reusable packaging for food delivery. Under this policy, customers can opt for stainless steel containers, which are later recollected by a third-party firm, for an additional fee of $0.80. While the initiative promotes environmental sustainability, it introduces frictions: consumers face higher costs, and restaurant owners bear operational burdens, such as coordinating with collection firms and managing separate order flows. Despite these challenges, environmentally conscious offerings may attract more orders from supportive customers. If so, is the increase substantial enough to offset the immediate costs of offering two types of food containers? To address this question, we collect online review data for 224 restaurants from South Korea's leading food delivery platform over 12 months—six months before and after the policy. We compare demand, proxied by the number of reviews, between treated restaurants (34) and control restaurants (190). We find that offering a reusable container option positively affects restaurant demand, with the effect emerging about two months after implementation. The policy effect is more pronounced for participating restaurants whose owners frequently replied to customer reviews prior to the policy, suggesting a higher level of customer engagement. This responsiveness may signal pro-social values that resonate with environmentally conscious consumers. This research addresses two key questions: Does offering reusable packaging harm restaurant performance? Or do consumers reward environmental commitment? We further assess whether such social consciousness leads to tangible business benefits for participating restaurants.

Keywords:

Reusable Packaging; Food Delivery; Environmental Policy; Sustainable Consumption

Mentor(s):

Wooyong Jo (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1824

Presentation Time: Final Call Session: 10:00-11:00am

Design of Logic-Based Genetic Circuits Using RNA Aptamers for Responsive Detection of Bacterial Vaginosis Biomarkers

STEM

Authors(s):

Prisha Nitin Shethia† (Engineering|JMHC)

Abstract:

Bacterial vaginosis (BV) is a prevalent and recurrent polymicrobial condition that presents persistent challenges to women's health and modern clinical management. Characterized by dysbiosis of the vaginal microbiota and significant inter-patient variability, BV requires innovative molecular approaches that extend beyond conventional broad-spectrum antimicrobial treatments. Current clinical interventions often fail to address the underlying microbial imbalances and inflammatory mechanisms with sufficient specificity, leading to frequent recurrence and suboptimal patient outcomes. The intricate and dynamic nature of vaginal microbial ecosystems calls for advanced molecular technologies capable of accurate biomarker detection and targeted intervention. RNA molecules, as programmable biomolecules with versatile biological roles, offer a powerful foundation for such innovations. In particular, RNA aptamer-based logic circuits emerge as a transformative strategy, enabling the creation of intelligent molecular systems that dynamically interact with BV-associated microbial and inflammatory markers. Leveraging cutting-edge synthetic biology and molecular engineering techniques, our research introduces a comprehensive design framework for engineering RNA aptamer-based genetic logic circuits within Lactobacillus crispatus, a dominant commensal vaginal bacterium with a well-established safety profile. By integrating computational design with experimental validation, we aim to develop responsive genetic circuits capable of precise molecular recognition and controlled gene expression within Lactobacillus strains. This approach holds the potential to redefine BV management through applications in personalized medicine, targeted microbial rebalancing, and real-time disease monitoring.

Keywords:

RNA Aptamers; Genetic Circuits; Bacterial Vaginosis; Synthetic Biology; Biomarker Detection

Mentor(s):

Derrick Dankwa (Engineering); Leopold Noel Green (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Poster Presentation Abstract Number: 1825

Presentation Time: Final Call Session: 10:00-11:00am

Machine Learning Driven Analysis of Duchenne Muscular Dystrophy Cardiac MRI Data

STEM

Authors(s):

Alan Yue† (Science); Katherine Xiaoxing Pesetski‡ (Engineering|JMHC)

Abstract:

Duchenne Muscular Dystrophy (DMD) is a devastating genetic disorder that's characterized by progressive muscle degeneration, primarily in boys, caused by a mutation in the gene responsible for producing dystrophin, which is key for muscle function. The disease drastically reduces mobility during early adolescence and leads to a life expectancy of approximately 20-25 years, with cardiopulmonary failure as the leading cause of death in patients. However, since there are no Food and Drug Administration (FDA) approved clinical endpoints, research into potential cardiovascular therapies as treatments have stalled. This study aims to leverage utilizing machine learning models to analyze key predictors in DMD patients using cardiac magnetic resonance (CMR) imaging data from multiple hospitals to predict mortality in patients. Specifically, left ventricular ejection fraction (LVEF), left ventricular end-diastolic volume index (LVEDVi), left ventricular end-systolic volume index (LVESVi), left ventricular strain, and late gadolinium enhancement (LGE) are examined as critical predictors for disease progression. By employing different classification algorithms, we can compare the differences between the algorithms and collect results on how best we can use these technologies to further improve treatments for individuals suffering from DMD.

Keywords:

[no keywords provided]

Mentor(s):

Guang Lin (Purdue University)

Other Acknowledgement(s):

Madison Ann Sullivan (Science)

Poster Presentation Abstract Number: 1826

Presentation Time: Final Call Session: 10:00-11:00am

Origami-Inspired climber for multidirectional Robotic Locomotion

STEM

Authors(s):

Eddie So† (Engineering)

Abstract:

In high-risk or inaccessible environments, such as outer space structures and large-scale infrastructures, humans depend on robots to carry out critical tasks like inspection, maintenance, and exploration. Among them, climbing robots have been developed to navigate vertical or inclined surfaces. However, heavy mechanisms and limited ways to move prevented their real-world application. Therefore, we designed a multidirectional climber using origami patterns in Fusion, a computer-aided design (CAD) software that allows us to create, modify, and optimize 3D models with precision and ease. The climber consists of a Bellow-folds patterned body and two Miura-Ori patterned mechanisms mounted on opposite ends of the body. The Bellow-folded body allows the robot to pitch, yaw, and move three-dimensionally. Likewise, the Miura-Ori mechanisms are sets of lightweight grabbers that can firmly grasp cylindrical objects of various diameters. Additionally, the design utilizes mixed-materials 3D printing, which enables rapid replacement and customization of any segment to tailor the climber for specific missions. To control the two distinctively behaved mechanisms, the robot uses data-driven modeling to control the robot accurately, where the model has achieved high accuracy in testing and training data sets. This robot climber has shown it is a viable alternative for climbing robots as a lighter and more portable alternative, which allows future researchers to explore more usage of origami in robotics.

Keywords:

Origami; Locomotion; Robotics

Mentor(s):

Ran Dai (Purdue University)

Other Acknowledgement(s):

Yuto Tanaka (Engineering); Harrison Booker (Engineering)

Poster Presentation Abstract Number: 1827

Presentation Time: Final Call Session: 10:00-11:00am

AI powered robot assistant

STEM

Authors(s):

Zander Huling Rafferty† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Robot; AI; Assistant

Mentor(s):

Stewart F Bauserman (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1828

Presentation Time: Final Call Session: 10:00-11:00am

Multimodal Characterization of Defects in Semiconductors

STEM

Authors(s):

Naren Velnambi† (Science)

Abstract:

This project aims to use machine learning to identify tiny defects in advanced electronic packaging systems by combining data from several testing methods. These packaging systems, known as Heterogeneous Integration Packaging (HIP), stack and connect different types of electronic components in a compact space to improve performance. One key element in these systems is Through-Silicon Vias (TSVs), which are small vertical holes filled with metal that allow electrical signals to pass between layers of a chip. Defects like cracks or layers separating (delaminations) in these structures can lead to failures. By analyzing data from multiple sources together, the project seeks to improve the ability to detect and accurately classify these hidden defects.

Keywords:

[no keywords provided]

Mentor(s):

Nikhilesh Chawla (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7000

Presentation Time: STEW 214B at 9:00-9:20

Modeling and Mitigating Lunar Habitat Disruptions

STEM

Authors(s):

Aaryan Sachin Lath† (Engineering)

Abstract:

NASA's Artemis program aims to establish a long-term human presence on the lunar surface. This ambitious goal presents numerous engineering and operational challenges. Lunar habitats must endure harsh environmental hazards, due to the absence of atmospheric protection and exposure to temperature extremes. At the Resilient Extraterrestrial Habitat Institute (RETHi), we focus on the safety and sustainability of habitats to maintain a lunar presence in the long run. This study focuses on analyzing disruptions to lunar habitats. Disruptions arise from sources like human errors, equipment failures, or external hazards such as micrometeoroid impacts. They can compromise astronaut safety and impact mission success. We have compiled a database of disruptions that can affect a lunar habitat's core systems, including life support, thermal control, and power distribution using RETHi's Habitat Simulator (HabSim). HabSim is a sub-scaled lunar habitat simulation that models disruptions by tracking their propagation throughout the habitat, assessing cascading failures, and evaluating the habitat systems and subsystem performance. We develop safety controls to manage disruptions and their cascading effects. . The findings will inform future habitat designs and operational protocols, improving risk assessment methodologies for sustained human presence on the Moon and beyond.

Keywords:

[no keywords provided]

Mentor(s):

Karen Marais (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7001

Presentation Time: STEW 214B at 9:20-9:40

Research and Development towards a Carbon-Fiber wire based drift chamber for Future Lepton Colliders

STEM

Authors(s):

Gino Christian Daniels†; Alexandre M Chevalier‡ (Engineering); John Cheng Yu Chang‡ (Engineering); Benjamin Andrew Velasco‡ (Engineering)

Abstract:

Lepton colliders are a promising look into the future of high-energy physics, two are currently under discussion in the community: FCC-ee and a muon Collider. Both have advantages, e.g. with less energy loss due to synchrotron radiation, muons serve as the best way to provide collisions at very high energies, while electron-positron colliders provide highest luminosities at Higgs mass or top quark anti-top quark production threshold. However, the need for high luminosity within muon colliders faces technical challenges which arise from short muon lifetime at rest, limitations of producing and controlling bunches with large amounts of muons, with small emittance, and effective radiation shielding. Due to the low number of protons, i.e. Z=6, carbon fiber has a low value of radiation length while still providing stiffness to any support and more importantly providing high conductivity for applications in active sensing. Performance of such a device is expected to be improved given the much lower amount of material in the active sensing volume. Hence, it is the best option to reduce material budget, reduce backgrounds from multiple scattering. In this work first prototype results for production of a carbon fiber wire chamber are presented.

Keywords:

[no keywords provided]

Mentor(s):

Andreas Jung (Purdue University); Sushrut Karmarkar (Purdue University)

Other Acknowledgement(s):

Caden Max Glenn (Science); Benjamin Edward Pulver (Engineering); Heather Nicole Martin (Science)

Talk Presentation Abstract Number: 7002

Presentation Time: STEW 214B at 9:40-10:00

Smart Prosthetics Through Deep Learning: A Comparative Study of Neural Architectures for Real-Time Activity Recognition

STEM

Authors(s):

Johnny Kamal Anton Hazboun† (Engineering); Aidan Cole Villegas† (Polytechnic|JMHC)

Abstract:

Activity classification using wearable sensors has significant applications in healthcare, sports, rehabilitation, and smart prosthetics, the latter being the focus of this paper. Smart prosthetics have the potential to improve mobility and quality of life by dynamically adapting motor configurations and settings based on the user's activity. We explore deep learning models for activity classification using time series data from two 9-axis Inertial Measurement Units (IMUs) placed on the foot and the shank. We developed and compared three architectures to classify walking, ascending stairs, and descending stairs. The models are Convolutional Neural Networks (CNN), Long Short-Term Memory Networks (LSTM), and Transformers. The data set consists of labeled IMU readings from 10 human subjects, processed using different sliding-window techniques: fixed-size window predictions and averaged window predictions. The models were evaluated on the basis of their ability to accurately classify activities under realistic outside of lab environments. Initial results indicate that CNNs and LSTMs excel in capturing sequential dependencies, making them well suited for real-time prosthetic adjustments. This research demonstrates the feasibility of integrating deep learning models with wearable sensors to enhance the adaptability of smart prosthetics, contributing to the field of assistive technologies and personalized mobility solutions.

Keywords:

Machine Learning; Neural Networks; Smart Prosthetics; Activity Classification; Artificial Intelligence

Mentor(s):

Andres Torres (Engineering); Mo Rastgaar (Purdue University)

Other Acknowledgement(s):

Ahmed Khaled Soliman (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7004

Presentation Time: STEW 214C at 9:20-9:40

Adaptive Speech Reconstruction Interface with AI (ASRIA): A Wearable-LLM Framework for Aphasia Rehabilitation

STEM

Authors(s):

Philip R Liu† (Science|JMHC); Richard John Silvester† (Science); Aadi Jangid‡ (Science|JMHC)

Abstract:

Speech rehabilitation plays a vital role in neuromuscular re-education, helping individuals with aphasia regain their ability to communicate effectively. Due to impaired fluency and articulation, many aphasia patients struggle to produce intelligible speech, making real-time correction and adaptive learning critical for rehabilitation. While wearable acoustic sensors have been proposed to enhance speech recognition accuracy, relevant studies do not fully address everyday communication hurdles such as mispronunciations and disrupted sentence flow.

Our goal for this project is to develop a wireless wearable speech interface that recognizes and corrects aphasic speech, enabling clear and understandable communication. We achieve this by integrating a Large-Language Model (LLM) component with a wearable piezo-tribo hybrid sensor optimized for the human vocal frequency range. The sensor captures vocalizations, while a convolutional neural network (CNN) detects mispronunciations and predicts intended utterances. The LLM component, leveraging pre-trained models such as OpenAI's GPT and Google's Gemini, enhances speech recognition through semantic inference, ensuring that partially formed or distorted speech is reconstructed into meaningful sentences.

By incorporating real-time speech correction, personalized feedback, and adaptive learning, ASRIA provides a seamless interface for aphasia patients to practice and refine their speech beyond traditional therapy settings. The wearable system enables continuous engagement, allowing users to communicate with others more naturally while reinforcing improvements over time. Additionally, a visual dashboard displays the corrected speech, providing users with instant feedback and progress tracking. Through this AI-driven, hands-free rehabilitation approach, ASRIA empowers individuals with aphasia to speak more fluently, confidently, and effortlessly in daily life.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Speech Rehabilitation; Wearable Sensor; Aphasia; Speech Recognition; Large-Language Model

Mentor(s):
Wenzhuo Wu (Purdue University); Robert Jose Ccorahua santo (Engineering); Jing Jiang (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7005

Presentation Time: STEW 214C at 9:40-10:00

Evaluating Blood Velocity Changes in Thoracic Aneurysm Progression for Rupture Risk Assessment

STEM

Authors(s):

Suhani Lodha† (Engineering); Daniel Ethan Kelley‡ (Engineering); Claudia Kayleen Albrecht‡ (Liberal Arts|JMHC); Christin Alyse Huene‡ (Engineering|JMHC)

Abstract:

A ruptured thoracic aneurysm, or breakage of the blood vessel carrying blood to the entire body, is almost always fatal. Thus, it is incredibly valuable to model and understand the development of thoracic aneurysms leading up to rupture in order to gain a better understanding of disease progression and eventual rupture. Vessel dilation at the aneurysm can decrease velocity, leading to increased risk of intraluminal thrombus and inflammation. When vessel size returns to normal beyond the aneurysm, velocity increases drastically, which increases wall stress and damage to the aortic wall, increasing risk of rupture and atherosclerosis. This project aimed to model and assess changes in blood velocity due to thoracic aneurysm development, induced pharmaceutically with B-aminopropionitrile (BAPN), in both male and female mice. Aneurysms were induced by introducing 0.5% BAPN to the water supply of the experimental groups. Aneurysm growth and blood velocity measurements were tracked using a 4-dimensional ultrasound with biweekly imaging for 140 days or until rupture. Results found a correlation between increased aneurysm diameter and decreasing aortic velocity. At the end of the 140 days, the experimental group had an average 51% decrease in velocity compared to the control group. These results demonstrate a clear correlation between aneurysm growth and decreasing blood velocity, which may be useful to model and predict both rupture risk and subsequent complications in patients. Future research is ongoing and includes collecting and analyzing histological images of the aneurysm tissues to quantify changes in wall structure.

Keywords:

Aneurysm; Blood Velocity; Cardiovascular Imaging

Mentor(s):

Cortland Hannah Johns (Engineering); Craig Goergen (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7006

Presentation Time: STEW 214D at 9:00-9:20

Reviving SLIP: Lightweight Networking for AFTx07

STEM

Authors(s):

Jiaming Situ† (Science)

Abstract:

This project implements Serial Line Internet Protocol (SLIP) for SoCET's custom AFTx07, demonstrating a lightweight and effective method of establishing network communication over UART. While SLIP is an outdated protocol in modern networking, its simplicity and low overhead make it ideal for embedded systems with limited computational power. This project involves implementing the data-link and network layers using "Femtokernel" system calls for low-level serial communication. Successful implementation will be validated once bidirectional ICMP communication can be demonstrated with an arbitrary auxiliary computer running SLIP. This work establishes the foundation for expanding AFTx07's networking abilities, allowing for higher-layer technologies such as TCP/UDP.

Keywords:

Serial Line Internet Protocol; System on Chip; Embedded Systems; Computer Networking

Mentor(s):

Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7007

Presentation Time: STEW 214D at 9:20-9:40

The Evolution of Tyrosine Kinase Activity and Chance, Contingency, and Necessity in Evolution

STEM

Authors(s):

Michael David Gardner† (Science|JMHC); Rachel Marie Isaac* (Science|JMHC)

Abstract:

A central question in biology is the extent of predictability in evolutionary outcomes and the relative roles of chance and contingency on this predictability. Since we cannot directly observe the past, the effects of chance and contingency are unknown. However, we could infer their effects by comparing the outcomes of repeated evolutionary events. Chance predominating would cause independent evolutionary events to produce variable outcomes, while contingency predominating would cause variable outcomes to depend on where evolution started. If the outcomes of evolution were always the same, there is evolutionary necessity (the absence of chance and contingency) and there was a single route available to evolution. Unfortunately, most traits evolved once and this analysis has been inapplicable. The repeated and independent evolution of tyrosine phosphorylation activity offers an exception.

Here, we determine the genetic and molecular basis for tyrosine kinase (TK) activity for one instance: the Wee kinase family. Using maximum likelihood analysis, we reconstructed a phylogeny of related kinases and mapped known phosphorylation capabilities onto it, determining when and how the Wee family gained TK activity. We refined our analysis using structurally validated sequence alignments. Future work will use this phylogeny to reconstruct the last common ancestor of Wee and related kinases and identify the genetic changes that conferred kinase activity. We will then compare the sequences and evolutionary mechanisms against those of TK activity in other kinase families, allowing us to determine the relative roles of chance and contingency in the evolution of acquired function for the first time.

Keywords:

Kinase; Evolution; Chance; Contingency; Necessity

Mentor(s):

Brian Patrick Ha Metzger (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7008

Presentation Time: STEW 214D at 9:40-10:00

Regime Switching Financial Model with Signature

STEM

Authors(s):

Yang Lyu† (Science)

Abstract:

Regime switching models are useful financial models describing time varying patterns of financial markets. While there are many variations of regime switching models, most of them rely on Markov chain to capture the changing mechanism. In this study, we generalize this Markov chain-based method to a model-free signature method. Our model is more flexible since this can be easily extended to multi-regime cases without adding more complicated structures. We demonstrate our new model to foreign exchange data and commodity data.

Keywords:

[no keywords provided]

Mentor(s):

Kiseop Lee (Purdue University); Jiwon Jung (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7009

Presentation Time: STEW 218A at 9:00-9:20

Modeling Drug Transport in the Umbilical Cord: Fetal Membrane

STEM

Authors(s):

Annika Mallari Munjal† (HHS); Morgan Stephens† (Science|JMHC); Dipali Rebecca Abraham† (Engineering); Ishaan Pratap Singh† (Engineering); Mira Nimesh Patel† (Engineering); Alexander Carnevale† (Engineering); Nicholas Maurer† (Engineering); Emma Elizabeth Wagner‡ (Agriculture|JMHC)

Abstract:

Microfluidic models created for examining the pharmacokinetics of umbilical cord connection to the fetus can serve as guidelines for further downstream applications of different drug diffusions and their interactions across the fetal membrane. As of now, widespread knowledge of how different drugs - such as blood thinners and anesthetics, and the impact that they have on diffusing through the fetal membrane to the fetus is limited. To fully understand the diffusion, a membrane-like model was created with the goal of simulating the dispersion of drugs on the fetal membrane. One of the ways we explored our study was through cell culture. This allows a barrier layer to be formed, and from this, one can obtain information such as permeability, compound transfer, and toxicity - allowing for the drug transport to be studied.

Keywords:

[no keywords provided]

Mentor(s):

Arezoo Ardekani (Purdue University); Ryan B Wagner (Purdue University)

Other Acknowledgement(s):

Harsa Mitra (Engineering)

Talk Presentation Abstract Number: 7010

Presentation Time: STEW 218A at 9:20-9:40

Prioritization of HPV Vaccine Preventable Diseases Among Emerging Adults – Implications for Health Education and Communication

Social Science

Authors(s):

Caroline Rhea Packee† (Science); Avery Grace Brubaker† (HHS); Evan Graham Coblentz‡ (Agriculture|JMHC); Emma Swanson* (HHS); Rhea Chintan Shah* (Science)

Abstract:

Background: Emerging adults are at the highest risk for Human Papillomavirus Virus (HPV). HPV increases the risk of cervical, oropharyngeal, and anogenital cancers, and skin lesions leading to warts. However, most health communications emphasize the risk of only cervical cancer.

Objective: To identify which HPV vaccine preventable diseases are highest priority among emerging adults and demographic factors associated with the prioritization.

Methods: We recruited participants to complete a voluntary, one-time, online survey at two no-cost vaccine clinics in September and October 2024. This study is limited to respondents 18 to 25 years (n=454, 61.9% female, 54.8% non-Hispanic white). Respondents ranked the importance of seven HPV vaccine preventable diseases. We determined the frequency with each disease was ranked first. We then conducted chi-square tests to determine if sex was associated with the prioritization and multivariable logistic regression to determine factors associated with ranking genital warts over cancer. Analyses were performed using IMB SPSS Statistics (Version 27).

Results: Cervical cancer (26.87%), genital warts (19.82%) and vaginal cancer (15.41%) were most often the highest priority. More females than males (68% vs. 3.47%) prioritized female-specific cancers while more males than females (44.5% vs. 13.5%) prioritized non-sex specific cancers ($X2 = 219.08$; $p<0.001$). Prioritization of genital warts over cancer was associated with being non-Hispanic Asian (aOR = 2.19; 95% CI=1.28-3.76) and non-Hispanic other (aOR = 2.73; 95% CI=1.32-5.68). Non-Hispanic Whites was the reference group.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Conclusions: To increase vaccine uptake, especially among males and racial minorities, it is critical to emphasize HPV health consequences beyond only cervical cancer.

Keywords:
HPV; Vaccination; Cervical Cancer; Health Communication

Mentor(s):
Shandey Derisa Malcolm (Purdue University); Monica Kasting (Purdue University); Samantha L. Ky (HHS)

Other Acknowledgement(s):
Trexie M Rudd (Purdue University); Abigale Louise Fritsch (Purdue University)

Talk Presentation Abstract Number: 7011

Presentation Time: STEW 218A at 9:40-10:00

A qualitative analysis of cyclical patterns in bobcat movement in relation to seasonal flooding and species life history

STEM

Authors(s):

Sierra Hunnicutt† (Science|JMHC); Alexandra Grace Early* (Agriculture); Lukas Benjamin Kraft* (Agriculture|JMHC); Anaey Gaurang Naik* (HHS|JMHC); Zhixin Cai* (Science|JMHC)

Abstract:

Continued urbanization has been increasing the amount of physical barriers that exist in the environment, preventing wildlife from necessary safe paths for migration and finding mates. Natural corridors exist in opposition to urbanization in the form of rivers and waterways that remain largely unimpeded by human development. However, river fluctuations due to the change of seasons and weather alter the geography of the river corridors in ways that make such corridors impassable at certain times of the year. During wet periods, high water levels may restrict terrestrial animal movement and impede river crossings, and dry periods with low water levels make for critical corridors for terrestrial animals. Studies observing small terrestrial mammals have found cyclical patterns in movement attributed to water levels in flood plains, specifically that small mammals leave only when forced to and typically return to their original habitats once the water levels have receded, however similar studies on larger mesocarnivores are far more lacking. Bobcats (Lynx rufus) have historically held a crucial position in the Indiana ecosystem as prominent mesocarnivores, made more important by the significant lack of larger predators in Indiana ecosystems. While not particularly attracted to water, previous studies have observed bobcats to use waterways for catching prey, defecation, and play with noticeable lack of hesitance. This study looks at bobcat sightings within the parameters of our study and in online forums against historical flood water data on the Wabash River and known life history traits in order to form a basic understanding of bobcat movement patterns in locations on or adjacent to high flood zones. We deployed visual remote sensors (camera traps) with bobcat attractant in several sites along the Wabash River and its tributaries, five of which were used in this study (n=5) on the basis of having positive bobcat presence and at least a year's worth of data (Fall, Winter, Spring, Summer). These sites now have Fall and/or Spring replicates that can be used to start building

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

a database of cycles within the parameters of our study in order to make preliminary conjectures on whether patterns are present with the intention of continuing to add seasonal replicates within our sites to further this database. Visuals were created to understand the variations in water level on the Wabash River in the past year and a half as well as to map positive bobcat sightings at e

Keywords:
Corridor; Ecology; Bobcat; Behavior; Flood

Mentor(s):
Kristen Marie Bellisario (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7012

Presentation Time: STEW 218C at 9:00-9:20

More than Financial Risk: Harassment and Financial Dependence in the Gig Economy

Social Science

Authors(s):

Julieta Claudia Aguilar† (Liberal Arts)

Abstract:

Research on gig workers has increased as the platform economy has expanded. However, previous studies have found that the experiences of gig workers are divided. Many find gig work a good way to supplement income, but other workers who are more financially dependent on gig work indicate dissatisfaction with the work. In addition to the unstable working conditions, gig workers must also deal with the risk of harassment, which has been widespread, without the organizational and legal protections the conventional jobs offer. Few studies have explored the extent to which being platform dependent (i.e., being financially dependent on gig income) is related to the levels of harassment gig workers experience. Using 2021 data from the American Trends Panel (ATP), we examine the potential link between financial dependence and experiences of harassment. Preliminary findings indicate that workers who say the money they earn from gig work is important or essential for meeting basic needs experienced higher levels of harassment than those who were less dependent on the income even after the inclusion of controls. This suggests that for financially dependent workers, gig work is not only financially precarious, but it also includes a heightened risk of harassment.

Keywords:

Gig Work; Harassment; Platform Dependence; Online Platform; Precarity

Mentor(s):

Jeremy E Reynolds (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7013

Presentation Time: STEW 218C at 9:20-9:40

Tradwives: Understanding the effectiveness of grassroots social media specialists

Humanities

Authors(s):

Marissa Elizabeth Velazquez† (Liberal Arts)

Abstract:

The Etymology for the word “tradwife” stems from “traditional” and “wife”. In other words, trad wives are women who fulfill traditional sex roles in a movement to “reclaim femininity”. Tradwives began to have an online presence post COVID and have grown rapidly post pandemic, parallel to an increase in conservatism. This mixed-methods research aims to look at the online image these women have created to gain a fanbase through the lens of Social Judgment Theory. I will be performing an in-depth analysis of multiple creators’ TikTok accounts to determine the strategies these women have used to gain a following and extent of their influence. A digital ethnography will be performed to identify key messages and recognize the most common topics and actions within the videos. Then a survey will be compiled using Qualtrix to reveal the most common demographic for tradwife viewership and compare their content to the demographic’s latitudes of acceptance. Expected results would imply that the main viewership of the tradwives is young women and that videos including actions and topics with mass appeal, such as baking, will be the most effective in idealizing their lifestyle. From these findings we can infer that combining persuasive messaging with broadly-liked content will increase ROIs on social media. This has implications for content creation fields including social media marketing and content creation.

Keywords:

Tradwife; Social Judgement Theory; Influencer Marketing; Persuasion

Mentor(s):

Spencer Dean Stewart (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7014

Presentation Time: STEW 218C at 9:40-10:00

Uncovering the Intentions behind the Unjust Conviction and Imprisonment Statute

Social Science

Authors(s):

Emma Lynn Johnson† (DSB)

Abstract:

Under 28 U.S. Code § 2513, also known as the Unjust Conviction and Imprisonment statute, those who have been wrongfully convicted can present a case in the United States Court of Claims to seek financial relief from the U.S. government. However, since the adoption of the act, very few claimants have been granted such relief. This suggests two options: the act was intentionally written to make relief nearly impossible to obtain or it just happened that the act was ineffective. 28 U.S. Code § 2513 has a lengthy paper history that can be examined to get an answer to this question. I review the legislative history of the statute, including prior attempts at legislation, committee reports, and congressional record to shed new light on the origins and intention of the Unjust Conviction and Imprisonment statute.

Keywords:

Legislative History; Unjust Conviction and Imprisonment Statute; Court of Claims

Mentor(s):

Logan Strother (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7015

Presentation Time: STEW 214B at 10:00-10:20

Pulse Flow Reverse Osmosis System for Home Scale Use

STEM

Authors(s):

Lucca Su Mo† (Engineering|JMHC)

Abstract:

Reverse osmosis (RO) is widely recognized as the most efficient method for water purification and recycling, particularly for brackish and wastewater treatment. However, traditional RO systems require high-pressure operation and periodic flushing cycles, which can limit their efficiency and feasibility for smaller-scale applications. The objective of this project is to design, prototype, and test a Pulse Flow Reverse Osmosis (PFRO) system optimized for home-scale water purification and recycling. This system integrates pulse flow technology to enhance water recovery rates while reducing membrane fouling and operational costs. The research focuses on developing a test bench that allows for controlled experimentation, analyzing key parameters such as water pressure, temperature, flow rate, and chemical composition. By investigating the feasibility of PFRO in a domestic setting, this study aims to improve the accessibility and sustainability of water purification technologies. The anticipated results include improved efficiency in water reuse with minimal energy consumption and lower maintenance requirements. The successful implementation of this system could lead to a more sustainable, cost-effective, and scalable solution for residential and portable water purification needs.

Keywords:

Reverse Osmosis (RO); Pulse Flow Reverse Osmosis (PFRO); Water Recycling; Water Purification

Mentor(s):

Jose M Garcia Bravo (Purdue University); Ali Naderi Beni (Engineering); Jarrod F Robbins (Polytechnic); David Warsinger (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7016

Presentation Time: STEW 214B at 10:20-10:40

Power, Performance, and Area Optimization of SoCET's AFTx07 Chip

STEM

Authors(s):

Ammar M Mukadam† (Engineering)

Abstract:

This project's focus is power, performance, and area (PPA) optimization of the AFTx07 RISC-V chip, the newest system-on-chip design from the VIP SoCET team. Maximizing performance while minimizing energy consumption and area on a chip is a delicate yet crucial objective of chip design. In this project, we analyze these tradeoffs across various aspects of the physical design. Specifically, we aim to increase maximum clock speed and decrease total power consumption and overall chip area compared to previous AFTx07 models. To do so, we will manually modify clock speed, process corner variations, and placement density, and report impacts on PPA through every flow iteration. Finally, we will analyze these results to determine the maximum capacities of each parameter and find the optimal balance for the final tapeout.

Keywords:

SoCET; Semiconductor; Design Flow; Power

Mentor(s):

Timothy Francis Hein (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7017

Presentation Time: STEW 214B at 10:40-11:00

Investigating Combustion Instabilities in Turbulent Jet Ignition for Internal Combustion Engines

STEM

Authors(s):

Mo Chen† (Engineering)

Abstract:

Turbulent Jet Ignition (TJI) is a promising technology for improving the efficiency and emissions of internal combustion (IC) engines. Previous research achieved a 13–15% improvement in fuel efficiency in a production-model engine by optimizing prechamber design, nozzle configuration, and ignition timing, but also revealed that TJI introduces higher cycle-to-cycle variation compared to conventional spark ignition (SI), frequently exceeding the industry-accepted 5% limit—particularly under low-load and low-temperature conditions such as cold starts. Additionally, delaying ignition timing, which is necessary for catalytic converter warm-up, further exacerbates combustion instability. This study aims to understand the fundamental mechanisms driving these instabilities by deploying a high-speed endoscopic camera inside the combustion chamber to visually capture flame propagation dynamics, while exhaust pressure and gas composition measurements will provide insights into combustion completeness and instability patterns. By integrating optical diagnostics with pressure and emissions analysis, this research seeks to characterize the root causes of instability and inform strategies for improving TJI system reliability, contributing to the development of more stable, efficient, and practical TJI implementations in next-generation IC engines.

Keywords:

Turbulent Jet Ignition; Internal Combustion Engines; Cycle Variation; Combustion Stability

Mentor(s):

Afaque Alam (Engineering); Li Qiao (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7018

Presentation Time: STEW 214C at 10:00-10:20

Modeling metabolic dysfunction-associated fatty liver disease using liver organoids

STEM

Authors(s):

Anna Catherine Dressman† (Science); Nora Mariam Sukkar* (Engineering)

Abstract:

Metabolic dysfunction-associated fatty liver disease (MAFLD) is a progressive liver disease characterized by excessive lipid accumulation in hepatocytes, leading to cellular dysfunction, inflammation, fibrosis, cirrhosis, and an increased risk of hepatocellular carcinoma. Affecting nearly 25% of the global population, MAFLD is projected to become the leading indication for liver transplantation. Despite its growing prevalence, the lack of physiologically relevant in vitro models hampers mechanistic studies and therapeutic development. Traditional two-dimensional culture systems have been instrumental in advancing our understanding of cellular processes and disease mechanisms. However, they are limited in replicating the complex cellular architecture, microenvironment, and dynamic interactions present in vivo. To complement these models and enhance physiological relevance, we aimed to assess the capability of three-dimensional liver organoid models to recapitulate key pathological features of MAFLD, with specific focus on hepatic lipid accumulation. Organoids were derived from mouse liver cells and cultured under defined conditions to maintain hepatic functionality. To induce MAFLD-like lipid accumulation, organoids were exposed to varying concentrations of a 1:1 mixture of oleate and palmitate, mimicking the metabolic conditions observed in MAFLD patients. Lipid deposition within hepatocytes was quantified using Oil Red O staining and lipid droplet analysis. Organoids treated with free fatty acids exhibited significant lipid accumulation, validating their potential as an in vitro model for studying early disease pathogenesis. Future studies will focus on optimizing the organoid system to better model additional pathological hallmarks of MAFLD, including inflammation, fibrosis, and metabolic dysfunction, thereby advancing its utility for translational research and preclinical drug screening.

Keywords:

Organoids; Fatty Liver Disease; Free Fatty Acids; Lipids

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Sunghee Park (Purdue University)

Other Acknowledgement(s):
Jiafei Zhu (Engineering)

Talk Presentation Abstract Number: 7019

Presentation Time: STEW 214C at 10:20-10:40

Snake Tongue Flicking Project

STEM

Authors(s):

Aditya Kumar† (Engineering|JMHC)

Abstract:

We set out to answer the question – ‘Why do snakes flick their tongues?' from the perspective of transport mechanics. Three-dimensional, time resolved particle tracking velocimetry (PTV) experiments were conducted on a simple, rigid tongue model. The actual tongue has some compliance, like most organic tissue. The focus of this project lies in making a better physical model of the tongue, on which similar PTV experiments will be performed.

The flexible model is printed using a stereolithography (SLA) printer, with a flexible resin (FormLabs Flexible resin). This is attached to the shaft of a servo motor. The servo motor is sealed with a SLA – printed rigid box and silicone adhesive. This will allow underwater operation of the servo motor, replacing the old mechanism consisting of a heavy linear guide driven by a stepper motor. After testing, the new, lighter, and more physically accurate model will be used in the new experiments for investigating the fluid structure interactions. The results of this investigation could have implications in the wide and growing field of bio-inspired sensing.

Keywords:

Snake Tongue; Fluid Mechanics; Particle Tracking Velocimetry; Transport Mechanics; Bio-Sensors

Mentor(s):

Pranjal Anand (Engineering); Pavlos Vlachos (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7020

Presentation Time: STEW 214C at 10:40-11:00

Identity Negotiation among LGBTQ+ Youth Experiencing Housing Insecurity through a Localized Engineering Program

STEM

Authors(s):

Maerianna Jane Artang† (Engineering)

Abstract:

For LGBTQIA+ learners, especially those experiencing housing insecurity, a strong sense of self is both a protective factor and a form of resistance and liberation in spaces that seek to erase or marginalize their identities. Recent studies discuss "engineering" as a field fosters an exclusionary environment for members of the LGBTQIA+ community. Therefore, we seek to understand how LGBTQIA+ learners draw on their experience negotiating their identities when navigating the subject of engineering.

This ongoing research endeavor draws from a three-year Design-Based Research (DBR) initiative studying the Localized Engineering in Displacement (LED) curriculum, which integrates community-driven problem-solving with interactive digital environments and microelectronics. DeBoer Lab at Purdue has partnered with a transitional living home for LGBTQIA+ youth in Indianapolis facing housing instability. The partnership ensures that learners have agency in addressing their own community-relevant problems. Upon completion, the participating students and instructor were interviewed on their understanding of their identity and its relation to engineering.

Preliminary findings suggest that the LED program fosters deeper engagement, personal meaning, and agency, allowing the youth to form supportive relationships and develop critical social awareness. We anticipate our study to highlight the necessity of creating learning environments that not only recognize but actively celebrate the intersectional identities of LGBTQIA+ youth and youth facing housing insecurity. The potential of engineering to serve as a pathway to liberation must be predicated on the dismantling of oppressive norms, making space for all youth to engage with and shape the future of the field authentically.

Keywords:

STEM; Education; LGBTQ+; Identity; Engineering

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Dhinesh Balaji Radhakrishnan (Purdue University); Jennifer J DeBoer (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7021

Presentation Time: STEW 214D at 10:00-10:20

Sensory Synergy: How a Frog-Biting Mosquito Uses Multimodal Cues for Host-Seeking

STEM

Authors(s):

Anna Judy Lozen† (Science|JMHC)

Abstract:

Mosquitoes rely on an array of sensory signals, including visual, olfactory, and acoustic cues to accurately detect and locate their hosts. This multisensory integration enables mosquitoes, such as those that bite humans, to navigate their surroundings and pinpoint suitable targets with precision. However, little is known about the role of diverse sensory cues in host-seeking behaviors of mosquitoes who bite non-human animals, such as frog-biting mosquitoes. Species of mosquitoes specialized in frogs rely on the mating calls of their host for long-range host detection. While other host-emitted cues are available, how non-acoustic sensory cues influence close-range host-seeking is unclear. In this study, we hypothesize that the integration of sensory cues enhances close-range host localization. We predict that after detecting a calling frog using acoustic cues, Ur. lowii females use olfactory and visual cues to fine-tune their approach to their host. To investigate this phenomenon, we analyzed the host-seeking behavior of individual female mosquitoes exposed to cues across sensory modalities. These included visual cues provided by 3D frog models, olfactory cues from the scents of six anuran host species, and various combinations of visual, olfactory, and acoustic cues. Our preliminary results show that Ur. lowii exhibit shorter response latencies when exposed to visual, acoustic, and olfactory cues combined, suggesting that these mosquitoes use a multimodal approach to host-seeking. This study enhances our understanding of the crucial role that multimodal sensory integration plays in host recognition, while also revealing the broader strategies mosquitoes employ to accurately find their hosts.

Keywords:

Olfactory Cues; Visual Cues; Acoustic Cues; Host-Prey Behaviors; Host-Seeking

Mentor(s):

Ximena Bernal (Purdue University); Richa Singh (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7022

Presentation Time: STEW 214D at 10:20-10:40

Streamlining Proteomics Data Analysis: A Full-Stack Application and Statistical Pipeline for Enhanced Accuracy and Interpretation

Creative

Authors(s):

Nathan Xuheng Li† (Science); Vatsal Sanjeevkum Dudhaiya† (Engineering); Rachel Catherine D'Souza† (Engineering); Isaac Kojima Shane† (Science|Graduate); Tingyu Yin‡ (Science); Purav Matlia‡ (Science)

Abstract:

Proteomics and biomarker discovery depend on mass spectrometry (MS) data, but existing analysis workflows often require extensive manual intervention, introducing inefficiencies and potential biases. To address these challenges, we have developed an automated, user-friendly web application that integrates statistical techniques from our own Python library to enhance data preprocessing, hypothesis testing, and biomarker identification. Our platform provides guided recommendations for key preprocessing steps, including quality control, missing value imputation, normalization (single reference and median scaling), and variance-stabilizing transformations such as log2 conversion. Each step is accompanied by interactive visualizations to ensure transparency and reproducibility. The analysis module applies robust statistical inference methods, including normality testing (Shapiro-Wilk), homogeneity of variance tests (Levene's test), parametric (T-tests, ANOVA), and non-parametric alternatives (Mann-Whitney U, Kruskal-Wallis, Friedman tests), facilitating the identification of statistically significant biomarkers. Future integration of machine learning approaches will enable the detection of complex, multivariate patterns within proteomics datasets. The platform has been validated using Alzheimer's disease patient data and is designed for broader applications in biomarker discovery. By automating and standardizing proteomics workflows, this tool enhances efficiency, improves reproducibility, and will be made publicly available for scientific use.

Keywords:

Proteomics; Biomarker Discovery; Mass Spectrometry; Statistical Analysis; Full-Stack Application

Mentor(s):
Marco Hadisurya (Purdue University); Amirhesam Mashaollahi (Agriculture); Zhuojun Luo (Agriculture)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7023

Presentation Time: STEW 214D at 10:40-11:00

Identifying potential enhancers of regeneration after zebrafish spinal cord injury

STEM

Authors(s):

Nikhil Samit Sadavarte† (Science|JMHC); Kaitlyn Ying* (Science); Jonathan Minh-Tri Ngo* (Science); Manasa Gudugundla* (Science)

Abstract:

Department of Biological Sciences, Purdue University, West Lafayette, IN

Treatments for spinal cord injuries (SCI) remain a significant medical challenge, especially with respect to effective pharmaceutical interventions. Zebrafish, capable of responding to acute SCI with complete axonal regeneration, serve as an excellent model for investigating potential drug therapeutics. In this study, SCI was induced at 5 days post-fertilization through a precise incision that transected the spinal cord at the level of the posterior end of the swim bladder. Using a visual motor response (VMR) assay to assess swimming behavior 2 days post injury (dpi), a partial screen of an FDA-approved drug library was previously conducted to identify potential drug candidates that improve functional regeneration. Based on significant differences in functional recovery compared to vehicle-treated larvae, several promising enhancers of regeneration were identified such as pramipexole, a D2/D3/D4 dopamine receptor agonist, and several histone deacetylase (HDAC) inhibitors. Dose-response curves measuring the functional recovery of injured zebrafish were generated to determine ideal drug concentrations for enhanced recovery. Then, using the ideal concentrations, candidates were further evaluated using immunostaining and confocal microscopy to visualize axonal regrowth at the injury site. Through this study, we hope to establish key pharmacological enhancers of axonal regeneration in the zebrafish animal model system with the goal of informing future therapeutic strategies for SCI in humans.

Keywords:

Zebrafish; Spinal Cord Injury; Regeneration; Drug; Therapeutics

Mentor(s):

Daniel Suter (Purdue University)

Other Acknowledgement(s):
Beatriz Cren Colalillo (Science)

Talk Presentation Abstract Number: 7024

Presentation Time: STEW 218A at 10:00-10:20

Researching the Old Naval Observatory

Social Science

Authors(s):

Alyssa Marie Berger† (Polytechnic|JMHC); Marisa Rose Crescent† (Liberal Arts|JMHC)

Abstract:

This project, in collaboration with the Office of the Historian (FSI/OH) within the US Department of State, sought to uncover more details about the Old Naval Observatory's construction and establish whether it used enslaved people or indentured servants in the construction of the building. We utilized the information that was digitally documented by the Library of Congress (LOC) and the National Archives (NARA) to go over various documents relevant to the Observatory's construction and the current state of slavery at the time. Furthermore, in September of 2024, we traveled to Washington, D.C., to visit and review the records of the Library of Congress (LOC) and National Archives (NARA). Through our research, we have noted a variety of indications against the use of slave labor, including the surrounding perception of slavery as displayed by the United States Navy and the individual stances of important observatory personnel involved in the construction. Moving forward, interested parties may move to highlight the building’s history as a historic landmark while remaining aware of its scientific global contributions. Despite its closure in 1893, the facility remains a catalyst for oceanographic and astronomical advancements alike. This research underscores the importance of clarifying the site’s origins and ensuring an accurate historical narrative regarding its construction.

Keywords:

Cultural Heritage; Historic Preservation; Old Naval Observatory; History; Washington, DC

Mentor(s):

Ashima Krishna (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7025

Presentation Time: STEW 218A at 10:20-10:40

Assessing Learning Gains in Energy-Focused Research Experience for Undergraduates (REU) Program

STEM

Authors(s):

Rhea Dutta† (Engineering|JMHC)

Abstract:

The NSF (National Science Foundation) REU (Research Experiences for Undergraduates) programs aim to provide students with hands-on research experiences across science and engineering disciplines. This study assesses participant learning gains in skill development and research understanding after an energy-focused REU program. Over three years, a total of 39 participants (15 during Year 1, 10 during Year 2, and 14 during Year 3) participated in the REU program, completing an overview intensive week and then completing weekly tasks while working on an applied-energy research project assigned by advisors. Participants consisted of undergraduate students from primarily minority-serving institutions across the United States. The program duration varied across the years (10 months during Year 1 and 10 weeks during Year 2 and Year 3). Participants completed a retrospective pre-then-post Qualtrics survey to assess learning gains across the categories of (1) Entrepreneurial Competencies, (2) Career Goals, and (3) Research Skills Development. A paired-sample Student's T-test was conducted with an alpha value of 0.05 to determine statistical significance across survey items. Across the learning gain categories, the total statistically significant items of perceived learning gains were 13, 11, and 21 for the end of each study year, respectively. A cumulative analysis for the program yielded a total of 24 items. Diverse mindsets across engineering research disciplines can be promoted within higher education through strengthening undergraduate research (UR) advocacy groups and university programs. Group aims can extend from being conduits to under-represented minority students to strengthening individuals' research knowledge and skills development.

Keywords:

REU; Diverse Mindset; Learning Gain Assessment; Energy-Focused

Mentor(s):

Lisa B Bosman (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7026

Presentation Time: STEW 218A at 10:40-11:00

Ecological impact of deer control hunts on wildlife activity in Indiana

STEM

Authors(s):

Antonia Christina Alexiou† (Science|JMHC); Katie Luo Hong* (Agriculture); Abigail Rose Malott* (Agriculture|JMHC); Vaishnnavi Purram* (Exploratory Studies|JMHC|Other); Anaey Gaurang Naik* (HHS|JMHC)

Abstract:

Throughout Indiana, human involvement has significantly impacted ecosystem dynamics by facilitating a decrease in natural predators and an increase in food abundance that has resulted in higher white-tailed deer (Odocoileus virginianus) populations throughout the state. Due to concerns about the impact of high deer densities on the environment, such as habitat degradation, reduced biodiversity, and overgrazing, November deer control hunts are used as a primary management system for maintaining white-tailed deer populations. Previous studies have shown that these hunts are successful, allowing for the recovery of vegetation communities decimated by deer overpopulation. However, regardless of the well-documented research on the benefits of deer control for native vegetation, little is known about the broader impact of deer control hunting on native wildlife biodiversity. To address this gap, we aim to determine the impact of deer control hunts on other wildlife species within Indiana ecosystems. Using a combination of camera traps and acoustic recording data gathered from hunted and non-hunted sites throughout four seasons, we aim to determine the relationship between deer activity and the activity of other wildlife, with a focus on small mammals. We predict the presence of deer control hunts will lead to an increase in small mammal activity in hunted areas, as a possible result of lower deer densities leading to decreased resource competition and improved vegetative conditions. In general, we aim to contribute to an overall understanding of how deer control hunts can further impact ecological communities on a broader scale.

Keywords:

Deer; Hunting; Biodiversity; Wildlife Management; Ecosystem

Mentor(s):

Kristen Marie Bellisario (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7027

Presentation Time: STEW 218B at 10:00-10:20

Data Mining for CityBus Ridership

Business Case Study

Authors(s):

Neha A Venkatraman† (DSB); Esther L Larson† (DSB|JMHC); Jaden R Azar† (DSB); Harshini Malarvannan† (DSB)

Abstract:

This project aims to analyze current ridership data of the CityBus transit system to identify trends that influence ridership numbers. By examining factors such as stop popularity, peak usage times, and route usage, the study will pinpoint areas for improvement. The ultimate goal is to develop strategic recommendations that align with CityBus's mission to operate safe, reliable, and cost effective transit services, to better serve the Greater Lafayette area. The data used to conduct this project is ridership data from CityBus for the years 2022 and 2023 and 22 routes (past and current) are analyzed to develop solutions. We use tools such as Python and Excel to visualize trends.

Keywords:

Data Mining; Descriptive Analytics; Prescriptive Analytics

Mentor(s):

Xing Wang (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7028

Presentation Time: STEW 218B at 10:20-10:40

Enhancing Healthcare Decision-Making with Explainable Generative AI

STEM

Authors(s):

Chase Nicholas Hamdan† (Engineering); Yash Rajendra Ashtekar† (Engineering); Utkarsh Bali† (Science)

Abstract:

This project develops a generative AI-powered conversational chatbot designed to assist healthcare operations professionals in analyzing complex data and its derived machine learning models. By enabling doctors, nurses, and administrators to engage with models through intuitive, scenario-based queries, the chatbot enhances decision-making by delivering real-time, model-driven insights in a natural language format.

Our approach integrates machine learning models trained on healthcare operations data with large language models (LLMs) to analyze user queries and generate reasoned responses. By leveraging explainability techniques such as SHAP values, the chatbot ensures transparency in predictions while providing clear justifications for its outputs. Additionally, the chatbot supports “what-if” scenario analysis, allowing practitioners to explore potential outcomes interactively.

Our recent work has focused on enhancing performance, explainability, and accessibility. To optimize efficiency, we have experimented with GPT, DeepSeek, and Llama models, evaluating the cost-to-performance tradeoff. On the backend, we have significantly expanded the chatbot’s functionality, particularly enhancing its ability to generate intuitive visual plots for improved data interpretation. For explainability, we employ Topic Clustering and Chain-of-Thought prompting, enabling the chatbot to decompose complex queries into structured reasoning steps. Additionally, we have developed a user-friendly front-end interface, making interactions seamless for healthcare professionals.

Preliminary results indicate improved precision, expanded functionality, and clearer AI-driven explanations, reinforcing the chatbot’s potential to facilitate informed decision-making. By integrating explainable AI techniques and visual analytics, this research introduces an innovative tool to bridge the gap between complex data models and healthcare

professionals, ultimately enhancing clinical decision-making efficiency and operational workflows.

Keywords:
Generative AI; Healthcare Operations; Explainable AI; Chain-of-Thought Prompting; Topic Clustering

Mentor(s):
Pengyi Shi (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7029

Presentation Time: STEW 218B at 10:40-11:00

Smart Cookies: A Predictive Approach to Girl Scout Cookie Sales

Business Case Study

Authors(s):

Gabriel Morales Nunez† (Science); Rishita Korapati† (DSB)

Abstract:

This project aims to enhance cookie sales forecasting for the Girl Scouts of Central Indiana by refining their approach to predicting future demand. Currently, their forecasting method relies on a simple, naive model that uses the previous year's sales data, which explains approximately 70% of sales variation. While this provides a basic benchmark, it leaves room for improvement as it does not adequately address the complexity and variability inherent in sales dynamics.

Addressing these limitations, this study employs time series forecasting techniques using comprehensive data collected from 1,000 Girl Scout troops over five years. The project explicitly incorporates crucial variables such as troop participation rates, regional market dynamics, and seasonal demand fluctuations. By thoroughly analyzing and integrating these factors, the new predictive models achieve superior accuracy compared to the existing method, with results above 80% in the current tests.

Effective inventory management is fundamental for maximizing fundraising outcomes. Underestimating cookie demand results in lost sales opportunities, whereas overestimating leads to surplus inventory, increased costs, and potential financial losses. The enhanced predictive analytics model developed through this project equips troops with actionable, data-driven insights. Consequently, troops are empowered to make precise, informed decisions when placing initial cookie orders.

Ultimately, this strategic approach fosters greater efficiency by minimizing surplus inventory, optimizing sales potential, and improving overall fundraising effectiveness. This project establishes a robust foundation for intelligent forecasting and resource allocation, significantly enhancing preparedness and reducing financial risk for the Girl Scouts of Central Indiana. The implications of this model extend beyond immediate forecasting needs, providing a framework for future analytical advancements within the organization.

Keywords:
Time Series Analysis; Cookie Sales Forecasting; Girls Scouts Central Indiana; Predictive Modeling; Fundraising Optimization

Mentor(s):
Davi Cordeiro Moreira (Purdue University)

Other Acknowledgement(s):
Ramya Chowdary Polineni (DSB)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7032

Presentation Time: STEW 218C at 10:40-11:00

Effects of Colostrum or Milk Replacer Feeding on Sertoli Cell Proliferation and Seminiferous Tubule Area of Neonatal Male Piglets

STEM

Authors(s):

Addison Mae Hill† (Agriculture); Lily Grace Blythe‡ (Agriculture)

Abstract:

Low intake of colostrum is linked to decreased fertility of boars due to low sperm production at sexual maturity. The number of Sertoli cells in testes drives sperm production, and their proliferation primarily occurs in the first days postnatal and during puberty. Currently, there is little understanding about how colostrum mediates proliferation of Sertoli cells. The objective of the study was to determine the effect of colostrum versus milk replacer feeding on Sertoli cell proliferation in piglets 24 hours postnatal. We hypothesized that colostrum fed piglets will have greater Sertoli cell proliferation and greater tubule area compared to milk replacer fed. 47 male piglets were assigned to: colostrum (COL), milk replacer (MR), MR + whey protein (MRW), zero-hour (ZH), and stay-on-sow (SOS) treatments. COL, MR and MRW were bottle fed every 2 h for 24 h for diet intake of 20% of birth body weight and were euthanized at 24 h postnatal. SOS received ad libitum colostrum and euthanized at 24 hours whereas ZH was euthanized immediately after birth. Testes were collected and fixed in formalin for immunohistochemical Ki67 staining, and images were captured under light microscopy to measure the percent Ki67 positive Sertoli cells and area of seminiferous tubules with ImageJ software. Preliminary analysis of n=3 pigs per treatment indicated a tendency for COL feeding to increase seminiferous tubule diameter compared to MR ($P = 0.07$), but there was no difference in the percentage of proliferating Sertoli cells or area of seminiferous tubule ($P>0.05$). Data analysis is still ongoing.

Keywords:

[no keywords provided]

Mentor(s):

Theresa M Anderson (Purdue University); Linda Marie Beckett (Purdue University)

Other Acknowledgement(s):

Kara R Stewart (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7033

Presentation Time: STEW 214B at 11:00-11:20

Using Reinforcement Learning for Automating Robot Path Planning in Manufacturing

STEM

Authors(s):

Aditya Manoj Nair† (Engineering)

Abstract:

This project aims to develop a tool and framework that leverages reinforcement learning (RL) to automate robotic manipulator tool path generation for manufacturing tasks. Currently, manual programming, adjusting, and validating robot paths consumes significant time and resources. The goal is to reduce this effort by creating an AI-driven solution that automates the motion planning process.

The project will begin with a literature review of current research, technologies, and commercially available products related to robotic motion planning. It will then explore enabling technologies, including the Robot Operating System (ROS), MoveIt, Open Motion Planning Library, Bullet Physics SDK (PyBullet), Gazebo simulator, and Gymnasium for reinforcement learning.

The core task will involve developing a simulation environment where RL algorithms, such as Q-Learning, can be applied to generate robot motions. The expected outcome is a software pipeline that can: (1) generate robot motions on demand for training the RL model, (2) allow the RL model to be trained, and (3) use the trained model to generate motion plans in a predefined environment.

This framework has the potential to significantly streamline the process of robot motion planning in manufacturing, reducing the need for manual intervention and improving efficiency. The project will offer a valuable foundation for future developments in AI-driven robotics in industrial applications.

Keywords:

Robot Operating System; Gazebo

Mentor(s):

Jaeeun Kim (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7034

Presentation Time: STEW 214B at 11:20-11:40

Utilizing the CycleGAN Architecture for Motion-Correction in HR-pQCT Imaging

STEM

Authors(s):

Anika Mathur† (Science)

Abstract:

[Abstract Redacted]

Keywords:

HR-pQCT; Generative Adversarial Network; Bone Microstructure; Domain Adaptive Motion Correction

Mentor(s):

Farhan Sadik (Engineering); Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7035

Presentation Time: STEW 214B at 11:40-12:00

Synthetic Data Generation for Enhanced Electric Vehicle Charging Demand Prediction

STEM

Authors(s):

Jaewon Cho† (Engineering); Alexa Joan Noto† (Engineering); Akanksh Rao† (Engineering); Ankitha Mallekav† (Engineering); Hyunsang Cho‡ (Engineering)

Abstract:

As electric vehicle (EV) adoption accelerates, accurate demand forecasting for charging stations is becoming increasingly important. However, the scarcity of granular public data presents a significant challenge. This study addresses this issue by developing a synthetic data generation framework using TimeGAN, Gaussian Mixture Models (GMM), and Exponential Smoothing (ETS) on EV traffic data from the I-210 corridor, sourced from Caltrans PeMS. After evaluating correlation coefficients, TimeGAN emerged as the most reliable model. Additionally, this study integrates CAISO data from 2018–2024 to analyze energy pricing trends, weather patterns, and external factors. By combining synthetic EV traffic data with energy market analysis, we construct a robust dataset that supports advanced optimization algorithms for charging station placement, energy distribution, and dynamic pricing strategies. This dataset is then fed into the TimeGAN model to generate improved synthetic data, further enhancing the scalability and efficiency of EV infrastructure.

Keywords:

Synthetic Data Generation; EV Charging Demand Prediction; TimeGAN; Energy Market Analysis; Time-Series Traffic Data

Mentor(s):

Sivaranjani Seetharaman (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7036

Presentation Time: STEW 214C at 11:00-11:20

Enhancing Diagnostic Accuracy of Atrioventricular Valve Regurgitation in Single Ventricle Hearts Using Machine Vision Algorithms

STEM

Authors(s):

Haseung Jun† (Engineering|JMHC)

Abstract:

Heart valve diseases are prevalent worldwide, particularly in patients with congenital heart defects. Single ventricle (SV) defects, where only one pumping chamber develops properly, often involve atrioventricular valve regurgitation (AVVR), affecting nearly 75% of cases and causing backward blood flow. AVVR severity is primarily assessed qualitatively using echocardiography (echo), as existing tools are designed for adults with biventricular hearts and do not account for the complex morphology and hemodynamics of SV hearts. Additionally, echocardiogram analysis relies on heuristic, operator-dependent measurements, introducing variability and reducing diagnostic reliability. Accurately resolving AVVR characteristics remains a challenge for cardiologists.

This study presents an automated echocardiogram analysis approach, incorporating advanced machine vision algorithms to improve valvular regurgitant flow quantification. This tool enhances jet resolution and enables automatic measurement of parameters such as regurgitant volume, effective regurgitant orifice area, jet area-to-atria area ratio, and proximal isovelocity surface area (PISA), reducing variability. It also quantifies novel indirect flow parameters, such as flow energy loss, which may provide a more sensitive assessment of regurgitation severity.

We apply these tools to analyze a population of SV patients at two stages—before and after the Fontan procedure—to evaluate medium-term changes in AVVR severity post-surgery. Our findings demonstrate that these automated tools effectively characterize patient AVVR. This technology provides a reliable, standardized method for evaluating echocardiographic scans, reducing operator bias and improving clinical efficiency. By streamlining valvular regurgitation analysis, this approach supports more accurate and objective decision-making in congenital heart disease management.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
[no keywords provided]

Mentor(s):
Brett A Meyers (Purdue University); Pavlos Vlachos (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7037

Presentation Time: STEW 214C at 11:20-11:40

Embodied Learning in Statistics: Using Gestures to Enhance Statistical Reasoning of Regression and Correlation

STEM

Authors(s):

Zhengyi Jiang† (Science); Manas Kathuria* (Engineering); Aashvi Miten Majmundar* (Engineering)

Abstract:

Several students struggle with understanding fundamental statistical concepts such as regression, correlation, distribution and best-fit lines. These concepts are pivotal to success in STEM education, scientific application, and data-driven decision-making. A strong foundation in STEM education is essential for students beginning in K-12 and for matriculation into undergraduate careers in engineering, computer science, and other technological fields. Statistics is a fundamental area of study and cuts across STEM, finance and humanities while playing an important role in developing students' ability and interest to analyze data, make evidence-based decisions, and solve real-world problems. Prior research in embodied learning highlights the benefits and role of embodied cognition in developing STEM learning, through gestures in teaching and learning. This is because gestural learning shows evidence of supporting students' understanding, providing additional sensory and cognitive clues and support instructions. However, sparse research delved into the application of cueing gestures and how students' intuitive gestures connect to their ideas, and reasoning in statistics.

This study explores first-year engineering students' understanding of linear regression, correlation and delving into their interpretation Best-Fit lines through both embodied expressions of gestures and verbal explanations. We analyze students' reasoning processes in interviews and categorize their spontaneous gestures based on McNeill's gesture framework. Preliminary results indicate students used embodiment and cueing gestures to convey their understanding of statistical concepts, these findings provide evidence of the potential benefits of embodied learning and teaching in statistics and STEM education and enhancing undergraduate students' comprehension and applications of important statistical fundamental concepts.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
STEM Education; Gestural Learning; Regression Analysis; Correlation; Embodied Cognition

Mentor(s):
Jason Wade Morphew (Purdue University); Junior Anthony Bennett (Interdisciplinary & Special Programs)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7038

Presentation Time: STEW 214C at 11:40-12:00

Acoustic Levitation for Additive Manufacturing

STEM

Authors(s):

Quintin David Dumouchelle† (Engineering)

Abstract:

Powder bed fusion (PBF) is a type of additive manufacturing (AM) that uses a laser to sinter powder particles together. During PBF, particles are sintered to a baseplate that acts as a heatsink, resulting in residual stresses in the final part. A proposed method to study the sintering of powder without a baseplate is acoustic levitation. Acoustic levitation is the method of using sound waves to suspend matter in mid-air through acoustic radiation pressure. One version uses a set of transducers and a reflector to generate a standing pressure wave to trap particles. This study focuses on optimizing current standing wave levitation techniques to enable the levitation of metal powder for sintering. In other words, the goal is to achieve “bed-less” PBF through acoustic levitation. Current constructions of acoustic levitators can only suspend particles that are either very small, spherical, or low in density. However, by developing an accurate model of a levitator’s pressure, a simulation can be optimized to output the necessary parameters to induce the levitation of larger and heavier objects. For this purpose, a MATLAB simulation was developed that uses acoustic radiation pressure and relative positioning to model the pressure field of a small levitator. This simulation also predicts the “lift capacity” of the levitator at each point along the standing wave. The next stage of this research involves optimizing the simulation to solve for the necessary inputs (voltage, frequency, etc.) that results in the levitation of enough powder to be suitable for “bed-less” PBF.

Keywords:

Acoustic Levitation; Additive Manufacturing; Powder Bed Fusion; Lift Capacity

Mentor(s):

Michael P Sealy (Purdue University); Luz Sotelo (Purdue University)

Other Acknowledgement(s):

Jacey Rebecca Birkenmeyer (Engineering)

Talk Presentation Abstract Number: 7039

Presentation Time: STEW 214D at 11:00-11:20

Multi-step Enzymatic Retrosynthesis using Monte Carlo Tree Search

STEM

Authors(s):

Danny Andre Thornewell† (Science)

Abstract:

Enzymatic synthesis provides a promising avenue for drug development and production; however, the inherent complexity of identifying feasible reaction pathways presents significant challenges for traditional synthetic planning. This study introduces a novel application of Monte Carlo Tree Search (MCTS) to facilitate efficient multi-step enzymatic retrosynthesis.

We employ RDEnzyme, a single-step retrosynthetic tool for enzymatic reactions, to generate all possible precursor reactions, which are then stored for later use in MCTS. We represent these reactions using an AND/OR tree framework. Here, AND nodes (representing reactions) encode the necessary precursor combinations, while OR nodes (representing chemicals) capture all possible reactions.

Given the expansive search space inherent to retrosynthesis, which is characterized by a high branching factor and medium depth, traditional brute-force methods quickly become computationally expensive and impractical. MCTS addresses this challenge by employing a heuristic, probabilistic approach. At its core, MCTS iteratively performs four key steps: selection, expansion, simulation, and backpropagation, which come together to provide each chemical with a likelihood of being part of a pathway. This iterative process enables the algorithm to intelligently focus on promising routes while effectively pruning unproductive pathways.

Notably, MCTS reduces computational time from a brute force approach of over 22 hours to roughly 10 minutes for complex multi-step synthesis, highlighting its scalability and efficiency. This process recovers experimentally validated synthesis routes and uncovers several alternative pathways, thereby offering a powerful tool for synthesis planning and optimization.

Keywords:

Enzymatic Retrosynthesis; Monte Carlo Tree Search (MCTS); Drug Synthesis; Computational Chemistry

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):

Karthik Sankaranarayanan (Purdue University); Olga Costa Alves Souza (Interdisciplinary & Special Programs)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7041

Presentation Time: STEW 214D at 11:40-12:00

Artificial Intelligence in Music - Computer Vision

STEM

Authors(s):

Gurtej Singh Bagga† (Science); Paige Lorenz† (Science); Michael X Zhang† (Engineering); Yumin Kim‡ (DSB); Aneesh Pendyala‡ (Science); Hanako S Keney‡ (Science); Han Li‡ (Science); Dinmukhamed Mukhtar Tynysbay‡ (Science); Jackson Patrick Shields‡ (Science); Benjamin Joseph Taylor‡ (Engineering|JMHC); Trevor Mission Ju‡ (Engineering); William P Jiang* (Science|JMHC); Shrinand Perumal* (Science)

Abstract:

This study presents an interactive application that helps string musicians correct their playing posture. By detecting posture deviations in real time, this research enables musicians to practice with guided feedback anytime, anywhere, while reducing the risk of injury.

The application records musicians using their camera, using Google's MediaPipe framework to precisely track the location of musicians' fingers and a custom-trained model to classify the correctness of the bow grip. Simultaneously, a custom-trained YOLOv8 model detects the key components of the instrument – the hair of the bow & playing length of the string. The evaluation of posture is achieved by comparing the relative locations of these components to that of sample performers in video training data. The result of this comparison, such as whether a bow is currently too high or low, is instantly displayed on the screen.

Despite the potential of AI in music training, a recent online survey found that only 1 out of 57 musicians regularly use AI technology, with most unaware of its applications in their field. The completion of this project can imply whether AI technology is ready to transform musical training and examine the extent to which musicians are willing to integrate AI technology in their practice/performance.

Keywords:

Computer Vision; Image Processing; Artificial Intelligence; String Musicians; Object Recognition

Mentor(s):

Yeon Ji Yun (Purdue University); Yung-Hsiang Lu (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7042

Presentation Time: STEW 218A at 11:00-11:20

Cultivating Cultural Awareness and Professional Growth: Reflections on Internship Experiences at Purdue's AAARCC.

Humanities

Authors(s):

Jae Yon Kim† (HHS)

Abstract:

This paper is a reflection of an undergraduate intern from the Human Development and Family Studies (HDFS) department with a placement at the Asian American and Asian Resource and Cultural Center (AAARCC). It details the student's transformative journey through a semester-long internship to foster cultural awareness, holistic success, and professional growth. Initially unaware of Purdue's five cultural centers, this internship has provided valuable insights about identity, academic success, and career readiness.

As an international student at Purdue, and specifically as a Korean, this internship has how I understand my and others' identity, embracing the diverse Asian cultures and recognizing the interconnectedness of our shared yet distinct experiences. Daily work with individuals from various Asian backgrounds allows me to explore the complexities of traditions and social dynamics within the Asian diaspora. As an undergraduate student in HDFS, this internship provides me with direct applications of my studies of how cultural contexts shape individual and family experiences and the importance of creating inclusive environments that honor diverse perspectives. Through this role, I can connect theoretical knowledge with real-world practices, enhancing my ability to support individuals and communities in culturally responsive ways.

As a senior getting ready to get into the professional world, the internship contributes to my world readiness by gaining active listening skills and time management from colleagues and coworkers. AAARCC has many programming events and partnerships, and thus it is important to listen actively and grow in time and project management to successfully implement the center programming.

Keywords:

AAARCC; Cultural Center

Mentor(s):

Pamela Sari (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7043

Presentation Time: STEW 218A at 11:20-11:40

The Inclusive Space Project: Adapting Physical Lab Spaces to Serve All Students

Humanities

Authors(s):

Frances Margaret Bajorat† (HHS|JMHC)

Abstract:

The Inclusive Space Project (ISP) aims to create affordable physical research lab spaces that promote the success of all students - both neurodiverse and neurotypical. This project began with a preliminary survey in order to assess the diverse needs of students in the lab space and how these needs impact their productivity and sense of belonging. Following this, a literature review was conducted to identify evidence-based interventions that foster neuro-inclusivity in physical spaces. These interventions were then implemented in the lab space and a second survey was administered to assess impact. Notably, 50% of the lab members reported that the physical lab space at the time of the preliminary survey “very negatively affected” their sense of belonging. Based on the feedback from lab members and insights from the literature, we found that providing a variety of seating options, customizable lighting, introducing more greenery, and increasing organization in the lab space enhanced a sense of belonging and productivity in lab members. These findings underscore the importance of intentional design that works to prioritize meeting the needs of students in order to create environments where individuals feel supported, valued, and are best able to thrive.

Keywords:

[no keywords provided]

Mentor(s):

A.J. Schwichtenberg (Purdue University); Amy Janis (HHS); Moon Rae West (HHS)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7044

Presentation Time: STEW 218A at 11:40-12:00

Title: Sex Differences in Social Isolation Effects on Compulsive Related Behavior in Crossed High Alcohol Preferring Mice

Social Science

Authors(s):

Caitlin Alexandra Williams† (HHS)

Abstract:

Authors: Caitlin Williams, Soyol Enkh-Amgalan, Julia A. Chester

Obsessive-Compulsive Disorder (OCD) and Alcohol Use Disorder (AUD) are highly comorbid, with compulsive-related behaviors potentially reflecting a shared underlying phenotype. Stress exposure increases compulsive-related behaviors and alcohol drinking. We used crossed high-alcohol preferring (cHAP) mice, which voluntarily drink binge-like levels of alcohol, to examine how adolescent social isolation stress affects compulsive-like alcohol drinking [quinine aversion-resistant drinking (QARD)] and sensorimotor gating [pre-pulse inhibition (PPI)], which controls processing of irrelevant stimuli. cHAPs were socially-isolated (SI; F = 12, M = 10) or group-housed (GH; F = 11, M = 10) for 28 days from mid-adolescence (PND 42-44) to adulthood (PND 77-79). Then, PPI was tested three days before and one day after QARD. For QARD, intakes were measured at 30 min, 2 hr, and 5 hr during the 5-hr access to 20% alcohol with different daily quinine concentration (100 mg/L, 320 mg/L, 740 mg/L; increasing across 3 days), followed by a day of 20% alcohol in tap water only. Higher quinine concentrations reduced alcohol intake in both males and females compared to the 100 mg/L concentration (5-hr total; $p<0.05$). SI males drank more 100 mg/L quinine-adulterated alcohol than GH males at the 2-hr time point; females showed a similar, non-significant; trend and overall showed more QARD than males. For PPI, there were no effects of housing, but females showed significantly reduced PPI after QARD. These results suggest that social isolation stress may increase compulsive alcohol drinking behavior in males susceptible to high-alcohol consumption.

Keywords:

Alcohol Use Disorder; Obsessive-Compulsive Disorder; Social Isolation; Crossed High Alcohol Preferring Mice; Sex Differences

Mentor(s):

Julia Chester (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Soyol Enkh-Amgalan (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7045

Presentation Time: STEW 218B at 11:00-11:20

Human vs. AI: Efficacy of LLMs in Performing Thematic Analysis

STEM

Authors(s):

Jose Jorge Bueso† (DSB); Vidya Reddy Madana† (Science)

Abstract:

Thematic analysis is widely used in qualitative research methods to conduct textual data analysis. Large language models (LLM) have gained popularity due to the rise in AI tools and its ability to simplify human tasks. LLMs' growing ability to process and understand textual data at-par with human capabilities present opportunities to automate qualitative analysis. This study explores the development of structured prompts to guide the LLMs to systematically conduct thematic analysis. Our strategy to develop prompts replicates the standard methodology to conduct thematic analysis and then we structure these prompts using CLEAR framework. The goal of this study is to design and test prompts that generate accurate and effective themes for qualitative data analysis and compare the findings with the human generated themes. The study will also examine the strengths and weaknesses of using LLMs in thematic research. For this study, we use survey data collected from senior year students in a spreadsheet modeling and simulation course to measure their metacognitive knowledge and regulation strategies.

Keywords:

AI; LLM; Thematic Coding; Analysis; Management

Mentor(s):

Prateek Jaiswal (Purdue University); Aparajita Jaiswal (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7046

Presentation Time: STEW 218B at 11:20-11:40

Analysis of Rental Markets at Big Ten Universities

Social Science

Authors(s):

Jakub John Jasinski† (DSB)

Abstract:

This research examines the influence Big Ten universities have on rental markets in their respective areas, focusing on both student and local populations. Using data from Big Ten universities and their surrounding communities, this study analyzes how enrollment, tuition, and on-campus housing availability have impacted rental prices at the county and zip code levels from the 2010 academic year onward. Regression models with fixed effects are employed to isolate the effect of each university. Preliminary findings suggest that college towns with Big Ten universities exhibit greater disparities in real rental prices than their state. After a tuition freeze at Purdue University, real rental prices stayed relatively constant from the 2013 academic year until the COVID-19 pandemic. The real rental price increases with the real tuition price but following the COVID-19 pandemic, the real tuition price stays relatively constant while the real rental price increases. This study investigates whether tuition prices have a prominent effect on rental prices and the market. By identifying patterns in rental price fluctuations, this study provides a framework for anticipating and addressing future housing market pressures as higher education institutions evolve. The findings aim to provide insight into the affordability challenges faced by students living off-campus and residents in university-adjacent areas.

Keywords:

Economics; University; Housing

Mentor(s):

Michael Donald Eriksen (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7047

Presentation Time: STEW 218B at 11:40-12:00

Crypto-Mining Integrated Software

STEM

Authors(s):

Jonathan S Carr† (Engineering); Samuel Joshua McBroom† (DSB)

Abstract:

Our team has been presented with a Raspberry Pi 4B. We sought to test a remote desktop feature, where we could run and manipulate a program remotely on a Raspberry Pi from a Windows computer. This exists, but we challenged ourselves to do it on our own. We plan on using secure shell (ssh) through a local terminal and using the XMRig platform to connect and manipulate the hardware. XMRig is a platform for mining Monero, and although we've never mined crypto, we thought it would be cool to try it while we're already using the platform. we will not be making any money, and we won't bother setting up a crypto wallet, but it will be an engaging project to better comprehend secure shells, cryptography, and secure network creation.

Keywords:

Raspberry Pi; 64-Bit; XMRig; Remote Desktop; Crypto

Mentor(s):

Stewart F Bauserman (Polytechnic); Steven R Dunlop (Purdue University); Saanvi Singh (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7048

Presentation Time: STEW 218C at 11:00-11:20

Comparative measurement of sow shoulder sore response to common and novel treatments

STEM

Authors(s):

Abagayle Caitlin Wright† (Agriculture); Lilly Cathleen Thomas* (Agriculture)

Abstract:

Shoulder sores form on sows during early lactation. The objective of this study was to test the efficiency of three different topical medications in healing sow shoulder sores. A total of 80 sows from day 0 to 15 of lactation, were blocked by farrowing date, parity, and initial sore size and randomly assigned to receive no treatment (CON, n=21), Mendicin (n=19), Healicin (n=20), or BarrierII (n=20). The treatments were applied to the sores for five days. Images of shoulder sores were taken with a ruler on days 0, 7, and 14. The direct surface area of the sores were calculated using an irregular area calculator app (SketchAndCalc®). Data were analyzed using the MIXED procedure in SAS 9.4 (Cary, NC) with treatment and parity class as the main effects and repeated measures for sore measurements by day with sow as a random effect within block. The change in sore size from day 0 to day 7 was greater in sows with no treatment or BarrierII than in sows treated with Mendicin or Healicin (2.08 vs 3.10 vs -0.33 vs -0.7

Keywords:

Lactation; Sow; Shoulder Sore; Treatment

Mentor(s):

Allan Schinckel (Purdue University); Andrew James Fisk (Purdue University)

Other Acknowledgement(s):

Will Jacob Getz (Purdue University)

Talk Presentation Abstract Number: 7049
Presentation Time: STEW 218C at 11:20-11:40

Balancing Science and Society: A Solution for Long-term Nuclear Waste Management, Finland's Onkalo Deep Geological Repository

Social Science

Authors(s):
Abigail Elizabeth Preston† (Engineering)

Abstract:
Safe, long-term storage of spent nuclear fuel remains a pressing global issue, with widespread public opposition preventing progress in many countries. This research examines the nuclear waste siting process by focusing on Finland's Onkalo deep geological repository, the first of its kind in the world. How did Finland reach this solution while other governments have faced opposition and delays? Finland's success stems from a combination of technical feasibility, longstanding public trust, and a structured decision-making process. Finland integrated public engagement from the outset, ensured transparency, and fostered local support through economic incentives and community involvement. Comparative analysis of less successful repository siting efforts in other countries underscores these key factors in Finland's success. Relevant data was collected from policy documents, technical reports, public opinion studies, and industry publications. Even in Finland, challenges remain, including ethical concerns over intergenerational responsibility and long-term repository monitoring. Future research should explore the applicability of Finland's model in other sociopolitical contexts and whether deep geological disposal can be widely replicated as a global standard.

Keywords:
Repository; Onkalo; Nuclear; Waste; Public Opinion

Mentor(s):
Austin Rory Cooper (Purdue University); Miriam Marina Barnum (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7050

Presentation Time: STEW 218C at 11:40-12:00

The Black Genealogical Research Project: Hill-Williams-Coleman Family of South Bend

Humanities

Authors(s):

NahShon Zion Williams† (Liberal Arts)

Abstract:

Genealogical research on African American ancestry presents unique challenges due to historical factors such as slavery, segregation, and limited documentation. This study explores these complexities by tracing my own family lineage (Hill-Coleman-Williams) using a combination of online and in-person archival research. The first phase focused on digital resources, including Ancestry.com and FamilySearch, to establish a foundational family history. Subsequent research involved visits to archives in Florida and Mississippi—states with deep family ties—to uncover additional records. This study provides a valuable framework for Black Americans pursuing genealogical research, highlighting effective methodologies while acknowledging the obstacles inherent in reconstructing ancestral histories.

Keywords:

Genealogy; Black History; History; Black Heritage; African American

Mentor(s):

Ashima Krishna (Purdue University)

Other Acknowledgement(s):

Scotty Secrist (Purdue University)

Talk Presentation Abstract Number: 7051

Presentation Time: STEW 214B at 12:00-12:20

Investigating the role of cell-cell communication and size in Calcium wave propagation

STEM

Authors(s):

Kenneth David Siefken† (Engineering)

Abstract:

Cell-cell communication plays an important role in signal propagation across tissues, particularly through second messengers like calcium (Ca2+). The spread of Ca2+ in response to an external stimulus varies across biological systems often facilitated by gap junctions in animal cells[1] and plasmodesmata in plants[2]. Ca2+ dynamics can also affect permeability, thereby influencing intercellular transport[3]. A popular mechanism of Ca2+ wave spread is Ca2+-Induced Ca2+ Release (CICR). The mechanism has been extensively used to study multiple biological systems[4]. However, the models fail to address the impact of cell-cell communication and size heterogeneity on wave propagation. The current models also fail to account for stochasticity in gating mechanisms of these Ca2+ channels that supplement wave propagation.

In this work, we extend the traditional models by developing a hybrid computational framework that combines the finite difference method (FDM) for solving reaction-diffusion processes with an agent-based model (ABM) to represent discrete components, such as Ca2+ channels and plasmodesmata. This approach allows us to systematically evaluate how variations in cell size and permeability influence Ca2+ wave dynamics within tissues. Additionally, we explore potential gating mechanisms that regulate intercellular Ca2+ transport, linking Ca2+ concentration to the dynamic permeability of cell-cell junctions.

Our findings provide new insights into the interplay between cell size, communication pathways, and gating mechanisms, with implications for understanding signal transduction in both plant and animal tissues. This model offers a versatile tool for studying Ca2+ signaling in complex multicellular systems.

References:

1. Goodenough DA, Paul DL. Gap junctions. Cold Spring Harbor perspectives in biology. 2009 Jul 1;1(1):a002576.

2. Lucas WJ, Wolf S. Plasmodesmata: the intercellular organelles of green plants. Trends in Cell Biology. 1993 Sep 1;3(9):308-15.

3. Holdaway-Clarke TL, Walker NA, Hepler PK, Overall RL. Physiological elevations in cytoplasmic free calcium by cold or ion injection result in transient closure of higher plant plasmodesmata. Planta. 2000 Jan;210:329-35.

4. Dawson SP, Keizer J, Pearson JE. Fire–diffuse–fire model of dynamics of intracellular calcium waves. Proceedings of the National Academy of Sciences. 1999 May 25;96(11):6060-3.

Keywords:
Signal Propagation; Agent-Based Model; Ca2+ Signaling

Mentor(s):
FNU Nilay Kumar (Purdue University)

Other Acknowledgement(s):
Elsje Pienaar (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7052

Presentation Time: STEW 214B at 12:20-12:40

Anchor Testing in Reinforced Concrete Structures

STEM

Authors(s):

Hamond Rahardjo† (Engineering)

Abstract:

From the foundations of towering skyscrapers to the sidewalks beneath them, concrete anchors are a critical component of global infrastructure. These are metal fasteners used to attach structures to concrete, and their design relies on building codes like ACI 318, which governs anchor design in the U.S. and internationally. ACI 318-19 primarily considers symmetric tension loading in anchors, yet daily use and environmental stress may result in eccentric loading—where forces are applied off-center—which introduces uneven force distributions that reduce anchor strength. Despite this, virtually no experimental data illustrate how eccentric loading affects anchor-reinforced structures. Building codes compensate for this lack of data by forcing engineers to overcompensate with material usage and reinforcement, increasing construction costs with little added structural strength. This work investigates the failure of anchors in reinforced concrete structures under eccentric loading conditions. To examine this, two full-scale reinforced concrete slabs, with and without anchor reinforcement, will be cast and tested. The specimens will be subjected to eccentric tension loading applied using a 500-ton hydraulic jack connected to the reinforced concrete slabs. Various measurements, such as resisted load, rebar strain, and concrete breakout, will be recorded to analyze their behavior. The results from the tests will feed into improving current design code requirements.

Keywords:

Eccentric Loading; Reinforced Concrete; Concrete Anchors; Design Codes; Structural Failure

Mentor(s):

Deepak Suthar (Engineering)

Other Acknowledgement(s):

Nickolas Koe (Engineering); Sanath Bhavankar (Engineering)

Talk Presentation Abstract Number: 7053

Presentation Time: STEW 214B at 12:40-1:00

Refining Text Detection using Transfer Learning and a Unified Approach to Text Localization and Transcription

STEM

Authors(s):

William Henry Stevens† (Science|Graduate); Karthik Selvaraj† (Engineering); Gabriel A Torres† (Engineering); Leo Ross Benaharon† (Engineering); Surya Teja Sripathi† (Science)

Abstract:

Text and writing are abundant in the human world. Every day, humans read and understand writing of various sizes, styles, and fonts. It is also important for machines like autonomous cars and technological aids for the blind to perform this task as well, necessitating robust computer vision algorithms to scan and understand text in our world accurately. We propose a unified text localization and transcription algorithm leveraging transfer learning techniques. Our algorithm, based on the TextBoxes architecture, is pre-trained on the SynthText dataset, containing 850,000 images and 7.5 million synthetically generated text instances for pre-training. For text localization, we employ hierarchical transfer learning that involves training the algorithm on progressively more difficult tasks while maintaining the learned weights between sessions. The output of this component is then sent to the transcription portion, based on the SVIPTR Vision Permutable extractor, for reading each word that the localization component identifies. Our goal is to maximize this unified model's performance in complicated natural scenes for end-to-end text recognition. We will utilize datasets from the Robust Reading Competition to evaluate the model's performance and ability to generalize on unseen data from the real world. This transfer learning strategy aims to achieve text recognition across a variety of examples, including menus from restaurants, store names, and street signs. By combining advanced neural network architectures with strategic dataset utilization, we aspire to develop an accurate and efficient text recognition model that can be generalized to various real-world scenarios.

Keywords:

Machine Learning; Computer Vision; Transfer Learning; Transformers; Text Detection

Mentor(s):

Fengqing Zhu (Purdue University); Carla Zoltowski (Purdue University);

Edward J Delp (Purdue University); Soudabeh Taghian Dinani (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7054

Presentation Time: STEW 214C at 12:00-12:20

Using RNA Sequencing to Evaluate Exercise as an Intervention for Unloading-Induced Joint Degeneration

STEM

Authors(s):

Allison Faye Matovic† (Engineering)

Abstract:

Spaceflight factors such as microgravity can disrupt mechanotransduction, cause inflammation, and accelerate aging. Ground-based models of spaceflight factors can replicate some of these effects. One area of interest regarding these observations is the synovial joint. Gene expression within fat pad tissue and synovial membrane can reveal transcriptomic signatures linked to detrimental phenotypes associated with microgravity.?To examine these signatures, hindlimb unloading (HU) was used to simulate microgravity environments in ground-based murine studies. For 30 days, experimental groups were subjected to either an exercise regimen, HU, or both exercise and HU concurrently. After humane euthanasia, synovial membrane including the infrapatellar fat pad was dissected for RNA isolation and sequencing (Novogene). Using custom workflows in RStudio, RNA sequencing data was analyzed to determine effects of HU and exercise. Further, genes and pathways with potential to serve as interventions for HU were identified. 558 genes were upregulated and 142 genes were downregulated due to HU, for a total of 700 differentially expressed genes (DEGs). Of the 700 HU associated DEGs, 2 DEGs exhibited an opposite response within range when prompted to exercise, indicating that exercise may mitigate HU effects via expression of these genes. Pathway analyses were conducted using Gene Ontology, Reactome, and Kyoto Encyclopedia of Genes and Genomes. Several genes of interest were identified, including Cd14, Acss2, and Acly. Ongoing work by the Purdue Chan Lab and the Blaber Lab at Rensselaer Polytechnic University will expand this workflow to determine how observed pathway enrichment associates with systemic responses to HU and exercise.

Keywords:

Mechanotransduction; Inflammation; Aging; Exercise; Microgravity

Mentor(s):

Mikayla Angelique Roach (Engineering); Ruth Singh (Rensselaer Polytechnic Institute); Deva Chan (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7055

Presentation Time: STEW 214C at 12:20-12:40

Development of a Novel Wave-Powered Dual-Stage Pulse-Flow Reverse Osmosis System

STEM

Authors(s):

Nikitha Sam† (Engineering); Diya Banerjee† (Engineering); Ryan Kumar San Juan† (Engineering); Nishtha Singh† (Engineering); Alex Joseph Nagel† (Polytechnic); Benjamin C Martin† (Polytechnic); Trysta Dephin Chiang‡ (Engineering); Lily Avery Waterman‡ (Engineering); Zihao Qin‡ (Polytechnic)

Abstract:

While seawater constitutes 97% of Earth's water supply, only 0.5% of drinkable water is sourced from the ocean. Producing fresh water is expensive due to high power requirements and reliance on non-renewable energy sources. As climate change exacerbates natural disasters that reduce access to drinking water, there is a greater need for fresh-water production; a highly efficient reverse osmosis process that is powered through renewable energy is a reliable and cost-effective method to achieve this.

A dual piston wave-energy converter (WEC) was designed to power a dual-stage pulse-flow reverse osmosis (DS-PFRO) system, with the pistons converting mechanical motion of waves to supply the pressure requirement for the reverse osmosis system to desalinate seawater. The WEC minimizes electronic components and focuses on the mechanical advantage to amplify the mechanical motion and convert into pressure for multiple membranes. DS-PFRO offers variable salinity across the two membranes, which decreases chances of biofouling and increases the longevity of the system. Furthermore, the system opens possibilities for feed water flow reversal which decreases scaling on membranes and can improve recovery rates. Overall, the integrated system is a unique, novel design that harnesses wave energy to power a system that provides reliable drinking water to disaster prone regions.

Both systems were modeled utilizing WEC-Sim, with wave data from northeastern coasts of Puerto Rico, then tested utilizing a simulated non-linear wave profile. Success of the system will be determined through measuring the pressure generation, the recovery ratio and efficiency of the system and salinity of the produced water.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Desalination; Wave Energy Converter; Renewable Energy; Reverse Osmosis (RO); Passive System

Mentor(s):
David Warsinger (Purdue University); Jose M Garcia Bravo (Purdue University)

Other Acknowledgement(s):
Ali Naderi Beni (Engineering); Jarrod F Robbins (Polytechnic)

Talk Presentation Abstract Number: 7056

Presentation Time: STEW 214C at 12:40-1:00

BrainTrain: Human Behavior Alignment Improves the Robustness of Neural Networks

STEM

Authors(s):

Bharath Anand† (Purdue University)

Abstract:

Deep neural networks (DNNs) have revolutionized the field of Artificial Intelligence (AI), leading to their adoption in wide-ranging applications from scientific research to chatbots. There is strong interest in applying DNNs to critical applications such as healthcare and defense where lives, safety, or significant resources are at stake. A major concern with the use of DNNs in such applications is their lack of robustness under noisy inputs. Previous approaches to improving robustness significantly increase the already high training times and fail to generalize across a wide range of input noise patterns. Our work is inspired by two key observations about human visual perception. First, humans demonstrate remarkable resilience to the noisy inputs that cause neural networks to fail. Second, the errors made by humans in tasks such as object classification provide insights into the relationships between objects. We propose BrainTrain, a novel training method to create robust DNNs through human behavior alignment. BrainTrain consists of (i) a mobile application that enables the collection of human behavioral data at scale, (ii) a composite loss function to co-optimize accuracy and human behavior alignment during DNN training, and (iii) an alternative training method based on class similarity-based label smoothing that achieves similar results without the need for human behavioral data. We implemented BrainTrain using open-source software frameworks and applied it to state-of-the-art DNNs, achieving over 20% higher accuracy under a wide range of noisy inputs without significantly increasing training time. BrainTrain offers a pathway to enabling the adoption of DNNs in critical applications.

Keywords:

Artificial Intelligence; Neural Networks; Robustness; Input Noise; Human Behavior Alignment

Mentor(s):

Ananth Y Grama (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7057

Presentation Time: STEW 214D at 12:00-12:20

A Triangular Ladder of Superconducting Qubits for Quantum Simulation

STEM

Authors(s):

Santiago Lopez† (Science|JMHC)

Abstract:

The electrical properties of materials result from their underlying lattice geometry and the interactions between the constituent particles. However, to explore new parameter regimes where novel material properties may exist, natural materials can fall short in controllability and tunability. Analog quantum simulators allow us to explore synthetic quantum materials in previously inaccessible parameter regimes using coherent engineered quantum systems. Here, we use coupled frequency-tunable transmon qubits to realize a strongly interacting triangular ladder lattice for microwave photons. The triangular ladder geometry offers a rich playground for studying the crossover from 1D to 2D by varying the energy detuning and coupling strength between lattice sites. Additionally, we can engineer tunable synthetic gauge fields to investigate the interplay between geometric frustration and strong interactions. We probe these effects via the many-body spectroscopy and the quantum walk dynamics of initially localized photons. I will present numerical simulations and our experimental progress.

Keywords:

Superconducting Qubits; Quantum Simulation; Bose-Hubbard Lattice

Mentor(s):

Alex Ruichao Ma (Purdue University)

Other Acknowledgement(s):

Botao Du (Science)

Talk Presentation Abstract Number: 7058

Presentation Time: STEW 214D at 12:20-12:40

MicroRNA-31 Regulates Neutrophil Migration and Activation

STEM

Authors(s):

Elizabeth Christine Farrell† (Science)

Abstract:

Neutrophils are a type of white blood cell that play a crucial role in immunity by fighting off infections and triggering inflammation. On the other hand, over activity of neutrophils can contribute to autoimmune diseases such as arthritis. Hence, the regulation of neutrophil activity plays a vital role in preserving immune system homeostasis, but the specific mechanisms or molecules involved have not yet been discovered or fully understood. Previous studies in our lab discovered microRNA-31 (miR-31) was associated with neutrophil motility in zebrafish and identified a specific target gene of miR-31, EFNB2B. EFNB2B is a cell surface ligand for Eph receptors which together mediate bi-directional signaling, activating various signaling pathways involved in heart morphogenesis, angiogenesis, as well as other things. Although ephrins are widely researched in other fields, they have yet to be characterized in the immune system. This study aims to validate the function of EFNB2B in regulating neutrophil motility by determining whether miR-31 directly targets it. A rescue experiment was conducted after a tissue specific knockout (TSKO) of EFNB2B replacing GFP with full-length EFNB2 gene (Tol2-LyzC-Enb2-2A-mcherry) allowing co-expression of rescue gene and sgRNAs.

Keywords:

Zebrafish; Immunology; Neutrophils; Autoimmune Diseases; miRNA

Mentor(s):

Tyler Renee Pikes (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7059

Presentation Time: STEW 214D at 12:40-1:00

Automation Methods for Gamma Ray Spectroscopy and Data Analysis

STEM

Authors(s):

James Thomas Pittard† (Science); Mason Patrick Julius Levere† (Science); Sydney Metz† (Science|JMHC)

Abstract:

Gamma ray spectroscopy provides challenging environment for data analysis since theoretical predictions are hard or not yet available. Hence, we employ machine learning to speed up the process of identifying transitions between excited states of isotopes, also referred to as “level schemes”. Radware, a commonly used spectroscopy data analysis program, is used to understand the complex properties of isomers, notably isomer decay paths. Using machine learning, we will rewrite aspects of Radware. The use of machine learning will shorten the process of data analysis and make it less intensive for the user, and to be able to identify transitions that so far escaped the human-based analysis. This algorithm will be trained with toy spectrum data generated by the Monte Carlo technique. This synthetic data will then be used in the training of our algorithm to help it identify these decay paths. In the future, we intend to improve the machine learning algorithm to predict other properties of nuclear spectroscopy and analyze data in higher dimensions. Using these tools in combination with real spectrum data, we intend to ameliorate the often-tedious process of generating isomer level schemes.

Keywords:

Gamma Ray Spectroscopy; Radware; Level Schemes; Machine Learning; Spectrum Data

Mentor(s):

Andreas Jung (Purdue University)

Other Acknowledgement(s):

Ace Rounds (Science)

Talk Presentation Abstract Number: 7060

Presentation Time: STEW 218A at 12:00-12:20

The Impact of Children's Sensory Perception Abilities on Early Lexical Development

Social Science

Authors(s):

Victoria Tuell† (HHS|JMHC)

Abstract:

Different words hold different sensory properties. For instance, the word “dog” has auditory, visual, and tactile properties whereas “moon” has only visual properties. Previous research has shown that children learn words with more sensory properties earlier in development (Seidl, Indarjit, & Borovsky, 2024). However, children vary in their sensitivity to sensory input (Mason, Goldstein, & Schwade, 2019). The current project aims to investigate the relationship between children’s sensory perception and the sensory properties of their vocabularies. To date, a total of 56 typically developing children (mean age = 24.05 months, 30 females, 24 males, 2 prefer not to say) have completed the study. Caregivers completed the MacArthur Bates Communicative Development Inventory (MBCDI), a measure of children’s early vocabulary, as well as the Sensory Experiences Questionnaire (SEQ), a measure of children’s sensitivity to sensory stimuli. We utilized the Lancaster Sensorimotor Norms, a set of adult ratings of the salience of different sensory modalities across words in order to create a sensory profile for each child’s reported vocabulary. We predicted that children with enhanced sensory sensitivity would have vocabularies with higher overall sensory ratings. Contrary to our expectations, there was no relationship between children’s sensory perception skills and the sensory properties of their vocabularies. However, children with greater sensory perception skills showed larger vocabularies overall. These results suggest that while sensory perception skills impact early vocabulary development, the relationship between specific sensory properties is more complex. Future work should utilize direct observation of children’s sensory perception skills and vocabulary in order to mitigate any influence of method variance.

Keywords:

Language; Sensory; Developmental Psychology

Mentor(s):

Arielle Borovsky (Purdue University); Philip Robert Curtis (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Amanda Seidl (Purdue University)

Talk Presentation Abstract Number: 7061

Presentation Time: STEW 218A at 12:20-12:40

Effects of Hearing Impairment and Cognitive Load on Postural Sway

Social Science

Authors(s):

Mia An-Mei Schmetter† (HHS|JMHC); Abigail Foley* (HHS)

Abstract:

Older adults are more likely to fall than younger adults, but the reasons for this are not clear. Aging affects many systems that are important for balance, including hearing and cognition. Previous research has suggested that maintaining balance imposes demand on cognitive processing and so does hearing loss. Therefore, people with less cognitive capacity may have poorer balance, especially if they have hearing impairment. This problem might get worse when people are using their cognitive capacity for other tasks, like listening to speech. In this study, we investigated hearing, cognitive function, and postural sway in 46 older adults, with and without hearing aids, while they were listening to speech that was manipulated to be easier or harder to understand. While we have not finished analyzing our data, our preliminary results suggest a correlation between higher cognitive impairment and more postural sway. The goal for this study is to provide a deeper understanding of how cognitive and hearing impairment correlate with postural sway that will contribute to future research to protect as many older individuals as possible from falling.

Keywords:

Hearing Loss; Fall Risk; Cognitive Load; Aging; Postural Sway

Mentor(s):

Alexander L Francis (Purdue University)

Other Acknowledgement(s):

Jeffrey M Haddad (Purdue University); Allie McCain Good (Purdue University); Alexia Lynn Robinette (HHS); Emily Anne Schmitz (Purdue University); Kali Elizabeth Manojlovich (Purdue University)

Talk Presentation Abstract Number: 7062

Presentation Time: STEW 218A at 12:40-1:00

Ultrastructural Characterization of White Adipose Tissue in Albumin Knockout Mice

STEM

Authors(s):

Yen-hsi Lai† (HHS)

Abstract:

Free fatty acids (FFAs) are carried in blood by albumin. Excessive release of FFAs from white adipose tissue (WAT) can lead to harmful lipid accumulation in other organs, and thus reducing the interaction between albumin and FFAs may ultimately be a way to improve health. However, when sequestering FFA in adipocytes, the elevated intracellular FFA might act as a stressor, and therefore we tested how adipocytes respond to this challenge. WAT from male albumin knockout (Alb-/-) mice and their wildtype (WT) littermates (n=4) was studied by transmission electron microscopy. WAT mass and adipocyte size were similar between WT and Alb-/- with no signs of cell death. Micro lipid droplet (mLD) density in adipocytes was significantly higher in Alb-/- than WT. There was a trend for elevation in mitochondrial density around the adipocyte nucleus in Alb-/- mice. In comparison to WT, Alb-/- also exhibited significantly lower abundance and size for caveolae in adipocytes. Additionally, the caveolae density on the basolateral side of capillary endothelial cells in WAT was significantly lower in Alb-/- than WT. WAT changes its cellular morphology in response to the absence of albumin, an adaptation that potentially protects the cells. The high abundance of mLD in Alb-/- adipocytes could be a result of rapid lipolysis and FFA re-esterification. The decreased abundance and size of caveolae in WAT of Alb-/- mice may suggest that FFA release is blunted when albumin is absent. The present results provide information on WAT plasticity under conditions of physiological stress.

Keywords:

White Adipose Tissue; Albumin; Free Fatty Acids; Cell Morphology; Transmission Electron Microscopy

Mentor(s):

Gregory C Henderson (Purdue University)

Other Acknowledgement(s):

Yi Zhang (HHS); Keigo Tomoo (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7063

Presentation Time: STEW 218B at 12:00-12:20

In Silico Analysis of Calmodulin-Calcium Binding Sites and their effects on Adenylyl Cyclase 1 Activation

STEM

Authors(s):

Shreya Krishnan† (Engineering)

Abstract:

Mammalian Adenylyl Cyclase 1 (AC1), which synthesizes the key cell signaling molecule cyclic adenosine monophosphate, is associated with neurological pathways for spatial memory, migraines, and drug abuse. Thus, understanding AC1 behavior can improve drug development for multiple diseases. This research investigated activation of AC1 by the protein calmodulin (CaM), which contains four calcium binding sites key for AC1 activation. Prior research demonstrated that calcium attraction and AC1 interactions differ across CaM-calcium binding sites; however, molecular mechanisms behind these differences have not been understood. This study aimed to understand the significance of each CaM-calcium binding site on CaM function and AC1-CaM interactions in order to elucidate new potential drug targets for AC1-associated diseases. To assess each CaM-calcium binding site, four mutant CaM structures - each where calcium binding was impaired at one site - were simulated using Desmond Molecular Dynamics. Simulations revealed that disrupting calcium binding in the C-terminal region at amino acid 141 increased conformational flexibility throughout the CaM protein, suggesting that the C-terminal plays a role in regulating CaM structure and function. Building on these findings, effects of the CaM C-terminal region on AC1-CaM interactions will be assessed using simulations of AC1 bound to each CaM structure; differences in AC1-CaM interactions between binding sites will be identified using principal component analysis and calculations of movement in key AC1 and CaM regions. Understanding effects of each CaM-calcium binding site on CaM and AC1 function can provide new drug targets for improving AC1 regulation to treat diseases including migraines, inflammation, and drug abuse.

Keywords:

Calmodulin; Calcium; Adenylyl Cyclase 1; Molecular Dynamics

Mentor(s):

Jianing Li (Purdue University); Tongtong Li (Purdue University); Talon Hicks (Pharmacy)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7064

Presentation Time: STEW 218B at 12:20-12:40

Engineering Stable HEK293T Viral Production Cells to Achieve High Lentiviral Vector Titer for Cell-based Immunotherapy

STEM

Authors(s):

Khanh Ha Nguyen† (Science|JMHC)

Abstract:

Lentiviral vectors (LVs) are widely used in cellular engineering to insert, modify, or delete genes in both dividing and non-dividing cells, making them particularly valuable for clinical applications with cell-based immunotherapies based on genetically-modified immune cells, such as CAR-NK and CAR-T therapies. However, conventional LV production methods rely on transient transfection of multiple plasmids (packaging, envelope, and transfer), leading to variability in viral quality, titer, and expression stability. These challenges, compounded by the need for extensive plasmid sourcing and transfection reagents, increase production costs and complexity, and lower the efficacy of genome engineering of immune cells, ultimately leading to less effective therapies. To address these limitations, we are developing a novel, stable HEK293T packaging cell line expressing the Baboon envelope-pseudotyped lentiviral vector (BaEV-TR) using the Sleeping Beauty transposon system. This approach aims to eliminate the need for repeated plasmid transfection, thereby improving efficiency and standardizing viral packaging. Efforts are currently underway to perform clonal selection with puromycin, expand selected clones, and evaluate the system's ability to transduce primary natural killer (NK) cells at efficiencies of gene expression greater than traditional second-generation LV production methods. By streamlining LV production, this system has the potential to enhance the scalability and reproducibility of viral vector manufacturing. More consistent and efficient LV generation will support the advancement of NK cell-based therapies and broader immunotherapy applications, facilitating the development of next-generation gene-modified immune cells for cancer treatment and beyond.

Keywords:

Lentiviral Vectors; BaEV-TR; Natural Killer Cells; Genetic Engineering; Immunotherapy

Mentor(s):
Sandro Matosevic (Purdue University); Soumyajit Das (Pharmacy)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7065

Presentation Time: STEW 218B at 12:40-1:00

Optimization of Diphyllin Analog Solubility for Ebolavirus Treatment as a V-ATPase Inhibitor

STEM

Authors(s):

Oliver Hu† (Pharmacy)

Abstract:

Ebolavirus (EBOV) causes a deadly hemorrhagic fever with a fatality rate that can approach 90%. However, recent developments such as antibody therapies and vaccines come with logistical issues like cold storage and hospitalization that risks infection spread. To maximize treatment access, we aim to pioneer the first oral treatment against EBOV. This will be done by targeting V-ATPase, a key protein in endosomal acidification—and also the initial step of the infection process.

Diphyllin is a natural product that has shown significant potential as a V-ATPase inhibitor, reaching an EC50 of 1?M. Additionally, it boasts a low-toxicity profile. However, in terms of oral treatment, Diphyllin falls short in efficacy and other drug properties. As such, our previous work aimed to utilize Diphyllin's structure as a scaffold to create an analog that was potent but also satisfied key oral drug properties.

Our work culminated in the discovery of D56-3C24, an analog possessing a 35nM EC50, with a tripling of half-life, a 10x increase in Caco-2 cell permeability, and the ability to maintain efficacious plasma levels for over 24 hours. However, its insoluble aggregation in the GI systems of mice led to toxicity and death.

This leads to our current focus on improving solubility through the addition of polar atoms. By replacing carbons on the analog's D-ring with nitrogens and adding polar groups to our potent side chains, solubility improved from 5?M to 80?M, placing it within the 20-30th percentile of drugs and in a more acceptable range for oral treatment.

Keywords:

V-ATPase; Solubility; Ebolavirus

Mentor(s):

Vincent Jo Davisson (Purdue University)

Other Acknowledgement(s):
Amr Hussien Elkabbany (Pharmacy); Laura Mae Sanford (Pharmacy)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7066

Presentation Time: STEW 218C at 12:00-12:20

How Audience Relations, University Practices, and Logistics of Student Journalism Impact the Journalistic Practices Used by Student Journalists

Social Science

Authors(s):

Makenzie Lee Albert† (HHS); Taylor Gloria Vic Graham† (Science); Yaajushi Valluri† (DSB); Margaret Elizabeth Collins* (Liberal Arts)

Abstract:

Student newspapers at universities across the nation are a primary way that aspiring journalists cultivate their skills and learn tricks of the trade. Student journalism is typically underrepresented in research on the field of journalism, but student journalists, at the beginning of their careers, have unique insights on the challenges, opportunities, and the future of the field. This study aims to gather insight on the challenges that student journalists face and the ways in which these challenges may be resolved. We conducted semi-structured interviews with 13 student journalists writing for student newspapers at Big 10 universities in the United States, and used thematic analysis to analyze the interview transcripts. Initial findings suggest that student journalists face unique barriers that impact their journalistic practices. These issues include, but are not limited to: complex and sometimes difficult relationships with their audience, resistance from universities to share information, and logistics like funding, time, resources, and professional guidance. The findings from this research study could inform student journalist organizations and others in the journalism field on how to improve training frameworks, combat common barriers, and better support young journalists developing their skills.

Keywords:

Student Journalism; Journalistic Practices; Audience Relations; Higher Education; Information Literacy

Mentor(s):

Rachel Fundator (Purdue University); Clarence Maybee (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7067

Presentation Time: STEW 218C at 12:40-1:00

Laponite-based clay inks for natural material 3D printing

STEM

Authors(s):

Emily Katherine Slotegraaf† (Engineering|JMHC); Tai S Hsu* (Engineering)

Abstract:

This research explores fundamental aspects of the additive manufacturability of clay-based inks through experiments on dispersions of Laponite. Laponite is a synthetic nano clay that exhibits a wide range of rheological properties that can be tuned based on the concentration of Laponite and a dispersant, as well as the aging time of the mixture. This allows Laponite to model a wide range of soft mixtures. The goal of these experiments is to gain fundamental knowledge to use a customized concrete 3D printer to print Laponite mixtures. Tests using a rheometer are done to characterize the evolution of mixtures based on their aging time about their respective key rheological properties: loss moduli, viscosity, and yield stress. These properties will control the mixtures' pumpability and extrudability. The behavior of these same mixtures is examined with pouring experiments and extrusion experiments. Extrusion experiments use a custom setup that pushes the mixture through the tip of a syringe while measuring the extrusion force. The objective of these experiments is to capture the dripping to jetting transition and determine the optimal conditions for printability of the mixtures. Preliminary results suggest that it will be possible to 3D print laponite. Further testing will be identifying laponite mixtures to be used for trial prints using a concrete 3D printer customized to print clay-based inks. The findings of this research will help advance research into additive manufacturing with natural materials.

Keywords:

3D Printing; Civil Engineering; Laponite

Mentor(s):

Maria Caterina Santagata (Purdue University); Luis Enrique Garzon Sabogal (Engineering); Tejas Gorur Sreenivasa Murthy (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7068

Presentation Time: STEW 214B at 1:00-1:20

Deep Learning for Enhanced Subvisible Particle Analysis in Auto-Injector Devices

STEM

Authors(s):

Jiwon Seo† (Science); Sai Aiswarya Sadagopan† (Science); Samskrithi Sivakumar† (Science); Jinhwan Kwon† (Science|Graduate); Anika Mathur† (Science)

Abstract:

The pharmaceutical industry must adhere to regulatory standards for the safe manufacturing of drugs. One standard deals with the amount of subvisible particles (SVP) — glass, plastic, or other substances smaller than 10?m — as their presence in high quantities can impact drug stability and trigger unintended immunogenic responses upon administration. Existing works exploring the automated identification of SVPs using machine learning are limited by an overreliance on datasets solely consisting of oils and proteins, resulting in poor performance when applied to particles with similar features. This study explores the application of improved convolutional neural networks (CNNs) to classify SVPs in the packaging of high molecular weight protein drug therapies delivered by autoinjectors. Furthermore, we use Generative Adversarial Networks (GANs) to augment the training process of the classification model by including synthetic images before validating on real data. Analysis of a diverse dataset of production-grade oils, glass microsphere particulates, and protein aggregates revealed similarities between oil and glass SVPs in their roundness, while protein aggregates exhibited varied shapes and sizes. Leveraging these insights, we designed a CNN architecture featuring multi-branch networks that process specific features and enhance differentiation between particle types, as well as incorporating synthetic images from Deep Convolutional GAN models to train a more robust classifier. Overall, our study aims to revolutionize SVP identification methods by offering an automatic tool to perform improved classifications of SVPs for protein-rich drug solutions.

Keywords:

Subvisible Particles (SVPs); Convolutional Neural Networks (CNN); Generative Adversarial Networks (GANs); Machine Learning; Deep Learning

Mentor(s):
Brett A Meyers (Purdue University); Pavlos Vlachos (Purdue University); Reza Babakhani Galangashi (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7069

Presentation Time: STEW 214B at 1:20-1:40

Synthesizing and Understanding Facility-Level Water Consumption Datasets in Computing at Scale

STEM

Authors(s):

Jaewon Cho† (Engineering); Isha Shamim‡ (Engineering)

Abstract:

As artificial intelligence (AI) and cloud computing scale, the environmental impact of computing infrastructure, particularly water consumption remains poorly quantified across the entire computing stack. Datacenters, including their supply chains, contribute significantly to freshwater withdrawals, exacerbating local water scarcity. However, comprehensive facility-level water consumption data is scarce due to fragmented reporting, inconsistent data sources, and difficulties in linking state and federal datasets.

This research addresses these gaps through three synergistic thrusts. Thrust 1 automates the discovery and synthesis of uncoordinated water consumption datasets for datacenters and computing hardware manufacturing. Thrust 2 enhances dataset accuracy using machine learning and image data through iterative verification procedures. Thrust 3 applies water scarcity factors, such as Available Water Remaining per area (AwARE), and leverages Geographic Information System (GIS) methods to benchmark and visualize the environmental impact of water consumption in computing.

Keywords:

AI; Sustainability; Water Consumption

Mentor(s):

Yi Ding (Purdue University); Inez Hua (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7070

Presentation Time: STEW 214B at 1:40-2:00

Optimizing Application Software for Greater Energy Efficiency using Large Language Models

STEM

Authors(s):

Rishi Mantri† (Engineering); Arjun Sandeep Gupte† (Engineering); Chien Chou Ho† (Engineering); Leo Deng† (Science); Michael Lie Setiawan† (Science)

Abstract:

Cloud computing has become a foundational pillar of the internet. However, the increasing energy demands of data centers conflict with global efforts to reduce carbon emissions. The emergence of AI systems has further exacerbated this issue, as their computational requirements significantly drive up energy consumption. While energy-efficient software can enhance mobile device experiences and mitigate data center emissions, energy goals are often deprioritized in favor of other requirements. Inspired by recent advancements in leveraging Large Language Models (LLMs) for software engineering tasks, we propose a novel application of LLMs as code optimizers for energy efficiency. We evaluate our approach and assess the effectiveness of LLMs in energy-aware code optimization on real-world applications, including mobile applications, data center, and high-performance scientific computing workloads. Our work highlights both the potential and limitations of LLMs in optimizing software for energy efficiency, paving the way for further exploration in this emerging domain.

Keywords:

Energy Efficiency; Software Optimization; Large Language Models

Mentor(s):

James C Davis (Purdue University); Huiyun Peng (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7071

Presentation Time: STEW 214C at 1:00-1:20

Adaptive Trip Extraction from GPS Data: A Context-Sensitive Approach

STEM

Authors(s):

Mahit Bheema† (Polytechnic)

Abstract:

Extracting reliable trajectories from cell phone GPS data is crucial for applications in transportation planning, urban mobility analysis, and traffic optimization. However, existing algorithms often struggle with noisy data, inconsistent sampling rates, and variations in trip trajectories, leading to inaccuracies in trip segmentation. Our work addresses these challenges by developing a trip extraction algorithm that improves trajectory inference through adaptive filtering and context-aware segmentation. Unlike traditional approaches, our method dynamically adjusts to varying GPS signal quality and user mobility patterns, resulting in more accurate trip identification.

Our methodology compares trajectory extraction algorithms using metrics including accuracy in stay region detection, trip attribute extraction precision (distance, time, speed), and effectiveness in handling irregular temporal sampling. We evaluate performance across smartphone GPS datasets with varying temporal coverage, specifically focusing on the algorithm's ability to correctly identify meaningful mobility patterns while filtering out data collection artifacts. Our findings highlight fundamental weaknesses in some baseline algorithms, particularly in handling sparse or scarce GPS signals, leading to possible missed trips. Our method demonstrates significant improvements in capturing complete trips while reducing false detections.

By addressing common failure points in trajectory extraction, our approach enhances the reliability of GPS-based mobility studies. This has broad implications for transportation research, smart city applications, and mobility behavior modeling, offering a more accurate foundation for data-driven decision-making in urban planning and more efficient transportation tactics.

Keywords:

Trip Extraction; Adaptive Filtering; Trip Attribute Extraction Precision; Stay Region Detection; Filtering

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Satish V Ukkusuri (Purdue University); Shagun Mittal (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7072

Presentation Time: STEW 214C at 1:20-1:40

Real-Time Agent Motion Prediction and Overtaking in Multi-Agent Autonomous Racing Using Deep Neural Networks

STEM

Authors(s):

Myron Milad Tadros† (Engineering); Abdelrahman Ahmed Safw Eissa† (Engineering); Ahmed Sayed Omar Omar† (Engineering); Bola Yosry Zaky Warsy† (Engineering); Omar Ahmed Roshdi Badawi Abousheishaa† (Engineering); Rohin Rajesh Nair† (Engineering)

Abstract:

Autonomous racing presents significant challenges due to the need for real-time precision and strict safety requirements. A motion prediction module of the autonomous racing car must accurately predict trajectories in unpredictable environments, where even minor errors could lead to major collisions. With the current advancements in deep neural networks, we tackle the challenge of predicting multi-agent behaviors such as future position, velocity, acceleration, and other states that fall under the umbrella of motion prediction. This creates the need to monitor the vehicle's surroundings in real time to quickly make informed decisions. Previously, Purdue AI Racing Team has implemented a physics-based stochastic approach using Kalman Filters to predict surrounding agents' future steps from perception data such as lidars, radars, and cameras. Inspired by state-of-the-art LSTM techniques, we developed a Transformer-based approach that, in many cases, equals or surpasses the performance of the established baseline recognized by leading teams in the race. In addition, we are investigating an extension to our approach through the incorporation of real-time learning, enabling the cars to adapt and optimize their performance while racing. Furthermore, by leveraging our enhanced motion prediction, we are developing an integrated autonomous overtaking system that aims to anticipate opponent vehicles' current and predicted trajectories with high accuracy and uses this foresight to optimize overtaking maneuvers. This approach employs advanced and greedy overtaking strategies, using algorithms such as Find The Gap (FTG) and others utilized by top racing teams in the Indy Autonomous Challenge, to make more informed and effective overtaking decisions.

Keywords:

Autonomous Racing; Deep Neural Networks; Motion Prediction; Overtaking; Multi-Agent Systems

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Andres Felipe Hoyos Moreno (Engineering); Samuel Labi (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7073

Presentation Time: STEW 214C at 1:40-2:00

Rapid Diagnostic Test for HPV 16 & 18

STEM

Authors(s):

Francesca Chiara Hamacher† (Agriculture|Engineering)

Abstract:

Human papillomavirus (HPV) is a virus that is an extremely common sexually transmitted infection (STI) that can lead to cervical cancer, however, if detected early, it can be treated. Two of the most virulent strains, HPV 16 and HPV 18, are responsible for the most HPV-related cancers. In lower-middle resource communities there is limited access to preventive and screening measures hence there is a need for a HPV rapid diagnostic test. A rapid-diagnostic test, like a COVID-test, is imperative to testing communities and devising a treatment plan for communities underserved by traditional cervical cancer screening. The goal of the project is to develop a rapid test with a test line for a human control, HPV 16, and HPV 18. One method used by this test is loop-medicated isothermal amplification (LAMP) which is method of amplifying the DNA with multiple primers at one temperature. Compared to the traditional method of amplifying DNA, polymerase chain reaction (PCR), LAMP offers a more affordable and time efficient option. Specifically, I have been working on combining the three reactions into one test in order to make a multiplexed test that can detect if the sample has human DNA, HPV 16, and HPV 18. Developing a multiplexed diagnostic test will lead to more timely diagnosis and effective treatment for pre-cervical cancer patients in low-middle resource communities.

Keywords:

Rapid Diagnostic Test; HPV 16 & HPV 18; Multiplex; Preventative Measures; LAMP

Mentor(s):

Jacqueline Linnes (Purdue University); Karin F K Ejendal (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7074

Presentation Time: STEW 214D at 1:00-1:20

Exploring Protein Environmental Effects on the Vibrational Spectrum of Chlorophyll a at Room Temperature

STEM

Authors(s):

Sarah A Alvarez† (Science)

Abstract:

Switching from fossil fuels to sustainable energy is one of the main ways we can lessen our impact on global warming. Solar energy is a promising alternative to fossil fuels, but it has some limitations. One of the greatest limitations is that solar cells are not efficient at energy transfer, with the average commercial solar cell only transferring 15-20% of the sunlight it absorbs into electricity. Conversely, photosynthetic proteins are 98% efficient, and scientists hope to better understand these systems through spectroscopy and simulations. If the relationship between structure and function (the function in this case being energy transfer) is understood, then we can “tune” our synthetic system to transfer energy more efficiently. Using 2D electronic spectroscopy, amongst other techniques, scientists have revealed interesting electronic data on chlorophyll, however it is still unclear how this spectroscopic data relates to protein structure. Vibrational spectroscopy allows us to directly correlate electronic data with changes in protein structure. In my project I relate mutations in protein structure to changes in chlorophyll a’s vibrational spectra, which can be used as a benchmark for theorists performing MD simulations.

Keywords:

Photosynthesis; Vibrational Spectroscopy; Chlorophyll a; Mutagenesis

Mentor(s):

Michael Earl Reppert (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7076

Presentation Time: STEW 214D at 1:40-2:00

Wildfire Impacts on Air Quality in the Midwestern United States

STEM

Authors(s):

Parth Thakre† (Science|Graduate); Kerstin Ariel Cox‡ (Science)

Abstract:

Wildfires are growing in frequency and severity and are affecting air quality thousands of miles away. Recent studies indicate a rise in summer smoke days in the Midwestern United States. Even short-term exposure to wildfire smoke harms human respiratory and cardiovascular health. Our research examines over 20 years of changes in regional air quality during the wildfire season (June–September) from ground measurements at 14 sites across 8 Midwest states. We analyze concentrations of atmospheric aerosol species indicative of wildfire emissions, such as Potassium, Phosphorus, Elemental Carbon (EC), and Organic Carbon (OC). By using statistical methods like time series analysis, hypothesis testing and regression modeling, we analyze long-term trends in aerosol compositions along with possible correlations with wildfires. Preliminary findings indicate significant seasonal changes in wildfire-associated aerosol components, namely OC, EC, and potassium. We also find that the OC:EC ratio is a better indicator of wildfire smoke than the individual aerosol concentrations. Our research confirms a positive summer wildfire influence on regional air quality in recent years. Understanding these changes over recent years is crucial to assessing air quality trends and their health implications. Further research of such wildfire indicators across different time periods will enable the quantification of long-term wildfire effects on regional air quality and emphasize health risks through increased particulate matter concentrations.

Keywords:

Wildfires; Data Analysis; Air Quality; Aerosol Composition; Midwestern United States

Mentor(s):

Gouri Gouri Prabhakar (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7077

Presentation Time: STEW 218A at 1:00-1:20

From BirdNet to BugNet: Leveraging AI to enhance Cicada Detection with comparison to bird calls

STEM

Authors(s):

Zhixin Cai† (Science|JMHC); Keith Meyers‡ (Science|JMHC); Ryan M Feller* (Science|JMHC); Thomas Allen Belcher* (Science|JMHC); Hiya Samanta* (Science|JMHC)

Abstract:

Insect biomonitoring plays a critical role in assessing habitat quality, tracking biodiversity changes, and informing conservation efforts. Passive acoustic monitoring has the potential to revolutionize insect monitoring, but acoustic insect recognition is presently a challenge. Current deep learning and Tensor Flow models accurately identify thousands of bird species, but insect calls have traditionally been viewed as noise. As a continuation of previous research, we will advance the ability of the convoluted neural network BirdNet to distinguish between periodical cicadas and bird calls. BirdNet is an open-source deep learning program that ingests WAV files, converts them to spectrograms, and then compares those images to a training data set. Last semester, we improved the classifier's accuracy and precision by expanding the training data, allowing BirdNet to recognize specific cicada species using multinomial classification. Due to the current effectiveness of BirdNet's interspecies recognition, we will train BirdNET to identify and classify calls across multiple animal phyla, ensuring its accuracy in real-world scenarios where soundscapes often include overlapping calls from different taxa within a single sound file. In future work, we will expand the training libraries, ensuring more accurate acoustic detection in real-world soundscapes across different animal phyla. In addition to helping bridge the gap between scientists and citizens through citizen science, this project also supports insect biomonitoring for conservation, agricultural management, and assessing biodiversity changes.

Keywords:

[no keywords provided]

Mentor(s):

Kristen Marie Bellisario (Purdue University); Christine Harrison Elliott (Agriculture)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7078

Presentation Time: STEW 218A at 1:20-1:40

Mapping Wildlife-Vehicle Collision Hotspots in Indiana: Impacts & Implications on Wildlife Corridor Success

STEM

Authors(s):

Lukas Benjamin Kraft† (Agriculture|JMHC); Sierra Hunnicutt* (Science|JMHC); Alexandra Grace Early* (Agriculture); Anaey Gaurang Naik* (HHS|JMHC); Zhixin Cai* (Science|JMHC)

Abstract:

Wildlife-Vehicle Collisions (WVCs) pose a significant threat to both wildlife and humans, leading to economic costs and wildlife fragmentation. Since the expansion of automobile-based transportation, particularly due to the Federal-Aid Highway Act of 1956, since the mid-20th century, wildlife have faced increased habitat fragmentation. While natural barriers such as geography separate animals in ways they have evolved to navigate, the modern transportation grid has disrupted migrational patterns of animals overnight, leading to high levels of WVCs and a predicted decline in genetic diversity and species resilience. In the past four years, the Indiana Department of Transportation has cataloged over 68,000 reports of WVCs across Indiana. This research uses ArcGIS to map high density WVC roadways, where further research could be done to mitigate collisions. Within these hotspots, a key focus is on WVC rates near bridges with access to water sources, comparing areas with and without culverts or dedicated crossings. We predict that higher rates of animal mortality will occur at sites lacking culverts, supporting the need for improved wildlife crossings. Findings from this research may provide valuable insight into impact sites to focus on in the future to reduce WVC rates in Indiana. Interestingly, a natural control is seen during COVID-19 (Dec 2021-2022) where we predict quarantine to result in lower WVC rates when compared to recently (Dec 2023-2024). Furthermore, this research aims to communicate with diverse research on wildlife corridor plausibility within Indiana and wildlife research done as part of the HIFI Lab Wildlife Corridor project.

Keywords:

Wildlife Corridor; ArcGIS; Wildlife-Vehicle Collisions; HiFi Lab; INDOT

Mentor(s):

Kristen Marie Bellisario (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7079

Presentation Time: STEW 218A at 1:40-2:00

An Assessment of Student Participation in the NSF REU Site: Growing Entrepreneurially-Minded Undergraduate Researchers with New Product Development in Applied Energy

STEM

Authors(s):

Ava Thant Samuel† (Engineering|JMHC)

Abstract:

An REU (Research Experiences for Undergraduates) is a program sponsored by the National Science Foundation (NSF) that provides undergraduate students with research opportunities to broaden participation in research and development. The purpose of this study was to assess student participation in a NSF REU titled, “NSF REU Site: Growing Entrepreneurially-Minded Undergraduate Researchers with New Product Development in Applied Energy.” This REU program offered engineering students with a research experience that combined the best aspects of academic applied research, such as strong theory basis and rigorous scholarship, with essential business practices such as real-world customer discovery and the generation of sound business plans. It took place over the span of three years, hosting 10 to 14 students each year. Upon completing the program, students completed a survey about their experiences, prompted to expand on the main themes of entrepreneurial mindset, research skills, advisor research lab, and connection to the real world as well as to provide positive and negative feedback on the program. Qualitative analysis using NVIVO identified sub-themes within the main themes of student responses which offer deeper insights into participants’ development. This study highlights both the strengths and challenges of the program and provides feedback for improving this, as well as similar types of REU programs. These findings can aid the development of onboarding guides for students and REU project coordinators to manage expectations and streamline project management. Additionally, these results can aid advisors in effectively mentoring students.

Keywords:

REU; Qualitative Analysis; Student Participation; Program Improvement

Mentor(s):

Lisa B Bosman (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7080

Presentation Time: STEW 218B at 1:00-1:20

PCNA-NKp44 Interaction Provides Avenue for Immunotherapeutics

STEM

Authors(s):

Jenna Yeager† (Pharmacy)

Abstract:

Multiple myeloma (MM), a blood cancer, has a 61% 5-year survival rate [1] and a 66% chance of relapse within 2-3 years [2]. One-third of patients who get MM will not survive. There is a need to develop new chemotherapeutics to treat MM, preventing relapse and improving mortality rates. The purpose of this project is to develop a selective chemotherapeutic blocking the interaction between extracellular protein PCNA on MM cells and extracellular receptor NKp44 on natural killer cells. In-silico docking program Maestro by Schrodinger was utilized for protein-protein and protein-peptide docking. Peptides of interest were synthesized for fluorescence polarization to determine binding affinities to PCNA. Potential peptide inhibitors have been discovered through Maestro by Schrodinger. A backward PIP motif was identified during docking studies near the ITIM motif, which could be responsible for NKp44's affinity to PCNA. Optimization of fluorescence polarization protocol is currently underway. Fluorescence polarization will determine how strongly the peptides of interest interact with PCNA, important for developing drugs and characterizing binding. The development of a protein-protein interaction inhibitor for PCNA and NKp44 would provide a novel and selective therapeutic for cell death evasion by multiple myeloma- as PCNA is not on healthy cell surfaces and is upregulated in cancer cells.

Keywords:

Cancer Therapy; Proteomics; PCNA; NKp44

Mentor(s):

Vincent Jo Davisson (Purdue University)

Other Acknowledgement(s):

Hui Tao (Pharmacy); Abhinav Singh (Purdue University)

Talk Presentation Abstract Number: 7081

Presentation Time: STEW 218B at 1:20-1:40

Targeting High-risk HPV E6: Structure Based E6-p53 Inhibition

STEM

Authors(s):

Sungyu Choi† (Engineering)

Abstract:

HPV16 is the most prevalent high-risk human papillomavirus, strongly linked to the tumorigenesis of various cancers, particularly cervical cancer. While the rise of vaccines has reduced HPV-related disease burden, it has discouraged the development of high-risk HPV inhibitors which remains essential for non-vaccinated individuals and those already exposed to oncogenic HPV types. Current studies focus on the E6 oncoprotein, which promotes cancer progression by degrading the tumor suppressor p53; however, effective inhibitors targeting E6 remain largely unexplored. To identify small molecule inhibitors, we analyzed the structural interface between HPV-16 E6 and p53 using the latest cryo-EM structure (PDB: 9CHT). The protein-protein interface between E6 and p53 indicates 2 major and 1 minor sub-interfaces with 2 major sub-interfaces creating a druggable pocket, EPP653. With these findings, an in-silico virtual screening was performed on a generated grid over EPP653, resulting in potential inhibitors of E6. Future studies will conduct in-vitro assays on the top candidates to evaluate their efficacy and validate the protein-protein interactions identified in the structural analysis, advancing the development of potential therapeutics inhibiting the progression of high-risk HPV types.

Keywords:

p53 Degradation; HPV E6; E6-p53; Protein-Protein Interface; Small Molecule Inhibitors

Mentor(s):

Vincent Jo Davisson (Purdue University)

Other Acknowledgement(s):

Hui Tao (Pharmacy); Abhinav Singh (Purdue University); Shalini Iyer (Purdue University)

Talk Presentation Abstract Number: 7082

Presentation Time: STEW 218B at 1:40-2:00

A Software Application to Predict and Optimize Healthcare Insurance Costs

Business Case Study

Authors(s):

Eric Tysinger† (DSB); Leo Zheng† (DSB); Michael Lance Whitfield† (DSB); Nelson A Paguada† (DSB)

Abstract:

This research project designs and develops an R-shiny software tool that consumers or insurers could use to predict and optimize factors influencing health insurance costs. The motivation for this research is that affordable healthcare and improved health have become major social challenges, particularly in the United States. Our tool provides two contributions. First, it allows the user to accurately predict healthcare expenses using variables such as age, BMI, number of children, smoking status, and area. Secondly, it provides decision recommendations via optimization modeling, in how healthcare expenses could be reduced based on BMI and smoking lifestyle decisions.

Keywords:

Healthcare; R-Shiny; DSS; Optimization

Mentor(s):

Matthew Lanham (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7083

Presentation Time: STEW 218C at 1:00-1:20

Building Barriers: Natural Variation Contributes to Reproductive Isolation in Arabidopsis thaliana

STEM

Authors(s):

Ava Grace Barnes† (Agriculture)

Abstract:

Natural variants of Arabidopsis thaliana exhibit various genetic polymorphisms, which contribute to the phenotypic diversity observed among ecotypes. However, little is known about how these impact plant sexual reproduction and fertilization success. We hypothesize that by analyzing specific variants in genes affecting reproductive traits, particularly those that affect gamete interactions and fertilization, we can potentially uncover new molecular variants underlying the establishment of reproductive barriers, hybrid incompatibility, and contribute to the evolution of speciation.

To test this hypothesis, we selected 39 natural accessions from diverse geographical locations containing moderate to high impact polymorphisms in DMP8 and DMP9 - two critical mediators of gamete interactions during double fertilization. To evaluate whether these polymorphisms exert significant selection pressure on the evolution of reproductive barriers, we performed reciprocal crosses between the selected ecotypes and specific marker lines that allow tracking of parental origin. These crosses are being evaluated for pollen tube performance, seed set and frequency of maternal haploid progeny. In addition, we have used advanced computer modeling and deep learning models to predict the impact of specific SNPs in protein structure and protein-protein interactions.

Keywords:

Plant Biology; Plant Genetics; Plant Reproduction; Evolution; Molecular Biology

Mentor(s):

Leonor Maria de Fatima Chagas Boavida (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7084

Presentation Time: STEW 218C at 1:20-1:40

Economic and Environmental Comparison of Tillage Systems in Illinois

Business Case Study

Authors(s):

Yufei You† (Agriculture)

Abstract:

This study examines the economic and environmental impacts of different tillage systems—conventional tillage (CT), no-till (NT), and chisel/reduced tillage (CR)—on soybean and corn production in Illinois. While NT and CR are promoted for their environmental benefits, including reduced soil erosion and improved water retention, their adoption has been constrained by economic considerations and land tenure dynamics.

Using FINBIN crop enterprise analysis data (2014–2023), this research compares net returns across tillage systems, incorporating key financial metrics such as direct costs, power expenses, land rent, and gross revenue. The Kruskal-Wallis Test is performed using Python to determine whether significant differences exist among the data. Results indicate that CR achieves the highest yields for both corn and soybeans, while NT reduces input costs, making it a cost-effective alternative. Despite yield reductions in NT, net returns remain competitive with CT and CR due to lower power and overhead costs. Statistical analysis using the Kruskal-Wallis Test finds no significant differences in net returns among the three tillage systems, suggesting that conservation tillage can be financially viable for soybean and corn farmers.

This study underscores the need for targeted policy measures, such as financial incentives and educational programs, to encourage NT and CR adoption. By balancing profitability with sustainability, these conservation tillage systems offer a promising approach for enhancing the long-term resilience of soybean and corn production in Illinois.

Keywords:

[no keywords provided]

Mentor(s):

Michael R Langemeier (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7085

Presentation Time: STEW 218C at 1:40-2:00

Adaxial versus Abaxial Translocation in Dicots for Organic Nanocarriers Produced via FNP

STEM

Authors(s):

Laurian Kate Lien† (Agriculture|Engineering)

Abstract:

Current agrochemical practices are highly inefficient, with as little as 0.1% of applied chemicals reaching their target. With increasing pathogens, environmental stressors, and growing populations, there are pressing needs for scalable, cost-effective delivery systems that can improve agrochemical delivery efficiency though systemic translocation. Nanotechnology, particularly organic nanocarriers (NCs), offers a promising solution. Flash Nanoprecipitation (FNP) is an antisolvent precipitation technique that provides a scalable method for producing NCs with a core-shell architecture, offering high encapsulation efficiency and flexibility for delivering hydrophilic and hydrophobic agents. However, further research is needed to assess the long-term fate, efficacy, dosing parameters, and biomolecules used as the “shell” of organic NCs for optimal delivery in planta. This research addresses a significant knowledge gap in dosing parameters by developing a mechanistic understanding for a model eudicot, Solanum lycopersicum, for dosing particles adaxially or abaxially on a leaf surface and the effect on internalization and translocation. To generate translocation and internalization data, NCs have a hydrophobic core of palladium and a tracer dye serving as tracers for quantification by ICP-MS and confocal microscopy to monitor distribution in planta. The surface chemistry of the NCs consist of low-cost amphiphilic stabilizers and biocompatible materials: lecithin, eudrgit S-100, and zein. The core of these particles can be substituted with pesticides in future applications, and it is expected that similar particle sizes and stabilizers will result in comparable plant trafficking. Developing a mechanistic understanding of nanotechnology dosing parameters is crucial for advancing organ-specific delivery, ultimately enhancing the efficiency of agrochemical applications.

Keywords:

Organic Nanocarriers; Agrochemical Delivery; Nanotechnology; Flash NanoPrecipitation; Sustainable Agriculture

Mentor(s):
Kurt Ristroph (Purdue University); Lucas Johnson (Agriculture)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7086

Presentation Time: STEW 214B at 2:00-2:20

NeuralRace: Autonomous Racing through Neural Perception, Planning and Control

STEM

Authors(s):

Manav Nikhil Gagvani† (Engineering); Sangeet Mohan† (Engineering); Zachary Thomas Nena† (Science|Graduate); Felipe da Paixao† (DSB)

Abstract:

This research aims to develop, test, and verify a primarily neural-network based autonomous driving stack for scaled-down autonomous racecars ranging from 1/10 scale to go-karts.

Traditional approaches to autonomous driving or racing break down the problem into three steps, perception (acquiring data from sensors), planning (determining the optimal course to take) and control (actuating the car such that it will follow the desired path). We aim to replace these three tasks using neural networks to directly predict future vehicle states or actuations from perception inputs.

Several design constraints and specifications need to be considered to develop neural algorithms that can successfully operate on the platforms mentioned previously: parallel compute is limited to 21 TOPS on the go-kart and roughly 1 TOPS on the 1/10 scale car, meaning that any algorithm deployed must be parameter-efficient to run in real-time.

We implement three strategies to this autonomous racing problem. First, we utilize an open-source waypoint generation model that uses front-facing camera images as input to create a path that a manually tuned Pure Pursuit controller follows. We also implement an end-to-end model which directly predicts steering and throttle controls using front-facing camera images which is trained to mimic a reference driver. Finally, we implement a neural network for lane detection, and then use manually created heuristics to determine optimal future waypoints.

These methods are stress tested on the Purdue Grand Prix track to evaluate the relative performance of each algorithm in varying driving situations.

Keywords:

Autonomy; Self-Driving Cars; Controls; Autonomous Racing; Neural Networks

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Shreya Ghosh (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7087

Presentation Time: STEW 214B at 2:20-2:40

ZnO Nanowire-Based Wearable Sensor for driver health Monitoring

STEM

Authors(s):

Zixuan Fei† (Engineering|JMHC)

Abstract:

This research develops a novel, zinc oxide (ZnO) nanowire-based wearable sensor for continuous pulse monitoring, with a primary focus on real-time driver health monitoring. By integrating principles of human factors engineering and design-for-wearability, the sensor addresses key limitations of existing devices—namely discomfort and poor long-term compliance. Enhancing the skin-sensor interface not only improves signal quality but also ensures that the device is comfortable enough for extended use, a critical factor in high-stress and safety-sensitive environments such as automotive transportation. The fabrication process combines bottom-up and top-down manufacturing techniques. ZnO nanowires are grown via a hydrothermal process, while the sensor device is constructed through a series of top-down steps, including layer-by-layer spin coating for flexibility, incorporation of silver nanowires for conductivity, and precision electrode patterning. A design of experiments (DOE) approach coupled with statistical process control methods enables a comparative analysis between pure and Li-doped ZnO sensors. Key performance indicators such as signal-to-noise ratio, environmental reliability, and robustness against operational stressors (e.g., vibration and temperature fluctuations) are systematically evaluated. Overall, this multidisciplinary project not only advances sensor performance and manufacturability but also offers a scalable, cost-effective solution for proactive risk management in transportation systems, thereby enhancing both driver safety and operational efficiency.

Keywords:

ZnO Nanowire Sensor; Wearable Health Monitoring; Flexible Electronics; Nanoelectronics; Doped ZnO Sensors

Mentor(s):

Tuhina Saxena (Engineering); Wenzhuo Wu (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7088

Presentation Time: STEW 214B at 2:40-3:00

ASTRO-USA: Analog Simulation Training and Research Outpost Utilizing Self-Sustaining Architecture

STEM

Authors(s):

Manya Devang Kadiwala† (Agriculture); Adriana K Sanchez† (Agriculture|Engineering); Shruti Subramaniyan‡ (Engineering); Brasen Paul Garcia‡ (Engineering); Nitya Manish Jhaveri‡ (Science); Vijay Muthukumar‡ (Engineering|JMHC); Mia Constance Schecter‡ (Agriculture|JMHC); John Michael Peters‡ (Polytechnic|JMHC); Micah David Ambrose‡ (Engineering); Ryan Arthur Sidney Grenier‡ (Liberal Arts); Emirhan Gunes‡ (Engineering); Mark T Crooks‡ (Agriculture); Nathanael Robert Herman‡ (Science|JMHC); Arabella Leia Crivello‡ (Engineering); Elizabeth Xian-Hui Kung‡ (Engineering|JMHC); Sonali Garg‡ (Engineering); Cole Anthony Massie‡ (Engineering); Ryan Charles Deangelis* (Engineering); Emma M Horn* (Agriculture); Swastik Patel* (Polytechnic); Luke Powell Williams* (Engineering); Simone Xin Moulton* (Engineering|JMHC); devyani tyagi* (Science); Spruha Jigar Vashi* (Engineering)

Abstract:

Human space exploration faces critical challenges in developing fully closed-loop systems that recycle air, water, food, and waste to sustain life during deep space missions. Bioregenerative Life-Support Systems (BLiSS) offer a promising solution, but no fully closed habitat currently exists in the Western Hemisphere. Purdue's Space and Earth Analogs Research Chapter (SEARCH) is addressing this gap through ASTRO-USA, a research initiative simulating deep space missions to advance BLiSS technologies. The project hypothesizes that integrating autonomous agricultural modules, biological waste recycling systems, and psychological support can sustain life in closed analog environments. Unlike the International Space Station, which recycles only oxygen and water, ASTRO-USA evaluates agricultural subsystems such as autonomous hydroponic towers for gas exchange and food production, while Mycoponics™ uses fungi to recycle solid waste into valuable resources. Since Fall 2023, SEARCH has designed hydroponic towers that sustain flora for atmospheric stability and nutrition, using growth methods like the nutrient film technique to mirror extraterrestrial systems. The habitat’s design incorporates garden spaces, natural light, and open-concept layouts to support psychological well-being. SEARCH has established an analog site using shipping containers and partnered

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

with NASA Kennedy Space Center to co-develop biological waste management technologies. Preliminary findings suggest the viability of closed-loop resource cycling for food, air, and waste management. ASTRO-USA aims to serve as a platform for future research in space architecture and self-sustaining habitats, laying the groundwork for sustainable extraterrestrial outposts.

Keywords:
Bioastronautics; Space Habitation; Hydroponics; Waste Management; Closed-Loop Systems

Mentor(s):
D. Marshall Porterfield (Purdue University); Dawn Whitaker (Purdue University); Robert M Stwalley (Purdue University)

Other Acknowledgement(s):
Rodrigo Nascente Schmitt (Engineering); Ilina Adhikari (Engineering); Emma Block (Engineering); Alexander Kevin Gordon (Purdue University); Brody Steven Cooke (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7089

Presentation Time: STEW 214C at 2:00-2:20

Machine Learning driven characterization of thermal conductivity in materials

STEM

Authors(s):

Jonathan Steven Hickle† (Engineering)

Abstract:

Thermal properties, alongside electrical properties, dictate the usefulness of materials in semiconductors and microelectronics. These properties are governed by bond strength within a material's crystal structure, which is influenced by its chemical composition. However, identifying materials with desirable thermal properties remains a challenge due to the vast number of potential candidates.

To address this, machine learning models trained on well-characterized materials can be used to predict the thermal properties of new materials. This method utilizes the mp_api library to retrieve material data from the Materials Project, which is then processed into lattice structures using the matgl library. A pretrained model from the PyTorch library analyzes these structures to estimate bond strength and thermal conductivity. The predictions are then sorted by relevant properties and exported for further analysis.

By automating property predictions, this approach streamlines materials discovery, allowing researchers to efficiently identify promising candidates and optimize experimental resources for further study.

Keywords:

Machine Learning; Semiconductors

Mentor(s):

Krutarth Hemant Khot (Engineering); Xiulin Ruan (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7091

Presentation Time: STEW 214C at 2:40-3:00

SWARMS: Multi-Agent Control Simulation

STEM

Authors(s):

Amikosh Dube† (Engineering); Jay Bhavesh Gandhi† (Engineering); Noah Anthony Wisniewski† (Engineering); Shrikar Hippargi† (Engineering); Dhanush Adhitya Gopalakrishnan‡ (Engineering); Berra Ulku Kalci‡ (Engineering); Derek John Matthei‡ (Engineering); Siddharth Shridhar Nadgaundi‡ (Science); Gautam Kottayil Nambiar‡ (Engineering); Patrick Randall Spillman‡ (Engineering|JMHC); Jammy Wang‡ (Science)

Abstract:

SWARMS: Multi-Agent Control Simulation research focuses on enhancing autonomous UAV (Unmanned Aerial Vehicle) navigation by developing advanced control algorithms for efficiently maneuvering through complex obstacle courses in virtual racing environments. Using Unreal Engine and the Colosseum (Airsim) API, we integrate computer vision techniques to improve motion planning, trajectory generation, gate detection, and obstacle avoidance. Additionally, our Guidance, Navigation, and Control (GNC) teams are developing a vision-based navigation system where drones rely on real-time object detection to locate and pass through gates without predefined waypoints, generating optimal trajectories and optimizing the controller for improved flight performance.

Preliminary results demonstrate significant improvements in navigation performance, particularly in reducing completion times and improving navigation efficiency and accuracy. Our approach has substantial implications for real-world autonomous systems, especially in vision-based multi-agent control frameworks. Future work will focus on refining detection algorithms to enhance robustness, improving real-time processing efficiency, and further optimizing navigation strategies through testing in dynamic simulation environments that closely replicate real-world conditions.

Keywords:

Simulation; Autonomous Control; Computer Vision; UAV; Machine Learning

Mentor(s):

Shreyas Sundaram (Purdue University); Younggil Chang (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7092

Presentation Time: STEW 214D at 2:00-2:20

The Implications of Information Challenges on Student Journalists

Social Science

Authors(s):

Norah Ann Wills† (Liberal Arts); Harsha Bansiwal† (HHS); Sophia Victoria Pimentel† (DSB)

Abstract:

This study examines how college student journalists perceive and experience information challenges related to using and communicating information in their work. The research team conducted semi-structured interviews with thirteen student journalists working at student-run newspapers in the Big Ten Academic Alliance.

Utilizing thematic analysis, the team iteratively coded transcript data and identified that student journalists face significant obstacles related to using information at university newspapers. Primary challenges for student journalists include university bureaucracy and gatekeeping, sources unwilling to go on record, audience engagement difficulties, and a lack of guidance from experienced journalists to navigate these information challenges. Many struggle to balance journalistic integrity with these challenges, particularly when university regulations and limited resources complicate reporting efforts. Interviewees underscored their commitment to maintain journalistic integrity, as evidenced by their strict code of ethics, which includes extensive fact-checking and balanced reporting. Despite identifying a wide range of information challenges affecting their work, most interviewees were uncertain about how the profession can address them.

Early implications suggest a need for greater institutional structure and training for student journalists to enable them to address these challenges while still striving to uphold journalistic integrity. This research contributes to the fields of journalism and information literacy by highlighting student journalists' commitment to the field and the broader importance of being able to access and use information to foster a more transparent and informed society.

Keywords:

Information Literacy; Student Journalism; Higher Education

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Rachel Fundator (Purdue University); Clarence Maybee (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7093

Presentation Time: STEW 214D at 2:20-2:40

DMRG Simulation of Spin-Chain Multichannel Kondo Model

STEM

Authors(s):

Jordan Alexander Gaines† (Science|JMHC)

Abstract:

The low-temperature thermal impurity entropy of the electronic multichannel Kondo model suggests the existence of exotic quasiparticles known as anyons. It is well known that thermal impurity entropy of the one and two channel electronic Kondo models corresponds to the ground-state impurity entanglement entropy of an analogous spin-chain model with next-nearest neighbor coupling fine-tuned to frustration. We seek to extend this correspondence to the three and four channel Kondo models by proposing a spin-chain geometry to realize the low-energy Kondo physics. This extension serves to generalize the relationship between the electronic and spin-chain Kondo models. We numerically analyze the ground state of our spin-chain model using the density matrix renormalization group (DMRG) algorithm for matrix product states (MPS). We recover the expected ground-state impurity entropy which supports our proposed geometry. Based on our simulation results, we also propose a relation between the non-integer ground state degeneracy of the three-channel spin-chain model and the anisotropy parameter of the next-nearest neighbor interaction.

Keywords:

[no keywords provided]

Mentor(s):

Jukka Ilmari Vayrynen (Purdue University)

Other Acknowledgement(s):

Guangjie Li (Purdue University)

Talk Presentation Abstract Number: 7094

Presentation Time: STEW 214D at 2:40-3:00

Accurate prediction of macroscopic transport during the Mott transition using fractal resistor network and surface imaging

STEM

Authors(s):

Po-Yu Chen† (Science)

Abstract:

Vanadium dioxide (VO$_2$) exhibits hysteresis in resistance while undergoing a thermally driven insulator-metal transition (IMT). Understanding the hysteresis in resistance is of great interest, as VO$_2$ is a strong candidate for brain-inspired computing, which is more energy efficient for AI tasks compared to traditional computing. Accurate models of the connection between microscopic and macroscopic transport properties of VO$_2$ will allow us to better utilize VO$_2$ in future applications. However, predictions of macroscopic resistance of VO$_2$ that quantitatively match observations using optical data have not yet been achieved. Here, we demonstrate an accurate prediction of the macroscopic resistance of VO$_2$ throughout the entire temperature range of interest, using our resistor network model combined with the assumption of the fractal sub-pixel structure of the optical data, where the configuration of insulating and metallic domains are drawn from the Random Field Ising model. This gives indirect evidence that the observed fractal, power law structure of metallic and insulating domains extends well beyond optical resolution, and that the two-dimensional random field Ising model near criticality is a suitable model for describing the metal and insulator patches of VO$_2$. Our methods demonstrate how macroscopic transport properties can be quantitatively predicted from optical measurements without the resolution of individual domains in the fractal structure.

Keywords:

[no keywords provided]

Mentor(s):

Erica Carlson (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7095

Presentation Time: STEW 218A at 2:00-2:20

Supporting Youth Learning and Development in an Afterschool Program

Social Science

Authors(s):

Amanda Reese Catey† (Science|JMHC); Zainub Aamir Kokan* (Science|JMHC); Lydia Sue Gonzalez* (DSB); Hannah Krouse* (Ivy Tech Community College)

Abstract:

After-school programs play a critical role in the learning and development of youth, such as by helping youth be more excited to learn and creating opportunities to learn life skills. Understanding how these programs support youth is essential for examining program effectiveness and developing recommendations for improvement.This study evaluated a local after-school program to determine how they are supporting youth learning and development. Surveys were administered to 12 youth in the neighborhood to examine if they feel the afterschool program is supporting youth by helping youth do better in school, helping youth feel happier or less stressed, having someone available to help youth when they need it, and supporting youth in the subjects they need the most help in. Youth shared that the afterschool program is supporting their learning and development by helping them feel happier or less stressed (75%), having someone available to help the student when needed (75%), helping the students do better in school (100%), and helping students that need help in reading, science, and social studies (100%, 66.67%, and 75% respectively). Youth also felt that the afterschool program can better support youth who need help in math and language arts/english. Therefore, it can be determined that the afterschool program is supporting youth learning and development. These results can be used to help create recommendations to the afterschool program.

Keywords:

Afterschool; Learning; Youth Development

Mentor(s):

Temitope Folasade Adeoye Olenloa (Purdue University)

Other Acknowledgement(s):

Rose Mbewe (Education)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7096

Presentation Time: STEW 218A at 2:20-2:40

Integrating Digital Twins and Virtual Reality for Advanced Manufacturing Education

STEM

Authors(s):

Alberto Minaya Lopez† (Engineering)

Abstract:

The demand for more effective and engaging manufacturing education has never been greater. This project addresses this challenge by integrating digital twins with immersive Virtual Reality (VR) environments, enabling learners to interact with realistic industrial settings and CAD models in real time. Through seamless connectivity with simulation software, physical machinery, and online platforms like nanoHUB, this educational ecosystem allows users to safely test hypotheses, optimize processes, and visualize complex manufacturing and nanoscale phenomena.

By leveraging VR Headsets and VR Cave technology, learners can conduct high-fidelity simulations of manufacturing scenarios without the need for costly physical prototypes. The integration of nanoHUB further enhances this experience by enabling real-time manipulation of nanoscale parameters, providing students with tangible insights into semiconductor carrier densities, nanoscale material properties, and other critical concepts. This hands-on approach bridges the gap between theoretical knowledge and practical application, equipping students with the skills to tackle complex engineering challenges in a risk-free environment.

Beyond enhancing student engagement and skill development, this approach has broader implications for education and industry. By transforming how manufacturing and nanoscale concepts are taught, universities can cultivate a new generation of professionals adept at leveraging advanced technologies to address challenges in areas such as sustainable production and next-generation electronics. Ultimately, this project establishes a scalable model for modern learning—one that not only prepares the workforce of the future but also reinforces the role of academic institutions in solving global engineering challenges.

Keywords:

Digital Twins; Virtual Reality; Workforce Development; Simulation Based Training; NanoHUB

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Ramses Martinez (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7097
Presentation Time: STEW 218B at 2:20-2:40

Land Price and Land Use Gradients in China: Empirical Evidence on the Monocentric Model and Policy Influences

Social Science

Authors(s):
Yizhou Fang† (DSB)

Abstract:
China has experienced rapid urbanization in recent decades. This study investigates how the urban structure has evolved in growing cities. Using around two million land transactions in China from 2000 to 2019, we test key predictions of the classic Monocentric City Model (MCM) on the gradients of land price and land use with regard to distance to the city center.

Preliminary findings show evidence consistent with the MCM predictions. Land prices decline with the distance from the city center, with the rate of decline slowing over longer distances. Similarly, the land use gradient varies across distances, with commercial and residential shares decreasing and industrial land use becoming more prominent at greater distances. Over time, both gradients are expected to steepen, suggesting larger price variations with distance and increasing commercial and residential land concentration in city centers. Future analysis will examine whether those patterns differ by city sizes. I expect larger cities to exhibit higher land prices and steeper gradients.

Urban policies affect a city's urban structure. For example, urban transportation infrastructure that connects the city center to its outskirts is expected to make land in the city center to specialize in commercial use, while the land price gradient is likely to flatten. I plan to test with Chinese cities that have built its subway and road networks in different formats. I also plan to study the impacts of land use regulations. This study provides insights in the design of urban planning and land market regulations.

Keywords:
[no keywords provided]

Mentor(s):
Ben Zou (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7098

Presentation Time: STEW 218B at 2:40-3:00

Opportunities and Risks of Biometric Security in the Age of Generative AI

STEM

Authors(s):

Amanda Huang† (Polytechnic)

Abstract:

With the rising prevalence of generative AI, there is an increased use of AI tools in various sectors, ranging from home safety and security. But, often, these tools lead to a wide range of risks to a user. Therefore, it is essential to assess the trade-off between the opportunities and dangers of bioacoustics data-driven security when employing generative AI to solve real-world challenges, such as detecting invasive species that can lead to threat to safety and security of our biometric-based safety ensuring systems/mechanisms. This project will use different AI/ML techniques to generate insightful analyses. Thus, our findings will aid future researchers and scientists in utilizing generative AI/ML to maintain biometric security.

Keywords:

Classification; Machine Learning; Mel Frequency Cepstral Coefficients (MFCC)

Mentor(s):

Sudip Vhaduri (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7099

Presentation Time: STEW 218C at 2:00-2:20

Analyzing a gradient of effective corridor widths for mesocarnivores in Indiana

STEM

Authors(s):

Katie Luo Hong† (Agriculture); Abigail Rose Malott* (Agriculture|JMHC); Antonia Christina Alexiou* (Science|JMHC); Vaishnnavi Purram* (Exploratory Studies|JMHC|Other); Anaey Gaurang Naik* (HHS|JMHC)

Abstract:

The Midwest has increasingly fragmented landscapes due to urbanization expansion and agriculture, reducing connectivity between core habitats. Research has shown that wildlife corridors can break barriers like cities and agricultural fields and bring connectivity, fixing our modern biodiversity loss problem. One type of corridor with limited research is the use of easements, such as utility easements, powerlines, fire roads, and railroad tracks; however, these corridors may utilize human management techniques such as herbicide spraying. Because of the lack of in-depth assessment, researchers have only focused on the easements' negative impacts on species by creating clearings that cause fragmentation. I aim to tackle the large knowledge gap on corridor designs that positively impact mesocarnivore movements, specifically on corridor width. Natural corridors are also affected by their widths, as some research has found wildlife utilizing trails that meet the minimum width criteria. For instance, a study in Canada found that an effective wildlife corridor for large mammals would need to be at least 600 meters wide, but these are specific to large mammals like Grizzly Bears. This width might also be useful for future design connectivity between states, supporting larger mammals. In this study, we aim to identify wildlife movement across a class of manmade corridors in a gradient of widths, from nature trails used by a few people to large easements managed by utility companies. To do this, we will utilize a remote sensing technique of capturing wildlife images using infrared sensors positioned at broadcast heights (6') and knee heights (24") at six sites in Indiana. We predict that the width of corridors will have increased sightings of large mammals and mesocarnivores, even in cases of broad herbicide treatments.

Keywords:

Corridor; Fragmentation; Easement; Mesocarnivore; Trail

Mentor(s):

Kristen Marie Bellisario (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7100

Presentation Time: STEW 218C at 2:20-2:40

Dress and Trade at Fort Ouiatenon and New France: Economic and Social Relations as Evidenced by Cloth Bale Seals

Social Science

Authors(s):

Jacob Scott Culp† (Liberal Arts)

Abstract:

European textiles were an important aspect of the 18th-century trans-Atlantic fur trade and global economy. Few examples of actual cloth have been recovered from historic archaeological contexts, but a common artifact found archaeologically are lead seals that were attached to bundles of textiles bound for North America. These seals were primarily used to signify whether taxes had been paid on the goods in question or to indicate that quality checks had been conducted by the proper authorities. Our ongoing research focuses on the cloth bale seals excavated from Fort Ouiatenon, a fur trade post established by the French in 1717 in present-day Tippecanoe County, IN. Using these seals as indicators of the cloth goods present at the fort and comparing them to contemporaneous sites, our goal is to better understand the economic and social relations in New France between and among Native Peoples and Europeans.

Keywords:

Lead Seals; Textiles; Fur Trade; Fort Ouiatenon; New France

Mentor(s):

Harold Kory Cooper (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7101

Presentation Time: STEW 218C at 2:40-3:00

Deliberative Polling: A Tool for Realizing Practical Deliberative Democracy?

Social Science

Authors(s):

Lynlee Morgan Rice† (Liberal Arts|JMHC)

Abstract:

Deliberative polling has been proposed as a solution to address the lack of public deliberation necessary for an effective democracy. While this method, as demonstrated in James Fishkin's America in One Room experiment, does reduce affective polarization and enhances political knowledge, its ability to model large-scale deliberation is lacking. This paper argues that deliberative polling fails as a strategy for realizing practical deliberative democracy in two key ways: first, it relies on aggregative logic that undermines deliberative norms, and second, it lacks democratic equity due to its inability to create inclusive, legitimate spaces for discussion. Additionally, deliberative polling does not account for the two essential "faces" of democracy—the deliberative and the agonistic—thereby neglecting the role of conflict in political engagement. Given these shortcomings, deliberative polling should not be institutionalized as a mechanism for decision-making. Instead, its most valuable application lies in functioning as an informational tool to guide public discourse, while ensuring that citizens remain engaged in democratic processes. Ultimately, while deliberative polling offers notable benefits, it is insufficient as a standalone solution for fostering large-scale public deliberation.

Keywords:

Democracy; Deliberation; Polling; Polarization; Politics

Mentor(s):

Mary F Scudder (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7102

Presentation Time: STEW 214B at 3:00-3:20

Modeling Drug Transport in the Umbilical Cord: A Fluidic Approach to Pregnancy Pharmacokinetics

STEM

Authors(s):

Dipali Rebecca Abraham† (Engineering); Mira Nimesh Patel† (Engineering); Alexander Carnevale† (Engineering)

Abstract:

Pregnancy brings about immense physiological changes to the formation of the umbilical cord, tissue structure, and blood flow, impacting the pharmacokinetics of drugs. Often, these alterations are insufficiently studied because it is unethical to include pregnant women in clinical trials. To bridge this gap, our research addresses how fluidic models can be used to understand modifications presented by pregnancy. Fluidic models uniquely replicate the dynamic and mechanical conditions of the umbilical cord vein to understand drug transport within it. To accurately emulate these properties, we investigated the properties of the umbilical cord vein. A fluidic channel was then designed and fabricated with polydimethylsiloxane. The pulsatile blood flow was created using a syringe pump. To quantify various flow properties, we utilized Particle Tracking Velocimetry. This model will allow researchers to gather data on drug transport in the umbilical cord and serve as a basis to test drug absorption and distribution within the umbilical cord. This is the first step to study drug delivery during pregnancy and ensure safe and effective treatments for mothers and their children.

Keywords:

Pharmacokinetics; Microfluidics; Fluidics; Pregnancy; Blood Flow

Mentor(s):

Arezoo Ardekani (Purdue University); Ryan B Wagner (Purdue University)

Other Acknowledgement(s):

Harsa Mitra (Engineering); Subham Das (Engineering)

Talk Presentation Abstract Number: 7103

Presentation Time: STEW 214B at 3:20-3:40

RISCV Multicore Extension and Benchmarking

STEM

Authors(s):

Aishwarya Saikrupa Anand† (Engineering); Seongjoong Yim† (Engineering); Devin Singh* (Engineering)

Abstract:

A multicore, or multiprocessor, is a type of microprocessor on a single chip with 2 or more CPUs. Compared to a single core, multicore allows performance enhancements from the specialization of cores. The current multicore design implements cache coherence and synchronization primitives, making it functional.

Our project focuses on furthering the work done by the previous teams. We are currently working on integrating the 2+ homogenous multicores into the top-level design for the upcoming AFTx08 chip. The next phase of the project involves performance characterization, including analyzing the trade-offs between core count and hardware area. The characterization will be done using microbenchmarks for different communication patterns, and open-source benchmarks for overall performance. The results of benchmarking will be used to inform optimizations of the multicore design. We also plan to implement heterogeneous multicore architectures. One approach is a big-little design, where high-performance cores handle heavy computation and vector extensions, while low-power cores manage lightweight tasks like sensor monitoring. We will develop a tool or methodology to enable simple core specialization in future chip iterations which will support configurations with a mix of core sizes, as well as the potential for task-specific optimizations.

Keywords:

Multicore; Optimization; Benchmarking; Design; Integration

Mentor(s):

Cole Aaron Nelson (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Burkay Sahin (Engineering); Malcolm Lloyd Seib McClymont (Engineering)

Talk Presentation Abstract Number: 7104

Presentation Time: STEW 214B at 3:40-4:00

The impact of gut microbiome dysbiosis and subsequent intervention on restoring spinal health in a murine model

STEM

Authors(s):

Sarah Marie Staller† (Engineering|JMHC)

Abstract:

Spinal degenerative diseases are prevalent in society, burdening the healthcare system and leading to reduced patient quality of life. However, the mechanisms behind spinal degeneration remain poorly understood. Research indicates a relationship between the gut microbiome (GM) and musculoskeletal (MSK) biomechanics. This study aims to investigate the efficacy of different intervention methods following GM disruption on restoring spinal health in a murine model. Mice were split into six groups based on control type or intervention method: negative control, positive control, cessation, cessation + prebiotic, cessation + exercise, and cessation + prebiotic + exercise. For four weeks, no treatment was administered. At week five, an antibiotic cocktail was continuously administered to all groups except for the negative control. At week 16, antibiotic dosing concluded, and intervention methods (cessation, exercise, and prebiotics) began. At 24 weeks, mice were euthanized. The negative control received no treatments for these 24 weeks; the positive control received continuous antibiotics from week five to 24. L5 vertebrae were isolated and scanned via micro-computed tomography. Trabecular properties were measured, including bone volume/trabecular volume (BV/TV), trabecular number (Tb.N), trabecular thickness (Tb.Th), and trabecular spacing (Tb.Sp). Significant differences among groups for several trabecular bone parameters were detected in the male mice; however, no significant differences were found in female mice. The results from this study will help elucidate the role of GM modulation on spinal mechanics, leading to a greater understanding of spinal degenerative diseases and guide the development of new treatments.

Keywords:

Gut Microbiome; Micro-Computed Tomography (Micro-CT); Bone Mechanics; Mouse Model; Spine

Mentor(s):

Deva Chan (Purdue University); Cameron Xavier Villarreal (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Melissa Kay DeFrench (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7105

Presentation Time: STEW 214C at 3:20-3:40

Bluetooth Functional Near Infrared Spectroscopy (fNIR) Software for Detection of Traumatic Brain Injury (TBI) in Athletes

STEM

Authors(s):

Khushi Choksi† (Engineering); Elan Smyla† (Science); Navya Gupta† (Engineering); Hannah Jordan Margulis† (Engineering|JMHC); Kenneth David Siefken† (Engineering); Ramya Prasanna‡ (Science|JMHC); Ian Kwan Yin Lam‡ (Science); Saqib Manjur Chowdhury‡ (Pharmacy|JMHC); Nasser H Sanwari‡ (Engineering); Grant Dlugos Congdon‡ (Engineering|JMHC); Paras Sandeep Punater‡ (Science|JMHC); Dalton J Aaker‡ (Engineering); Deniz Eksioglu‡ (Engineering|JMHC); Saishri Bagde‡ (Engineering)

Abstract:

According to the University of Michigan, sports-related injuries cause 3.8 million concussions annually in the United States. Contact sports like football put athletes at high risk, with 5-10% experiencing concussions each season. Many cases go undiagnosed, leading to cognitive impairments, emotional and behavioural issues, and, in cases of repeated concussions, neurodegenerative diseases like chronic traumatic encephalopathy (CTE). Current imaging modalities, such as Computed Tomography (CT) scans and Magnetic resonance imaging (MRI), are both expensive, lengthy, and require large machines. Functional Near-Infrared Spectroscopy (fNIRS) presents a promising alternative, offering a portable and accessible means of assessing brain function through blood oxygenation measurements. However, existing fNIRS solutions require expert interpretation, restricting their widespread use. To address this, our team is developing software capable of detecting various types of TBIs across different fNIR platforms. By integrating machine learning (ML), our software aims to automate injury assessment, enabling early detection by providing accurate and real-time prognosis on the sidelines. Using a Random Forest ML algorithm, we are analyzing key physiological constraints such as mean oxygenated blood levels by performing an analysis on specific data features and contrasting hemaglobin levels in healthy and unhealthy individuals. With the development of a Bluetooth data transmission device, the AI-driven diagnostics software becomes compatible with the fNIRS. This lays the foundation for broader neurological applications for improving

concussion outcomes and reducing the chances of severe neurological disorders such as CTE.

Keywords:
Machine Learning; Traumatic-Brain Injury; Functional Near-Infrared Spectroscopy; Bluetooth; Nanotechnology

Mentor(s):
Hammad Furqan Khan (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7106

Presentation Time: STEW 214C at 3:40-4:00

AI-Driven Non-Invasive Wireless Blood Pressure Assessment via Triboelectric Sensors

STEM

Authors(s):

Kevin Nathan Qu† (Science|JMHC); Pranav Perumal† (Science); Padmaja Sachin Khairnar† (Engineering|JMHC)

Abstract:

Cardiovascular disease remains the leading cause of death worldwide. Accurate blood pressure monitoring is essential as even slight fluctuations may signal the early onset of severe cardiovascular complications. Proactive assessment enables healthcare professionals to detect risks of heart attacks and strokes before they become critical, significantly improving patient outcomes. First, cardiovascular data is collected using two triboelectric sensors placed at a fixed distance apart, capturing the arterial blood pressure waveform. By analyzing the time difference between peaks in the waveform, pulse wave velocity (PWV) and pulse transit time (PTT), experimentally derived equations and key indicators of arterial pressure, can be calculated. This real-time data is fed into a deep learning model to detect hemodynamics in high-stress environments. Then, the derived hemodynamics sensor data and model predictions are fed into a web-based dashboard built with Python, Flask, and Chart.js for intuitive data visualization. This dashboard allows medical professionals to readily observe various metrics like heart rate, heart rate variability, differential volumetric pulse, and radial augmentation index, essential for gaining early insights into future cardiovascular complications. Ultimately, by integrating triboelectric sensors, deep learning, and web development, this project aims to improve the accuracy of non-invasive blood pressure monitoring in high-stress environments, enabling proactive interventions that enhance cardiovascular health.

Keywords:

Healthcare; Cardiovascular Disease; Artificial Intelligence; Triboelectric Sensors; Web Dashboards

Mentor(s):

Robert Jose Ccorahua santo (Engineering); Wenzhuo Wu (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7107

Presentation Time: STEW 214D at 3:00-3:20

USING TOPOGRAPHY TO SEARCH FOR STRATOVOLCANOES ON MARS: RESULTS FROM THE JEZERO AND NE SYRTIS REGION

STEM

Authors(s):

Samuel Garrison D Singer† (Science); Matthew B Winter‡ (Science); David Matthew Moore‡ (Science); Aksh Sandeep Iyer* (Engineering)

Abstract:

Lead author: S. Singer,

Contributing students: M. Winter, D. M. Moore, A. Iyer

Mentor: B. Horgan

On Mars, volcanism is an important process, driving the transfer of energy and chemicals from deep beneath the crust to the surface of the planet. However, while the large shield volcanoes on Mars have been well studied, only a few examples of composite volcanoes have been identified on Mars, and their broader distribution is unknown. Stratovolcanoes form through a combination of explosive and effusive eruptions, and typically reflect different conditions from shields, so understanding the distribution and history of these types of eruptions could tell us about heat flow and volatile sources in the interior, magma evolution, tectonic processes, and atmospheric evolution. In this study, we develop a framework for identifying possible stratovolcanoes on Mars from remote sensing data, based on examination of databases of the topographic properties of volcanoes on Earth. We apply this framework to Mars to constrain the distribution of volcanic edifices in the circum-Isidis region of Mars, where the Mars 2020 rover is exploring Jezero crater. A better assessment of possible volcanic sources would provide critical context for Mars 2020 and samples returned to Earth via Mars Sample Return. By looking at potential edifices in this region, and comparing topographic properties with those of Earth volcanoes, our preliminary results suggest the presence of several potential candidate stratovolcanoes around Jezero crater, and we are currently verifying these results using other satellite datasets in addition to topography.

Keywords:

Volcanoes; Mars; Remote Sensing; Jezero; Topographic

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Briony H Horgan (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7108

Presentation Time: STEW 214D at 3:20-3:40

Genetic Engineering of SLC1A5 for Improved NK Cell Metabolism Against Brain Tumors

STEM

Authors(s):

Luke Nathaniel Abram† (Science)

Abstract:

NK cells, which belong to the innate immune system, are our first line of defense as immune cells against pathogens. They have shown promise in cancer immunotherapy owing to their ability to natively eliminate cancer cells.

NK cells survive because of the amino acid glutamine, that functions as one of their main energy sources. However, in tumors such as glioblastoma, the most aggressive brain cancer, NK cells are exhausted and their ability to kill cancer is impacted because the available glutamine is diminished. The goal of my research is to metabolically reprogram NK cells via genetic engineering to survive despite limitations in glutamine availability. To accomplish this, my research in cancer immunotherapy focuses on establishing the effect of SLC1A5 on NK cell activity and, by using genetic engineering, enhancing this transporter's expression on the immune cells. SLC1A5 is a glutamine transporter that increases the metabolic rate of the NK cells to help them fight against cancer cells. We have found that blocking SLC1A5 on NK cells diminishes their viability and cytotoxicity. To enhance NK cell anti-tumor function, we are performing viral transduction to express SLC1A5, phenotyping analysis via flow cytometry to determine expression, and functionality assays to test the ability of genetically-engineered NK cells to promote higher killing of glioblastoma cells.

My ongoing research can lead to a safer alternative to chemotherapy by developing new NK cell immunotherapies for brain tumors.

Keywords:

NK Cells; Immunotherapy; Brain Cancer; Metabolism

Mentor(s):

Sandro Matosevic (Purdue University); Shambhavi Sanjay Borde (Pharmacy)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7109

Presentation Time: STEW 214D at 3:40-4:00

Development of a data calibration pipeline and identification and mapping of pyroxene in lunar spectroscopy via RGB image and absorption band analysis

STEM

Authors(s):

Jessica Marie Cyr† (Science); Arunima Saha† (Science); Kamden Elliott Maddox‡ (Science); Matthew Robert Scheer‡ (Polytechnic)

Abstract:

The Moon's surface composition can provide insight into the formation and evolution of the lunar crust. Much of our knowledge of the lunar surface's composition comes from spectroscopy data collected from orbit, so filtering out noise from a spectrometer and preserving as much data as possible is very important. We have developed a pipeline to calibrate data from the Indian Space Research Organization's Chandrayaan-2 Imaging Infra-red Spectrometer (IIRS). To calibrate the spectra, we create and apply a bad pixel map, smooth the data using a Savitzky-Golay filter, and adjust for the specific illumination conditions of each pixel. After calibrating the dataset, we create a reference spectrum from the mean of the scan which is representative of the bulk composition of the scene, covering a ~580 km by 20 km rectangle on the lunar surface. We focused our analysis on pyroxene, as chemical variations in this mineral group represent different formation origins of the surface material. Pyroxene has 2 easily identifiable absorption features in the near-infrared, 1µm and 2 µm. To visualize the spatial distribution of pyroxene, we create RBG images (using the band depth at each absorption feature and the reflectance at 1.58 µm) where the color distinguishes types of pyroxene. We also measure the 2 µm band parameters (band depth, width, and area) of specific regions in the dataset to evaluate the compositional variations across the lunar surface. We will apply these methods to 6 other lunar surface observations taken by IIRS and compare maria and highland spectra.

Keywords:

Moon; Lunar; Pyroxene; Spectroscopy

Mentor(s):

Kris Laferriere (Science)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7110

Presentation Time: STEW 218A at 3:00-3:20

Music's Impact on Asian/American Adolescents

Social Science

Authors(s):

Michelle Wan† (HHS)

Abstract:

Adolescents have a deep connection to music.1 Music shapes their identity and fosters independence. This connection is particularly significant for Asian/American adolescents exploring and integrating their multiple identities. Concurrently, Asian/American adolescents are experiencing a growing mental health crisis. The National Institute of Health (NIH) indivate that Asian/American adolescents and young adults may be especially vulnerable to increased depressive symptoms.2 Several contributing factors include the model minority myth and cultural values. In this study, 16 Asian/American adolescents engaged in a in depth interview, which lasted one to three hours. In this study we examine Asian/American adolescents' perspective regarding music taste and how these songs are related to their identity. Qualitative analysis was utilized to examine the lyrics and their importance to the adolescents. This presentation will show the themes centered around the lyrics and their meantng to adolescents.

Keywords:

[no keywords provided]

Mentor(s):

Stewart C Chang Alexander (Purdue University); Pamela Sari (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7111

Presentation Time: STEW 218A at 3:20-3:40

Monitoring the size distribution of aerosols in manual metal arc welding fumes

STEM

Authors(s):

Shane Kevin Limas† (HHS|JMHC)

Abstract:

Stick welding, also known as manual metal arc welding (MMAW), generates welding fumes containing toxic metallic aerosols. Inhalation of these metallic aerosols can cause adverse health effects, for example, cancer and neurological damage. The impact of these aerosols depends on their deposition in different regions of the respiratory system, such as the head airways, tracheobronchial region, and alveolar region. To estimate deposition, aerosol size must be characterized. This study generated welding fumes in a lab setting and monitored aerosol size distributions across inhalable particle sizes. The experimental setup included a welding station, an exposure chamber for monitoring, and a centrifugal fan to direct fumes. Three welding sticks were tested, and aerosol size distributions were measured using a NanoScan Scanning Mobility Particle Sizer (SMPS) and an Optical Particle Sizer (OPS). After a fixed measurement period, the results were processed and input into the International Commission on Radiological Protection's (ICRP) respiratory deposition model. The geometric mean diameter of aerosols was 0.11 µm, and the mode diameter was 0.12 µm. According to the ICRP model, 0.12 µm particles had depositions of 2% in the head airways, 2% in the tracheobronchial region, and 11.7% in the alveolar region. These findings indicate that welding fumes contain aerosols capable of reaching deep into the alveolar region, potentially entering the bloodstream. This study provides critical insights for occupational health and safety, supporting risk assessment, regulatory compliance, and strategies to minimize worker exposure to hazardous welding fumes.

Keywords:

Welding; Metallic Aerosols; Respiratory Deposition; Aerosol Size Distribution; Occupational Health

Mentor(s):

Jae Hong Park (Purdue University)

Other Acknowledgement(s):

Chang Geun Lee (HHS)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7112

Presentation Time: STEW 218A at 3:40-4:00

Systemic Inflammatory and Organ-Specific Tissue Remodeling Responses Induced by Acute Electronic Cigarette Vapor Exposure.

STEM

Authors(s):

Andrew Patrick Folkers† (HHS); Thomas John Cowden† (HHS); Arni Prakash Bhatnagar‡ (HHS); Anvi Bhatnagar‡ (HHS); Nicholas James Georgiades‡ (Agriculture)

Abstract:

[Abstract Redacted]

Keywords:

E-Cigarette; Inflammation; Nicotine; Oxidative Stress; Tobacco

Mentor(s):

Thivanka M Muthumalage (Purdue University)

Other Acknowledgement(s):

Md Ehsanul Kabir (HHS); Benjamin Kieth Dierolf (HHS)

Talk Presentation Abstract Number: 7113

Presentation Time: STEW 218B at 3:00-3:20

Student Identification of Persuasion Strategies in AI-simulated Financial Scams

Social Science

Authors(s):

Jennifer L Harvey† (Polytechnic)

Abstract:

[Abstract Redacted]

Keywords:

Cyber Resilience Interventions; Online Financial Scams; AI-Facilitated Simulations; Persuasion Strategies

Mentor(s):

Tatiana Ringenberg (Purdue University)

Other Acknowledgement(s):

Miguel Alfonso Feijoo Garcia (Polytechnic)

Talk Presentation Abstract Number: 7114

Presentation Time: STEW 218B at 3:20-3:40

Securing Aviation Communications: A Network-Based Approach

STEM

Authors(s):

Andrew Markel† (Polytechnic)

Abstract:

Insecure aircraft communications pose a significant threat to aviation security, as unauthorized actors can spoof and intercept transmissions between pilots and air traffic controllers (ATC). This research presents a secure authentication and integrity framework to improve trust in aviation communications. Secure aviation networks require the ability to authenticate aircraft to the secure ATC network and verify the integrity of all transmissions. The proposed solution uses Public Key Infrastructure (PKI) to verify the integrity of communications. Certificates are attached to both aircraft registration and ATC stations, and the national database of valid certificates is managed by the Federal Aviation Administration (FAA) which acts as the Certificate Authority (CA) to ensure consistency and trust. Each aircraft's radio is equipped with a certificate store containing valid ATC certificates, updated dynamically via ATC networks or manually through standard FAA database updates. Pilots authenticate to secure ATC frequency networks with their valid digital certificates, and pilots verify authenticity of the ATC station using the built-in certificate store, which mitigates the risk of spoofed transmissions. For aircraft-to-aircraft communication, pilots must trust that all aircraft authenticated and connected to a secure ATC frequency network are authenticated and trusted against the FAA database. This solution significantly improves aviation security by eliminating existing vulnerabilities that leave safety-critical communication open to spoofing and interception. Secure ATC networks that authenticate users and verify integrity of communications will protect these safety-critical communications.

Keywords:

Aviation Security; Integrity; Secure Communications; Network Security; Radio Security

Mentor(s):

Jason Schoenbeck (Collins Aerospace)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7115

Presentation Time: STEW 218B at 3:40-4:00

The effect of the addition of MXene (Ti3C2Tx) on the long term stability of poly(3,4-ethylenedioxythiophene): poly(styrene sulfonate) (PEDOT:PSS) bioelectronic interfaces

STEM

Authors(s):

Charlita Sinmak† (Engineering); Ayden Matthew Rosencranz‡ (Engineering); Antonio C De Oliveira Segura‡ (Engineering)

Abstract:

Implanted bioelectrodes are a means to electrically modulate and interact with the nervous system. Low frequency alternating currents (LFAC) are a new waveform that is being explored with the ability to not only induce nerve activity but also can reversibly and instantaneously slow or block its activity. However, unlike standard pulse stimulation waveforms, LFAC requires an interface with low-low frequency interfacial impedance properties to safely deliver currents to tissues without electrode polarization or producing toxic byproducts. Poly(3,4-ethylenedioxythiophene): poly(styrene sulfonate) (PEDOT:PSS) is a conductive polymer with excellent low frequency properties and is being widely explored for its excellent conductivity. However, its long-term stability remains unclear. MXenes, two-dimensional (2D) nanomaterials, has unique properties including high electrical conductivity (~ 24000 S/cm) and colloidal stability. Incorporating MXene to PEDOT:PSS bioelectrodes offers a promising solution for improving the interface stability and enhancing electrical conductivity. 3,4-ethylenedioxythiophene (EDOT) will be introduced into the multilayers titanium carbide (Ti3C2Tx) MXene, followed by the addition of polystyrene sulfonate (PSS) using electrodeposition. This project aims to produce and test the electrical conductivity, resistance, and long-term stability of PEDOT:PSS-MXene in accelerated aging tests. Its electrochemical will be serially characterized using cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and pulse waveform analyses. The performance will then be compared to that of PEDOT:PSS and PEDOT:PSS carbon black electrodes.

Keywords:

Bioelectronic Interface; MXene; Low-Frequency Alternating Current

Mentor(s):

Ken Yoshida (Purdue University); Babak Anasori (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):
Anupma Thakur (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7116

Presentation Time: STEW 218C at 3:00-3:20

Gender Affinity in State Legislature Campaign Donations

Social Science

Authors(s):

Maylee Ann Rollins† (Liberal Arts|JMHC)

Abstract:

Money is central to politics, particularly campaigns. Candidates for office must raise funds from donors to increase their chances of election. This paper seeks to understand whether or not women donate more frequently to female candidates than male candidates for state congressional campaigns. The data looks specifically at campaign donations for the 2012 elections in the southern states of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia. The data show that ideology is not a significant factor in women's likelihood to donate to female candidates' campaigns.

Keywords:

Gender Affinity; State Legislatures; Campaign Donations

Mentor(s):

Eric Waltenburg (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7117

Presentation Time: STEW 218C at 3:20-3:40

Stalin and Groupthink: How Stalin's Personality Colt Existed Alongside Collective Leadership

Humanities

Authors(s):

Isidore Peter White† (Liberal Arts)

Abstract:

[Abstract Redacted]

Keywords:

Stalin; Groupthink; Soviet Union

Mentor(s):

Christopher Ewing (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7118

Presentation Time: STEW 218C at 3:40-4:00

Thermal Actuation Inspired Machine Learning Algorithm for Reconfigurable Antenna

STEM

Authors(s):

Prisha Rachakonda† (Polytechnic); Adina Ioana Margineantu‡ (Science); Tanya Vijay‡ (Engineering); Sishir Mahavadi‡ (Engineering); Jacob Daniel‡ (Engineering|JMHC)

Abstract:

Current antenna technology is limited in its motion once sent into outer space. Expanding on antenna shape-shifting capabilities allows for one antenna to serve a wider range of purposes such as meeting human radio/television needs and communicating with space exploration vehicles at the same time. Therefore, this research implements an origami-inspired folding pattern on a traditional antenna design in order to allow for reconfiguration capabilities. The origami feature is constructed using shape memory alloys (SMA), a material that expands and contracts when heated. We identified key features such as elastic strain, coefficient of thermal expansion, elastic modulus, and change in temperature of the SMA, and used them as inputs for a variation of Hooke's Law that calculates stress placed on the SMA. This stress is what induces thermal actuation. We plan to train a machine learning model to identify these inputs and use the Hooke's Law equation as an algorithm, allowing for autonomous reconfiguration once in space. Ultimately, the goal is to build an actual prototype of the antenna and use it to test efficiency in terms of response time and accuracy in autonomous reconfiguration.

Keywords:

Aerospace; Origami; Reconfiguration; SMA Based Actuation; Machine Learning

Mentor(s):

Ran Dai (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7119

Presentation Time: STEW 214B at 4:00-4:20

Restoring Functional Independence: A Grip-Assistive Glove for Muscular Dystrophy through Responsive Motor Control

STEM

Authors(s):

Luke Brian Johnson† (HHS); Shreya Prakash† (Engineering); Ariel Scout Hudson† (Engineering); Uday Mittal† (Engineering|JMHC); Supreet Mishra† (Engineering); Anjan Nanisetti† (Science); Ayush A Kabirpara‡ (Engineering); Isha Varshney‡ (Engineering); Rishaan Ponna‡ (Science); Zion Maurice Julius Hackett‡ (Agriculture|Engineering); Krish Majumdar‡ (Science); Ishana Didwania‡ (Science)

Abstract:

Muscular dystrophies (MD) are a group of genetic disorders causing progressive muscle weakness and degeneration, significantly impairing hand function. In the U.S. alone, MD affects approximately 250,000 individuals, making daily tasks requiring grip strength and joint dexterity increasingly challenging. The core problem lies in the weakening of key hand muscles, particularly the extensor and flexor carpi ulnaris, limiting fine motor control. Existing assistive devices lack adaptability and precise support for varying levels of muscle weakness, creating a gap in effective solutions. To address this gap, this project aims to develop a novel grip-assistive glove that utilizes a pulley system actuated by stepper motors. Muscle control will be achieved through a dual-input mechanism: an electromyographic (EMG) sensor that measures forearm muscle activity to proportionally modulate grip force, and flex sensors that detect individual finger movements for targeted support. This integration enables precise, adaptive grip enhancement tailored to the user's needs. Preliminary testing focused on optimizing sensor combinations and motor functionality, with promising results in signal acquisition. The project now centers on refining sensor output, motor efficiency, and software adjustments. Future steps include user testing to evaluate comfort, responsiveness, and long-term usability. Success will be determined by improved grip strength, increased frequency of use, and enhanced precision in daily tasks. This interdisciplinary design blends engineering innovation with a patient-centered approach, offering a practical solution for individuals with MD and potentially benefiting those with other neuromuscular conditions.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Muscular Dystrophy; Biomechanics; Feedback Response; Electrodiagnostic

Mentor(s):
Zachary Robert Davis (Engineering); Rahaf Salim (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7120

Presentation Time: STEW 214B at 4:20-4:40

Analyzing Gestures in Statistics Instruction: A Study on Digital Video Learning Environments

STEM

Authors(s):

Aashvi Miten Majmundar† (Engineering); Manas Kathuria* (Engineering); Zhengyi Jiang* (Science)

Abstract:

For this project, I contrasted the use of pedagogical gestures in statistics teaching in digital video learning environments (DVLEs) to ascertain their effect on student learning. As a component of my scholarship in the I² Lab at Purdue University, I analyzed a collection of videos from assorted online sources, including YouTube and TeacherTube, that delivered statistics teaching through both human interaction and computer animation. I focused on 12 human-based videos where instructors used gestures to explain statistical concepts such as central tendency (mean, median, mode), variance, and quartiles.

I analyzed by coding the gestures based on the specific content being explained, discovering common hand movements, positions, and gestures that instructors used to explain key statistical terms. For example, I videotaped gestures such as inward curling of hands to explain central tendency or chopping motions to illustrate variance. I also analyzed how these gestures were related to the verbal explanations provided by the instructors and explored how they helped the students understand and engage with the material.

This project is part of a larger project exploring how gestures in DVLEs can aid student learning, especially in self-directed, online learning environments. My study provides an insight into how teachers use bodily gestures to make abstract concepts more concrete, with the potential to inform the design of more effective online learning materials. This research contributes to the ongoing development of digital learning technologies that facilitate STEM learning, particularly in flipped and online learning environments.

Keywords:

[no keywords provided]

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Jason Wade Morphew (Purdue University); Junior Anthony Bennett (Interdisciplinary & Special Programs)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7122

Presentation Time: STEW 214C at 4:00-4:20

Cardiac Remodeling by Pressure and Volume Overload During Pregnancy

STEM

Authors(s):

Samantha Stebbings† (Engineering|JMHC); Sarah Elizabeth Grev‡ (Engineering); Jake Anthony Castro‡ (Engineering)

Abstract:

Left ventricle hypertrophy is a form of cardiac remodeling where the heart wall thickens, a change that can be attributed to pressure and/or volume overload. Volume overload can result in extra cellular matrix degradation and increased stroke volume. Conversely, pressure overload can result in increased fibrosis and decreased stroke volume. The combined effects of these conditions on cardiac remodeling are under-studied, especially as a result of pregnancy. We investigate the effects of hypertensive pregnancy on the function of the heart during cardiac remodeling by comparing hypertensive control mice to hypertensive-pregnant mice (n=5/group). 4D Ultrasound (4DUS) images were analyzed using a custom MATLAB graphical user interface to obtain measurements of strain, ejection fraction (EF), stroke volume (SV), and left ventricular mass (LV mass) [1]. From this initial analysis, we found that both end diastolic volume and end systolic volume show greater increases over time for hypertensive-pregnant mice in comparison to the hypertensive control group, although the baseline values were lower on average for the pregnancy group. SV increased for the pregnancy group, while a slight decrease in SV was observed for the hypertensive control group. EF decreased for both the hypertensive-pregnant mice and the hypertensive control group, with a greater decrease in the pregnant group. Additionally, LV mass showed a greater increase for pregnant mice with hypertension. These results highlight the effects of pregnancy on cardiac remodeling, emphasizing the need for further study of pregnancy-related effects on cardiovascular health.

[1] Damen FW, Salvas JP, Pereyra AS, Ellis JM, Goergen CJ. Improving characterization of hypertrophy-induced murine cardiac dysfunction using four-dimensional ultrasound-derived strain mapping. American Journal of Physiology-Heart and Circulatory Physiology. 2021 Jul 1;321(1):H197-207.

Keywords:
Cardiac Remodeling; Pregnancy; Hypertension; Ultrasound; Cardiovascular

Mentor(s):
Elnaz Ghajar-Rahimi (Engineering); Craig Goergen (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7123

Presentation Time: STEW 214C at 4:20-4:40

VIP Bechtel IoT

STEM

Authors(s):

Xuan Chen† (Engineering); Shivanya Chandra‡ (Science); Naeem Saeed Bahemia‡ (Science|JMHC); Aarav Mangla‡ (Science); Isha Virat Yanamandra‡ (Science); Nina Hu‡ (Science|Graduate); Alexander Chen‡ (Engineering)

Abstract:

Industrial environments often face operational and safety risks due to anomalies in sensor data from critical equipment. This project aims to develop a machine learning-based anomaly detection system utilizing time-series sensor data to enhance workplace safety, optimize maintenance schedules, and prevent potential equipment failures. The system integrates real-time data collection from multiple industrial sensors, including temperature, CO2 levels, air quality, and noise level—via a robust data ingestion pipeline using tools like Apache Kafka and MQTT.

The collected data undergoes preprocessing, normalization, and exploration analysis to identify patterns and anomalies. Initial baseline models, including statistical and rule-based approaches, establish preliminary anomaly thresholds. The core of the system employs a machine learning model using Long Short-Term Memory (LSTM) networks implemented in PyTorch. The LSTM model processes sequential sensor data to predict failures and detect early warning signs of hazardous conditions. Model performance is continuously refined through iterative improvements, leveraging hyperparameter tuning, additional data sources, and domain-specific optimizations.

By implementing this predictive system, industries can proactively mitigate risks, reduce unplanned downtime, and enhance overall operational efficiency. Real-time monitoring and predictive capabilities contribute to a safer working environment while ensuring compliance with environmental and safety regulations.

Keywords:

Industrial Environment; Workplace Safety; Machine Learning; Predictive System; Reduce Risks

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Matthew A Swabey (Purdue University); Jaeeun Kim (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7124

Presentation Time: STEW 214C at 4:40-5:00

Studying Cello Bowing Performance through a Robotic Arm and Reinforcement Learning

STEM

Authors(s):

Tanishaa Shah† (Engineering); Jiashu Liu† (Engineering); Samantha Sudhoff† (Science); Pranesh S Velmurugan‡ (Science|Graduate); Vincent Wentao Zhao‡ (Science)

Abstract:

This project explores reinforcement learning and neural networks to develop a robotic arm capable of performing cello bowing with human-like expressiveness and precision. Instead of relying on pre-recorded motion capture data, we focus on designing a Recurrent Neural Network (RNN)--based system that translates MIDI inputs into dynamic bowing motions. By leveraging a Long Short-Term Memory (LSTM) network and Proximal Policy Optimization (PPO), the system aims to generate smooth, realistic bowing transitions that adhere to musical phrasing and articulation.

The project utilizes the UR5e robotic arm, integrating physics-based simulations and real-world execution to refine motion planning and control. A key aspect of the research involves optimizing bow allocation strategies—ensuring the robot efficiently manages bow length, timing, and transitions between strings. Additionally, we address data processing challenges by improving robotic motion tracking and adjusting reinforcement learning parameters to enhance performance.

Beyond developing an expressive robotic musician, our research contributes to the broader fields of robotics, artificial intelligence, and human-robot interaction in the arts. Future work will evaluate the realism of the generated performances using the Harmonic-to-Noise Ratio (HNR), and a user survey that compares robotic bowing output to human cello recordings. Ultimately, this project seeks to advance robotic musicianship by combining machine learning, and motion control.

Keywords:

Reinforcement Learning; Recurrent Neural Network; Long Short-Term Memory; Robotic Motion; Human-Robot Interaction

Mentor(s):

Yung-Hsiang Lu (Purdue University); Yeon Ji Yun (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7125

Presentation Time: STEW 214D at 4:00-4:20

Physical Characterization of Atmospheric Microplastics in Precipitation

STEM

Authors(s):

Frances Geraldine Johnson† (Science); Jacob David Dorson‡ (Science|JMHC)

Abstract:

Atmospheric Microplastics (AMPs), synthetic airborne pollutants, are a growing concern due to their potential impacts on human health and ecosystems. AMPs have been detected in remote locations, indicating a persistence in the atmosphere and long range transport from urban areas where they are produced. AMPs are unique particles due to their wide variation in size (nm to ?m), shape (fiber or fragment), and chemical composition (polypropylene (PP), polyethylene (PE), amongst others). Understanding and classifying the physical characteristics of AMPs can aid in assessing particle origin and support comprehensive studies of AMP transport and mixing. Precipitation samples were collected at Purdue's Agronomy Center for Research and Education (ACRE) and filtered to isolate AMPs. We analyze AMPs using a Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDS) to quantify and analyze the size, shape, and chemical compositions of particulates in collected precipitation samples. Lab-made microplastic samples with known characteristics, such as PP and PE, are used for comparison purposes. These lab based samples establish reference data, aiding in the analysis of collected AMPs. We anticipate identifying AMPs in the collected precipitation samples with a range of sizes, shapes, and chemical compositions. A comparative analysis between known microplastics and collected AMPs will allow us to assess the presence of different particle types in collected precipitation samples. The findings will contribute to the understanding of the range of AMP characteristics in precipitation, which can be further utilized to develop mitigation strategies.

Keywords:

Atmospheric Microplastics (AMPs); Precipitation Samples; Size Distribution; Chemical Composition; Scanning Electron Microscopy (SEM)

Mentor(s):

Alexandria Vincenza Johnson (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7126

Presentation Time: STEW 214D at 4:20-4:40

Refining Atmospheric Chemistry Models: The Role of O-17 in Tracing Oxidation Reactions

STEM

Authors(s):

Nathan Nguyen† (Science); Thomas Preston Temperley‡ (Science)

Abstract:

Ambient air pollution contributes to millions of premature deaths annually and significantly impacts climate, infrastructure, and ecosystems. Accurately modeling the transport and transformation of pollutants is critical for improving air quality predictions and mitigation strategies. However, existing models lack detailed isotopic chemistry, limiting their ability to track pollution sources and transformation processes. This research aims to enhance the U.S. Environmental Protection Agency's Community Multiscale Air Quality (CMAQ) model by incorporating O-17 isotope. While oxygen isotopes were once considered chemically indistinguishable, recent high-precision analyses reveal that O-17 follows unique fractionation patterns, making it a valuable tool for tracing specific oxidation pathways. By integrating detailed reaction kinetics into both gas-phase and aqueous-phase chemistry modules, our approach improves the representation of ozone formation, nitrogen oxide oxidation, and other critical atmospheric processes. High-resolution simulations conducted on Purdue's high-performance computing cluster, with subsequent statistical analysis in R, demonstrate that resolving O-17 dynamics significantly enhances isotope-based source attribution and reaction pathway identification. These variations are not fully captured by current models, highlighting gaps in chemical mechanisms. Incorporating isotopes into chemical transport models improves source attribution and reaction pathway analysis, leading to more accurate air quality predictions. This research contributes to refining atmospheric models and developing better strategies for pollution mitigation.

Keywords:

Computer Simulations; Air Pollution; Air Quality; Atmospheric Chemistry; Climate

Mentor(s):

Greg M Michalski (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7127

Presentation Time: STEW 214D at 4:40-5:00

Enhancing Low-Resource Machine Translation Using Synthetic Data Augmentation

STEM

Authors(s):

Akshith Garapati† (Science|Graduate)

Abstract:

Neural Machine Translation (NMT) has achieved remarkable success with high-resource languages yet performance tends to degrade when approaching low-resource languages due to the data scarcity that exists with these languages. This research explores a hybrid approach integrating supervised-learning using encoder-decoder models with synthetic data augmentation. Specifically, I rely on both rule-based methods like Markov models, which aim to generate synthetic sentences by modeling linguistic structures and probabilistic transitions alongside existing Large Language Models to generate synthetic data and improve translation quality for low-resource language pairs. I evaluate both methods of synthetic data augmentation using human-verified translation datasets. Additionally, I evaluate this approach on multiple low-resource language pairs, comparing it with conventional supervised learning, back-translation baselines and also comparing the efficacy of the different methods in synthetically generating artificial data. My results will help provide insights into the trade-offs between rule-based and LLM-driven augmentation and offer a pathway for improving NMT performance in resource-constrained settings.

Keywords:

Synthetic Data; Machine Translation; Encoder-Decoder Models; Low-Resource Languages

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7128

Presentation Time: STEW 218A at 4:00-4:20

Influence of Manganese Exposure on SHI-Adapted SH-SY5Y Cells: Neurotoxicity and Adaptive Mechanisms

STEM

Authors(s):

Yuchen Zhang† (DSB|JMHC)

Abstract:

Manganese (Mn) is an essential trace element but poses neurotoxic risks at elevated exposure levels, contributing to neurodegenerative disorders such as Alzheimer's and Parkinson's disease. The SH-SY5Y human neuroblastoma cell line is a valuable in vitro model for studying neurotoxicity, especially for Parkinson's disease, and its differentiation with retinoic acid (RA) enhances its resemblance to mature neurons. However, adapting SH-SY5Y to serum-free, high-insulin (SHI medium) conditions alters cellular metabolism and stress responses. This study first focused on the influence of RA concentration on SH-SY5Y cells and the difference between SHI-adapted and non-adapted SH-SY5Ys. Then, this study investigates the effects of Mn exposure on RA-differentiated, SHI-adapted SH-SY5Y neurons, focusing on oxidative stress, neuron dendrites, and neuron signals. Neurons were exposed to varying chronic Mn concentrations (0.01-50μM) for 40 days, and the other group was exposed to acute Mn concentrations (0.05-100μM) for 6 hours on Day 49. Mn exposure significantly reduced neuronal viability in a dose- and time-dependent manner; an increased dose of Mn exposure led to weaker neuron staining signals and increased sensitivity compared to undifferentiated cells. Furthermore, an extra 10 days of recovery after chronic exposure also indicates an increase in neuron signals. SHI adaptation led to heightened antioxidant responses, yet prolonged Mn exposure resulted in excessive reactive oxygen species (ROS) accumulation and mitochondrial depolarization. These findings highlight the differential susceptibility of SHI-adapted SH-SY5Y cells to Mn toxicity and provide insights into cellular adaptations relevant to neurodegenerative disease models.

Keywords:

Manganese Exposure; Retinoic Acid Differentiation; SH-SY5Y Neurons; SHI medium; Neurotoxicity

Mentor(s):

Aaron B Bowman (Purdue University)

Other Acknowledgement(s):
Xueqi Tang (HHS)

Talk Presentation Abstract Number: 7129

Presentation Time: STEW 218A at 4:20-4:40

Diet Quality and Nutrient Biomarkers - Results from the Personalized Nutrition, Education, Assessment, “Real” Food, and Lifestyle Support (PEARL) Study for Individuals with Autism Spectrum Disorde

STEM

Authors(s):

Grace Kathryn Adams† (HHS); Adrienne M Baumann‡ (HHS|JMHC); Galit Beraja‡ (HHS|JMHC); Alec Carter Didocha‡ (HHS)

Abstract:

Background & objectives: Diet-based interventions have been shown to improve autism-related symptoms and nutritional status in individuals with autism spectrum disorder (ASD). However, research on personalized nutrition strategies is limited. The 12-week PEARL study examined feasibility of nutrition education and a personalized eating plan in individuals with ASD. We present exploratory results comparing end-line to baseline dietary quality and nutrient status.

Methods: Participants (N=36, 9-30y) were recommended to follow MyPlate guidelines with a focus on organic, whole, gluten-free (for 24/31 who tested sensitive) foods and a food-based multivitamin/mineral. Families participated in six virtual nutrition education sessions and weekly check-ins with clinicians. Blood samples and two 24-hour dietary recalls (ASA-24) were collected at baseline and end-line. Differences in Healthy Eating Index (HEI) scores, nutrient intakes, and nutrient markers were analyzed using the Wilcoxon Signed-Rank test.

Results: Significant differences were seen from baseline to end-line for the following: improvements in total HEI score ($p=0.04$) and HEI component scores for greens/beans ($p=0.02$), added sugar ($p=0.03$), and refined grains ($p=0.03$); decreased consumption (g) of refined grains ($p<0.001$), total grains ($p<0.01$), added sugars ($p=0.04$), fatty acids ($p=0.04$), folate ($p=0.03$), and iron ($p=0.02$). However, blood biomarkers showed no significant changes in concentrations of folate or iron. Vitamin B12 concentrations significantly increased ($p<0.001$).

Conclusion: These results indicate that dietary intervention can improve diet quality and nutrient status in individuals with ASD, with reduced refined grains balanced by whole foods and supplements. Our findings offer a basis for future clinical trials following a similar intervention for autistic individuals.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Autism; Organic; Diet Quality; Nutrition; ASD

Mentor(s):
Anita Aalia Panjwani (Purdue University); Monica Ramakrishnan (Purdue University)

Other Acknowledgement(s):
Xinyi Zhou (HHS)

Talk Presentation Abstract Number: 7130

Presentation Time: STEW 218A at 4:40-5:00

Iron Nanoparticle and Radiation-Induced DNA Damage with Intracellular Calcium Quenching in Triple Negative Breast Cancer (TNBC)

STEM

Authors(s):

Dhriti Manish Laddha† (HHS)

Abstract:

Triple Negative Breast Cancer (TNBC) is an aggressive malignancy with limited treatment options, necessitating novel therapeutic strategies. This study investigates the combined effects of iron oxide nanoparticles (IONPs) and radiation therapy on TNBC cells, focusing on the role of intracellular calcium (Ca^{2}?) in DNA repair. IONPs (5 nm) were used to sensitize TNBC cells to radiation, leading to enhanced cytotoxic effects, including increased apoptosis and growth inhibition. The combined treatment resulted in a significant accumulation of DNA double-stranded breaks (DSBs), as detected by ?-H2AX staining. Intracellular calcium levels were assessed using Fluo-4 AM fluorescence, revealing that IONPs reduced Ca^{2}? levels, contributing to impaired DNA repair post-radiation. Further inhibition of calcium signaling using BAPTA-AM exacerbated DNA repair suppression, confirming the role of Ca^{2}? in repair mechanisms. The most pronounced effect was observed in cells treated with 50 µg/mL IONPs and 4 Gy radiation, which exhibited the greatest reduction in calcium-mediated DNA repair. These findings suggest that IONP-induced calcium quenching sensitizes TNBC cells to radiation by impairing DNA repair pathways. The involvement of DNA repair proteins such as CHOP and ATM in this process warrants further investigation. Future studies will explore the distinction between store-operated and store-independent calcium pathways in DNA damage responses. This research highlights the potential of IONPs as a radiosensitizer in TNBC, providing insights into calcium-regulated DNA repair mechanisms and novel therapeutic approaches for enhancing radiotherapy efficacy in resistant cancers.

Keywords:

Triple-Negative Breast Cancer; Iron Nanoparticles; Radiation Therapy; Intracellular Calcium (Ca^{2}+) Regulation; DNA Double-Stranded Breaks (DSBs)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Matthew Louis Scarpelli (Purdue University); Anukrishna Radhakrishnan (HHS)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7131

Presentation Time: STEW 218B at 4:00-4:20

Cross-Species Deep Learning: Evaluating the Generalization of Human and Veterinary Segmentation Models

STEM

Authors(s):

Madison Sarah Loiselle† (Engineering)

Abstract:

Computational medical image analysis enables precise organ segmentation and disease classification supporting quantitative diagnostics, targeted therapies, and treatment monitoring in human medicine. Extending these capabilities to veterinary medicine could augment clinical decision-making, but the paucity of curated veterinary imaging data limits deep learning (DL) model development. This research investigates whether the DL models trained on human radiology images can generalize to veterinary data, and vice versa, evaluating cross-specie transferability in organ segmentation.

We evaluated TotalSegmentator, a full-body anatomy segmentation model trained on human data, on murine micro-CT (n=30), and canine CT (n=10) scans for liver, left kidney, and right kidney segmentation. On murine micro-CT, the model failed to generate segmentations for all three organs. For the canine CT, the model failed in 2 cases for the liver, 2 cases for the right kidney, and 3 cases for the left kidney. Each organ was segmented separately. Future work will expand segmentation tasks to additional organs, i.e., spleen, lungs, pancreas, and stomach, with qualitative assessment by a veterinary radiologist. Overall, we expect this study to provide an understanding of the cross-species applicability of segmentation models between humans and animals.

Keywords:

Deep Learning; Veterinary Medicine; Segmentation; Radiology

Mentor(s):

Fiona Kolbinger (Purdue University); Muhammad ibtsaam Qadir (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7132

Presentation Time: STEW 218B at 4:20-4:40

Assessing heart rate dynamics following postural change in hypermobile-type Ehlers-Danlos Syndrome using wearable health monitors against POTS diagnostic criteria

STEM

Authors(s):

Monique Watson† (Engineering)

Abstract:

Postural Orthostatic Tachycardia Syndrome (POTS) is a form of dysautonomia characterized by sustained heart rate increases over 30 bpm within 10 minutes of rising from supine to standing without significant decreases in blood pressure. Due to its episodic nature, the manifestation and intensity of symptoms can vary daily, making diagnosis and treatment challenging. To better understand this variability, metrics like heart rate were collected continuously for 30 days using the Corsano CardioWatch 287-2B. Fifteen individuals with hypermobile-type Ehlers-Danlos Syndrome (hEDS), in whom POTS is prevalent, wore the watches. The wearable identified wake-up time, and the initial standing time was determined by visually assessing accelerometer data 3.5 hours after waking. Standing time after waking was assumed to be a postural change from supine to standing. Heart rate was analyzed for 10 minutes after standing from bed in four individuals with hEDS. Two individuals diagnosed with POTS by a healthcare provider exhibited day-to-day variability of heart rate increases from 9.10 to 34.34 bpm and 11.70 to 42.26 bpm, respectively. Using our methodology, these individuals met POTS diagnostic criteria 2/16 and 6/7 days, respectively. The two undiagnosed individuals also showed variations in heart rate increases from 9.82 to 28.24 bpm and 15.86 to 31.77 bpm, respectively, but only met diagnostic criteria 0/13 and 1/16 days. The initial findings demonstrate significant day-to-day variability in heart rate increases within hEDS-POTS patients and highlight POTS-like manifestations in undiagnosed individuals. These findings emphasize the need for personalized diagnostic and treatment methods that account for the condition’s variability.

Keywords:

Heart Rate Dynamics; Wearable Heath Monitors; Hypermobile-Type Ehlers-Danlos Syndrome; Postural Orthostatic Tachycardia

Mentor(s):
Damen Alec Wilson (Engineering); Matthew Peter Ward (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7133

Presentation Time: STEW 218B at 4:40-5:00

Integrating Wearable Technology for Electrochemical Sensor based Remote Health Monitoring

STEM

Authors(s):

Surya Pratheek Turaga† (Engineering|JMHC)

Abstract:

Wearable health monitoring devices are an attractive solution to decentralizing healthcare and enabling remote chronic patient care for their affordability and high convenience compared to regular hospital checkups. Skin interfaced sensor arrays that make use of sweat electrochemical analysis, skin impedance testing, and temperature sensing are ideal for such a target due to their small size and multimodal sensing capabilities. We are working to design, build and test a wearable bioelectronic module that can carry out skin interfaced longitudinal analysis to collect extensive patient biomarker data through non-invasive methods in real-time. The system currently being developed uses custom printed electrode patches and an electrochemical front end to carry out skin interfaced sweat analysis. The system aims to automate skin interfaced testing through a microcontroller and relay biomarker levels to a computer system. The goal of this design is to collect extensive real-time diagnostic data in a non-intrusive manner. Analyzing trends in such datasets can help discover correlations between certain trends and underlying health conditions. Making such new insights will help healthcare systems better monitor patients remotely and carry out more accurate diagnoses. Such a device will also shape the course of personalized healthcare and enable the medical industry to obtain a better understanding of human physiology at the molecular level.

Keywords:

Wearable Technology; Embedded Systems; Remote Healthcare; Electrochemical Sensors; Nanomanufacturing

Mentor(s):

Jing Jiang (Engineering); Wenzhuo Wu (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7134

Presentation Time: STEW 218C at 4:00-4:20

Radiomic Analysis of Collagen

STEM

Authors(s):

Sidh Jain† (Engineering)

Abstract:

The mechanical integrity of human cortical bone depends on collagen concentration, which influences tensile strength, flexibility, and overall structural behavior. However, limited research has investigated bone structure variations due to systematic removal of collagen in individual bone components. This study aims to decipher the role of collagen content in the texture and mechanical properties of human cortical bone via radiomic analysis. To address this, we utilized HR-pQCT image stacks of de-collagenated bone, where collagen was removed through treatment with 7.5% 0.5 M sodium hypochlorite (NaOCl). Segmentation of cortical segment of bone was performed, followed by division of image dataset into 6 equal segments (15 image slices each segment). 753 radiomic features were extracted from each segment. After dimensional reduction, we used top radiomic features, which included original, log-filtered, and wavelet-transformed features, to assess texture information of each segment. Results showed that original_shape2D_MajorAxisLength feature was most prominent at baseline, indicating collagen maintains the bone's elongated structure; log-sigma-2-mm-3D_firstorder_Minimum feature was most prominent at halfway, suggesting increased texture heterogeneity; original_shape2D_MinorAxisLength feature was dominant at fullway, implying structural collapse in the minor dimension. This shows that collagen is crucial for maintaining bone structure and integrity. As it is removed, the bone undergoes significant shape and structure alterations, potentially losing strength and stability. While standard HR-pQCT provides limited insight, radiomic techniques reveal collagen's significant effect on bone texture. These findings emphasize the importance of collagen concentration in assessing bone health, especially in CKD patients, where radiomics may differentiate CKD and non-CKD bones.

Keywords:

Bone Texture Analysis; HR-pQCT; Chronic Kidney Disease; Collagen Removal; Radiomic Features

Mentor(s):
Youngjun Lee (Engineering); Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Talk Presentation Abstract Number: 7135

Presentation Time: STEW 218C at 4:20-4:40

How Engagement in the Academic Setting Allows for Improvement of Grades

Social Science

Authors(s):

Abigail Marie Kiracofe† (Exploratory Studies|Other)

Abstract:

When it comes to being a successful teacher or professor, having a good relationship with students is a key factor in their success. This literature review's purpose is to explore how a professor's ability to make lectures and assignments engaging can positively impact a students grade and the overall attitude to the class. This study will be conducted through surveys of college students and a literature review. Through research, I have found that when professors take steps to actively engage their students, not only are the students more receptive to learning, but they also perform better in class. When students perform better in class, it has many effects on the world around them.

Keywords:

[no keywords provided]

Mentor(s):

Catherine Jean Shukle (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7136

Presentation Time: STEW 218C at 4:40-5:00

Utilization of Hydroponics for Self Sustainable Farming and BLSS Integration for a Closed Loop Space Habitat

STEM

Authors(s):

Mia Constance Schecter† (Agriculture|JMHC); Vijay Muthukumar† (Engineering|JMHC); Adriana K Sanchez† (Agriculture|Engineering); Mark T Crooks† (Agriculture); Gregory Alfred Glenn‡ (Engineering); Emerson Drew Cozart‡ (Engineering)

Abstract:

Closed-loop systems support life using Bioregenerative Life-Support Systems (BLSS) to recycle air, water, food, and waste with no reliance on Earth. Previous efforts for BLSS integration have mostly demonstrated only open-loop solutions, and none have focused on self-sustainable farming. In order to address this gap, the Space and Earth Analog CHapter (SEARCH) of Purdue proposes a fully closed-loop habitat designed to advance bioastronautics research. The Analog Simulation Training & Research Outpost Utilizing Self-Sustaining Architecture (ASTRO-USA) contains agricultural modules with fully autonomous hydroponic towers. These towers will manage harvest rates and life cycles in order to serve as a reliable food source for analog astronauts as well as maintain gas exchange between plants and humans. Hydroponics is ideal as it eliminates the need for soil, uses less space and water, lowers possibility of contamination and is highly adaptable for different plants. Our research focuses on optimal crops for supplying appropriate sustenance while integrating BLSS in a singular hydroponics system. Our design investigates a Nutrient Film Technique (NFT) system for its low water usage, customizability, and potential to recycle power, as well as the optimization of crop selection to meet the nutritional requirement for future analog astronauts. Our design focuses on integrating sensors for crop management to build autonomous towers to minimize risks and labor. Successful development of this technology would allow further advancements in fully closed-loop systems for long-term space habitation applications.

Keywords:

Space; Engineering; Autonomy; Bioastronautics; Hydroponics

Mentor(s):

D. Marshall Porterfield (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

LLLC - Talk Presentation Abstract Number: 8000

Presentation Time: STEW 218D at 9:40-10:00

Phonetic and Handwriting analysis

Humanities

Authors(s):

Hannah Marie Kovach† (Liberal Arts)

Abstract:

Phonetic and Handwriting Analysis

This study explores how regional dialects and multilingual backgrounds influence the relationship between spoken language features and handwriting characteristics. Data from 10 participants of diverse linguistic and geographical backgrounds included both speech and handwriting samples. Speech analysis focused on regionally marked phonetic features, while handwriting samples were examined for stylistic variations influenced by language and culture.

The research consisted of two parts: a spoken task and a writing task. In the speech portion, participants read an English prompt designed to highlight phonological differences across dialects and the influence of their first language (L1) on English pronunciation. The writing portion included three paradigms to analyze handwriting styles.

Findings suggest a strong correlation between L1 influence and handwriting style. Multilingual participants exhibited handwriting patterns aligned with their L1 stylized alphabets, while monolingual participants showed less pronounced regional influences. These results indicate shared cognitive and motor pathways shaped by language exposure and sociolinguistic identity.

Additionally, the study highlights cross-linguistic transfer in both written and spoken modalities, offering insights into the interplay between language, identity, and physical expression. This research contributes to fields such as forensic linguistics, education, dialectology, and phonetics, laying the groundwork for future studies on handwriting and speech as markers of linguistic identity.

Keywords:

Linguistics; Phonetics; Dialectology

Mentor(s):

John D Sundquist (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

LLLC - Talk Presentation Abstract Number: 8001

Presentation Time: STEW 218D at 10:00-10:20

Professor of Philosophy

Humanities

Authors(s):

Jack William Fellmy† (Liberal Arts)

Abstract:

An important methodological debate in recent political philosophical literature has investigated the relationship between ideal theory and non-ideal theory. Both ideal theory and non-ideal theory are concerned with justice or realizing value, with the former seeking to understand what justice demands of us in the abstract and the latter seeking to understand and abolish existing injustice. The debate has become challenging to navigate as the terminology is vague, with one term referring to several different ideas. To address this challenge, I provide a conceptual space of ideal theory and non-ideal theory. I partly map the space by exploring Charles Mills' criticism of ideal theory as ideological. Then, I present a four-quadrant map created by Brian Kogelmann to add more precision to the debate. Following that, I analyze the Marxist system in terms of the Kogelmannean conceptual scheme. I then demonstrate that Marx's non-ideal theorizing of oppressive devices in capitalism guides his formulation of an end-state devoid of conflict and oppression, i.e., communism. I assert that this method of non-ideal theory guiding the formulation of an end-state was carried out through two conceptual moves – negation and dialectical synthesis.

Keywords:

Marxism; Dialectics; Methodology; Non-Ideal Theory; End-State

Mentor(s):

Christopher Yeomans (Purdue University)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8002

Presentation Time: STEW 218D at 10:20-10:40

The Power of Linguistic Landscapes in Indiana's Libraries

Humanities

Authors(s):

Claudia Kayleen Albrecht† (Liberal Arts|JMHC)

Abstract:

The term "linguistic landscape," coined in the 1990s, has captured the attention of linguistic and cultural studies. Public signage, advertisements, graffiti, and cyberspace provide evidence about the linguistic diversity and multilingualism of specific places. The United States is known as the melting pot of diverse cultures and identities, and there is no official language; however, it is globally understood that English is a dominant language. This research aims to illuminate the linguistic landscape of public libraries in three cities in Indiana that vary in their percentage of Spanish speakers: West Lafayette, Lafayette, and Frankfort. Using a mixed-methods approach, the study examines signage, book displays, and public communication to assess how language use reflects and potentially influences social belonging. Findings indicate that English predominates in library signage, with limited bilingual or Spanish-language signs, despite significant Hispanic populations, particularly in Frankfort. Differences in font size, color, and placement of multilingual signage subtly reinforce English dominance. The study highlights the role of libraries as sociolinguistic institutions and emphasizes the need for more equitable multilingual representation to foster inclusive environments for non-English-speaking communities.

Keywords:

Linguistic Landscapes; Spanish Speakers; Sociolinguistics; Language Representation; Cultural Inclusion

Mentor(s):

Lori A Czerwionka (Purdue University)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8003

Presentation Time: STEW 218D at 10:40-11:00

Animacy in English Object Relative Clause Structure Choice: A Comparative Study Between L1 and L2

Humanities

Authors(s):

Marley Grace Mack† (Liberal Arts)

Abstract:

While English speakers' object relative clause (ORC) structure choices are affected by animacy, the mechanisms behind those choices remain debated. L1-English speakers strongly favor passives (e.g., the baby carried by the woman) over actives (e.g., the baby that the woman carries) when both agent and head noun are animate, but not when the head noun is inanimate (e.g., the box that the woman carries). This study aims to see if both theorized mechanisms, similarity-based competition and animacy-based accessibility, are used in ORC choices. To do so, this study uses both configurations previous literature has- animate head/animate agent and inanimate head/animate agent- and two understudies configurations of inanimate head/inanimate agent and animate head/inanimate agent. This study also tests L1-Spanish and L1-Chinese English learners' choices alongside English native speakers'. In this ongoing test of production using a Picture-Based Elicitation Task, 8 participants of each group were asked to produce ORCs based on images they were shown, although more data is being collected. L1-Chinese speakers produced 100% passive ORCs; L1-Spanish speakers produced more variety of passive and active ORCs, but not significantly ($p>0.05$) different across animacy conditions. L1-English speakers' production showed significant animacy effect, with the greatest variety shown between IA and AI ($p<0.001$) & AA ($p<0.001$). These preliminary results potentially suggest a complex interplay between both mechanisms in English ORC production among L1-English speakers.

Keywords:

Linguistics; Language Production; Animacy Effect; English Object Relative Clause

Mentor(s):

Elaine J Francis (Purdue University); Yue Li (Liberal Arts)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8004

Presentation Time: STEW 218D at 11:20-11:40

Systematic Review of Humanities Pedagogy

Humanities

Authors(s):

Lillian Sarah Pirotto† (Liberal Arts|JMHC); Haley Diane Imus† (Agriculture|JMHC); Elizabeth S Noh* (Science|JMHC); Tran Nguyet Anh An* (Polytechnic|JMHC); Brody Everett Snyder* (Science|JMHC); Olivia Marie Scavo* (Science|JMHC); Edjutawee Dawit* (Science); Laura Esther McWilliams* (HHS|JMHC)

Abstract:

This study aims to identify different pedagogical practices and educational philosophies employed in undergraduate humanities classrooms in order to explore potential applications for humanities education in other disciplines, including STEM fields. Using systematic reviewing software (Covidence), a team of 5-6 undergraduate researchers judged a collection of 24,791 scholarly articles gathered from a comprehensive search across humanities, social sciences, education, and multi-disciplinary databases. Decisions about including scholarship in the full text review were made using specific exclusion and inclusion criteria, taking careful consideration to only include articles that explored the teaching practices of classrooms falling under the team's working definition of humanities, and not any interdisciplinary pedagogy used in non-humanities fields. The next steps are to review the full text of included articles and write a literature review on the scope of humanities pedagogies, including traditional and digital humanities.

Keywords:

Humanities; Pedagogy; Scoping Review; Systematic Review

Mentor(s):

Anne Victoria Wrobetz (Engineering); Kirsten A Davis (Purdue University); Jerilyn Pia Tinio (Purdue University); Lori A Czerwionka (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

LLLC - Talk Presentation Abstract Number: 8005

Presentation Time: STEW 218D at 11:40-12:00

Laughter in Exile: The Concept of Laughter in Chekhov

Humanities

Authors(s):

Emily Doris Gervais† (Liberal Arts)

Abstract:

Anton Chekhov's Sakhalin Island is an ethnographic and literary work that documents the conditions of exiled convicts and settlers in Russia's isolated Sakhalin penal colony. As an experienced physician, Chekhov's fiction prose often reflects evidence of his medical perspective. Sakhalin Island, a nonfiction documentary revealing the violent survival and horrific conditions of the colony, is an outlier from his many fictional short stories. This study examines Chekhov's linguistic choices in his depiction of laughter in such an oppressive environment, and how his medical background influenced his observation. A comparative examination of the Russian and English translations reveals meaningful variations, particularly in the intentional absence in translations of specific words for laughter. This absence of linguistic variety, alongside the selection of certain terms, hints at his intent while portraying laughter as a social and psychological extreme indicative of the harsh environment of Sakhalin.

By investigating the context in which laughter occurs—who participates, at whose expense, and in what emotional register—laughter is explored as a symptom of psychological distress, as a social phenomenon, and as a behavior amongst children, whose expressions of humor and suffering reflect the conditions of their upbringing. Using contrastive lexical semantic analysis and thematic analysis methodologies, the research seeks to deepen understanding of how Chekhov's medical and literary sensibilities converge in Sakhalin Island, illuminating the broader implications of the concept of laughter in an environment of exile and deprivation.

Keywords:

Literature; Russian; Medical; Exile; Laughter

Mentor(s):

Olga Lyanda-Geller (Purdue University)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8006

Presentation Time: STEW 218D at 12:00-12:20

AI-Powered Tutoring with Retrieval-Augmented Chatbots: Enhancing Interactive Learning in Intercultural Communication

STEM

Authors(s):

Mohamed Alaa Moham Ahmed† (Engineering); saumya verma‡ (Science)

Abstract:

This study presents the development of a personalized AI-powered tutoring platform designed to enhance student learning in intercultural communication. Traditional instruction often lacks immersive, immediate opportunities for students to actively engage in intercultural interactions within a risk-free environment. To address this gap, our system integrates AI-driven interactive role-play scenarios that simulate real-world intercultural encounters, allowing students to practice communication strategies, navigate cultural differences, and receive personalized feedback in real-time. Our platform leverages a retrieval-augmented generation (RAG) framework, with its responses grounded in verified course materials, such as lecture slides, textbooks, and supplementary documents, ensuring content fidelity and minimizing inaccuracies through an intelligent chatbot interface. Furthermore, adaptive learning algorithms drive personalized quiz generation, tailoring assessments to each student's learning history and proficiency, thereby reinforcing course content and enhancing comprehension. Gamification elements, including achievement badges, point-based rewards, and interactive challenges, are integrated to encourage engagement and track progress. This paper outlines the design and implementation of the platform, highlighting its impact on student engagement, comprehension, and the practical application of intercultural communication skills. Finally, it discusses opportunities for further enhancements in adaptive learning and real-time content validation, positioning this work as a significant step toward more reliable and effective AI-driven educational tools.

Keywords:

Intercultural Communication; RAG; Educational Chatbot; Adaptive Learning; AI Tutoring

Mentor(s):

Hyesun Choung (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

LLLC - Talk Presentation Abstract Number: 8007

Presentation Time: STEW 218D at 12:20-12:40

Rethinking Control Groups in L2 Pronunciation Research: Insights from a Systematic Review

Humanities

Authors(s):

Paige Katherine Doyle† (Science); Adam Wesley Buehrer† (DSB); Hannah Marie Marlowe† (HHS|JMHC)

Abstract:

While second language (L2) pronunciation research has grown in recent years (Derwing & Munro, 2005), methodological inconsistencies—particularly in control group design—have hindered cross-study comparisons. Pedagogical intervention studies often rely on control groups to test the efficacy of novel pedagogical approaches, yet their definitions vary widely. Some control groups receive no instruction (Okuno, 2013), others receive traditional classroom instruction without intervention (Ruellot, 2011), and some engage in alternative treatments focusing on different linguistic features (Olson, 2019). Additionally, control group designs are often underspecified, limiting their comparability. In the absence of a set of field-specific norms or recommendations, control group design represents a significant methodological issue that prevents meaningful comparison and knowledge building.

To address this gap, this study systematically reviews L2 pronunciation intervention research using the PRISMA framework (Page et al., 2021). A keyword search across five academic databases (ERIC, Social Sciences Full Text, Scopus, Education Source, Web of Science) identified approximately 3,500 peer-reviewed studies published between 2004 and 2024. Only 4.6% included a control group, highlighting its underuse. An analysis of 254 studies that included control groups were coded for key indicators (e.g., intervention design, phonetic feature, language of instruction), with control group classification conducted via double-blind coding for reliability.

Findings reveal a lack of standardization in control group use and significant variability in design. The discussion focuses on developing field-specific recommendations to enhance methodological consistency. This review has critical implications for improving cross-study comparability, advancing theoretical insights, and refining best practices in L2 pronunciation research.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Linguistics; Pronunciation; Language Acquisition; Experimental Design; Pedagogy

Mentor(s):
Daniel J Olson (Purdue University); Yiying Jiang (Liberal Arts)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8008

Presentation Time: STEW 218D at 12:40-1:00

Perspectives on Mental Health and Society in the Novels of Fyodor Dostoevsky

Humanities

Authors(s):

Luke A Diehl† (Pharmacy|JMHC)

Abstract:

Fyodor Dostoevsky's novels provide a multifaceted literary exploration of human nature while capturing the political, philosophical, economic, and cultural upheavals of mid-19th century Russia. Across his works, Dostoevsky repeatedly engages with themes of suicide, poverty, morality, and mental illness, depicting characters whose psychological deterioration reflects both personal and societal crises. This paper examines how Dostoevsky constructs mental illness not only as an individual affliction but also as a symptom of broader cultural and spiritual collapse, which he attributes to the rise of nihilism and atheism. Drawing on Crime and Punishment, Demons, and The Brothers Karamazov, this analysis situates Dostoevsky's portrayals of mental illness within the social and ideological transformations of his time, demonstrating how his philosophical and religious inquiries frame psychological suffering as inseparable from moral and spiritual disintegration. In doing so, the paper highlights Dostoevsky's belief that personal madness and social ruin are deeply intertwined in a world increasingly untethered from faith and meaning.

Keywords:

Dostoevsky; Psychology; Russian

Mentor(s):

Amina Gabrielov (Purdue University)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8009

Presentation Time: STEW 218D at 1:00-1:20

From Nationalism to Moral Responsibility: The Redefinition of German Patriotism in Postwar Literature and Film

Creative

Authors(s):

Kerri Jayne Easton† (Liberal Arts)

Abstract:

This study investigates the transformation of German patriotism following World War II through postwar literature and film. The purpose of this research is to explore how cultural artifacts, including Heinrich Böll's collection of short stories, Wanderer, kommst du nach Spa, Wolfgang Staudte's Murderers Among Us (1946), Bernhard Wicki's The Bridge (Die Brücke, 1959) and Joachim Kunert's The Second Track (Das zweite Gleis 1962) critique nationalist ideologies and redefine patriotism in terms of collective responsibility and moral reflection. This research employs qualitative analysis of key literary literature and films produced during the postwar period. Primary sources were selected based on their thematic focus on war guilt, moral responsibility, and the redefinition of patriotism. Secondary sources, including historical reviews and academic commentaries, provide additional context. The study finds that postwar German literature and film portray patriotism as a conflicted concept. Characters such as the wounded soldier in Böll's story and Dr. Hans Mertens in The Murderers Among Us struggle to reconcile personal guilt with national responsibility. These works emphasize ethical reflection, human connection, and the rejection of blind allegiance to authoritarian ideologies. The findings suggest that shifting German patriotism from nationalism to moral accountability shaped the country's postwar identity. This redefinition influences contemporary German society and offers insights into rebuilding collective identities after trauma. Appendices include translations of selected text excerpts, film scene analyses, and a comprehensive bibliography of primary and secondary sources.

Keywords:

German Film; WWII; European History; War Psychology; German Literature

Mentor(s):

Beate I Allert (Purdue University)

Other Acknowledgement(s):

LLLC - Poster Presentation Abstract Number: 8010

Presentation Time: STEW 218D at 1:20-1:40

Physics of Speech Perception: Cross-Linguistic Variations in Vowel Frequency Discrimination

Social Science

Authors(s):

Aastha Rasesh Patel† (Engineering)

Abstract:

Speech perception is influenced by the physics of sound waves, specifically the way the human auditory system processes frequency components and resonance patterns. This study investigates how speakers of the ten most spoken languages of 2022- English, Mandarin Chinese, Hindi, Spanish, French, Arabic, Bengali, Russian, Portuguese, and Urdu- differ in their ability to perceive subtle vowel frequency shifts based on their language's vowel inventory size. Participants complete an online psychoacoustic discrimination test, where they listen to pairs of synthesized vowel sounds with slight formant frequency shifts and determine whether they are the same or different. These formant shifts are directly related to resonance frequencies in the vocal tract, which shape vowel perception. This experiment uses Just Noticeable Differences (JNDs) to examine how different languages, with varying vowel densities, influence critical band filtering- a fundamental concept in acoustics that describes how the cochlea groups frequencies into perceptual units. The findings will offer insights into how language experience interacts with fundamental acoustic principles, contributing to research on speech processing, second-language acquisition, and auditory perception by demonstrating how speakers of languages with larger vowel inventories exhibit greater frequency resolution.

Keywords:

Acoustic Phonetics; Psychoacoustics; Frequency Discrimination; Speech Perception

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8011

Presentation Time: STEW 218D at 1:40-2:00

Castles in the Sky: A Comparison of Constructed and Natural Paradise in Dostoevsky and Utopian Literature

Humanities

Authors(s):

Tessa Clarabelle Stahly† (Liberal Arts)

Abstract:

As a product of his time, Dostoevsky approaches ideas of socialism and social change in many of his works. However, much of the socialist thought of 19th century Russia was founded on the ideals of Utopianism, in the construction of perfect and ideal societies based on equality and reason. Dostoevsky interacts with these beliefs by directly broaching topics of contemporary social philosophy, but he also pushes a moral undertone in his works that disagrees with the construction of Utopian society.

In this presentation I will discuss how Dostoevsky explores the effects of space and the environment on the human soul, and counters the ideals of constructed Utopias by enforcing the belief that the natural world is where true paradise lies. First, I will explore how Dostoevksy uses physical spaces to emphasize morality and the nature of mankind, before comparing these depictions to examples from Utopian literature, namely Sir Thomas Moore's Utopia and Chernyshevsky's What is to Be Done? Finally, I will return again to Dostoevsky's response to the ideals of a constructed paradise, emphasizing his philosophy on nature as healing and holy, the true paradise of God's earth.

Keywords:

Dostoevsky; Utopia; Comparative Literature; Religious Studies

Mentor(s):

Amina Gabrielov (Purdue University)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8012

Presentation Time: STEW 218D at 2:00-2:20

Spanish Pragmatics Development during Study Abroad: A Review

Humanities

Authors(s):

Madilen Helene Gesse† (Liberal Arts); Adler Olivia Kolb† (HHS)

Abstract:

Study Abroad is often thought of as an educational experience that leads to linguistic and cultural learning, including pragmatics learning. Pragmatics is a field of study that examines language use and its appropriateness in context. Despite the overarching conclusion that study abroad facilitates pragmatics development, a scoping review is needed to summarize existing research, ask questions to further the field, examine shortcomings, and address areas that lack significant study.

PRISMA guidelines were followed in conducting the scoping review of second language pragmatics development during study abroad. The search was conducted through databases and a manual hand search, focusing on second language learners of Spanish considering that Spanish is the most common second language studied in the United States. The search resulted in 40 relevant sources that were then coded under categories of linguistic variables (e.g., target pragmatic structure, level of proficiency) and study abroad variables (e.g., location, duration, program type).

Results highlighted various trends in the literature, including a focus on speech act development and the examination of short-term study abroad experiences in Spain. While second language pragmatics development during study abroad was confirmed, some gaps in the field were revealed. These gaps will be discussed and suggestions for future research will be shared.

Keywords:

Pragmatics; Study Abroad; Linguistic

Mentor(s):

Lori A Czerwionka (Purdue University)

Other Acknowledgement(s):

LLLC - Poster Presentation Abstract Number: 8013

Presentation Time: STEW 218D at 2:20-2:40

Semantic Interpretation in Humans and Large Language Models of Quantified Statements

Humanities

Authors(s):

Lauren Mackenzie Matthews† (Liberal Arts)

Abstract:

This poster discusses my role of an undergraduate research assistant in research around semantic interpretation of sentences involving quantifier scope by human beings and state-of-the-art large language models. My roles included the creation, sourcing, and refining of stimuli for use in experimentation under the supervision of a postdoc researcher in the Department of English whose expertise is in psycholinguistics and language acquisition. In addition, I also assist in the experimental process and support the record keeping of the experiment. Work was done between two projects. One being an experiment that compared the interpretation of the meaning of negatively quantified statements and doubly quantified statements between L1 and L2 English speakers. Another being the testing and examination of large language model's interpretation of similar ambiguous universal quantifier phrases. It is hoped that the efforts described here will support future endeavors in the understanding of semantic interpretation across languages by humans and artificial intelligence systems.

Keywords:

Semantic Interpretation; Psycholinguistics; Language Modeling; Cross-Linguistics; Quantifier Scope

Mentor(s):

Shaohua Fang (Purdue University)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8014

Presentation Time: STEW 218D at 2:40-3:00

"Holy Jokesters" in Russian Culture and Literature: Then and Now

Humanities

Authors(s):

Davyd Revenko† (DSB|JMHC)

Abstract:

This research focuses on Dmitry Lihachev's "The World of Laughter of Ancient Rus", which explores individuals in Russia who consciously adopt the role of "jokesters". These figures have played a significant role in shaping Russian society over the decades, leaving an influence that remains traceable among Russian-speaking communities today. By engaging in humor and intellect, they established a distinct and influential social class. This study analyzes key examples of such jokesters in both classic (particularly through the protagonists of Nikolai Gogol's "Dead Souls" and Ilf and Petrov's "The Little Golden Calf") and modern Russian literature. The primary objective is to define the concept of the "jokester by choice" and examine their lasting impact on Russian-speaking societies by identifying recurring patterns and thematic connections between these seemingly distant yet very similarly-minded fictional characters.

Keywords:

Jokester; Classic Literature; Modern Literature

Mentor(s):

Olga Lyanda-Geller (Purdue University)

Other Acknowledgement(s):

LLLC - Talk Presentation Abstract Number: 8015

Presentation Time: STEW 218D at 3:00-3:20

AI as a Creative Partner: Exploring the Effects of Communication Modality and Chatbot Persona on Human Creativity

Social Science

Authors(s):

saumya verma† (Science); Mohamed Alaa Moham Ahmed‡ (Engineering)

Abstract:

As generative AI becomes increasingly integrated into various fields, its impact on human creativity remains underexplored. While AI can enhance creative expression, its interaction with users may significantly influence their creative outcomes. This study investigates how different AI personas and communication modalities shape creative performance using a 2 × 2 experimental design. Undergraduate participants are randomly assigned to one of five conditions: a control group without AI and four experimental groups that generate a short story with AI assistance. The AI-assisted groups interact with a chatbot, using either text or voice-based interaction, each featuring one of two distinct personas.

The personas are designed using OpenAI's text and voice features. Persona 1 is a neutral, friendly chatbot that provides straightforward responses without shaping the creative process. In contrast, Persona 2 encourages creativity by acting as a supportive collaborator. It offers positive reinforcement, asks open-ended questions, and provides constructive feedback through open prompts and variations. This persona fosters creativity by introducing analogies, encouraging divergent thinking, and promoting spontaneity. Additionally, the study explores how communication modality (text vs. voice) influences creative process and performance. Participants complete a structured creative task—writing a short story—with or without chatbot assistance. Creativity is assessed through linguistic and computational text analysis of chatbot interactions and task outputs, along with self-reported assessments. The findings will offer insights into how AI personas and communication modes shape creativity, contributing to broader discussions on AI's role in creative collaboration and beyond.

Keywords:

Communication; AI Chatbot; Creativity; Persona; Human-AI Collaboration

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Hyesun Choung (Purdue University)

Other Acknowledgement(s):

LLLC - Poster Presentation Abstract Number: 8016

Presentation Time: STEW 218D at 3:20-3:40

The Intersection of Motivation, Community, and Happiness

Social Science

Authors(s):

Mia An-Mei Schmetter† (HHS|JMHC)

Abstract:

Happiness and “being happy” are terms that get used every day, but they are often used as a façade for deeper feelings. Previous research has shown the possible reasons for someone being happier – consistent and meaningful motivation and a strong community. The years of college can be home to someone’s happiest moments, but also their darkest days. Many college students express happiness on the outside, while they are struggling with their mental health on the inside. In this pilot study, I interviewed a sample of college students and inquired about their happiness, their motivation, and their relationships. While I haven’t completely analyzed the data, there seems to be a correlation between someone’s happiness and them having strong sense of motivation and a strong sense of community. My goal with this study is to increase college students’ knowledge and understanding about how they can take control of their happiness but also find contentment in the emotions they’re experiencing in the present, connecting them with the greater community.

Keywords:

Happiness; Motivation; Community; Connection; Relationships

Mentor(s):

Linda E Haynes (Purdue University)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7200

Presentation Time: STEW 206 at 1:00-3:00

A novel self-entry restraint device for low-stress handling of mice

STEM

Authors(s):

Shikha Adhikari† (Agriculture); Kelly Marie Curry† (Agriculture)

Abstract:

In-vivo research is fundamental to scientific discovery in both veterinary and human medicine. While study efficacy and implementation remain paramount, ensuring the welfare of animal models is crucial for producing reliable and accurate data. This study aimed to identify humane and effective handling methods that enhance animal well-being and improve human-animal interaction by minimizing stress for both the animals and laboratory technicians. To this end, we collected blood samples from 66 mice (33 male and 33 female) immediately following three distinct handling methods, i.e. standard tail handling, handling via polymer tubes, and handling via a special-designed novel device. Data were analyzed using ANOVA to compare group means. Our results indicated no significant differences in corticosterone levels among the handling groups. However, we observed a significant effect of sex on corticosterone levels. These findings underscore the ongoing need to refine handling techniques in comparative medicine to improve animal welfare and ensure the quality of research.

Keywords:

Innovation; Biomedical Device; Comparative Medicine; Corticosterone Test; Animal Handling

Mentor(s):

Amanda K Darbyshire (Purdue University); Aidan Patrick Horvath (Purdue University)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7201
Presentation Time: STEW 206 at 1:00-3:00

Trust in the Food Supply Chain: Pre- and Post-Survey Analysis of Poisoned's Influence on Young Adults

Social Science

Authors(s):

Shams Adigozalzade† (Agriculture)

Abstract:

One in six Americans experiences foodborne illness annually, underscoring the need to understand how media influences public trust in the food supply chain. This study evaluates the short- and long-term impact of the Netflix documentary Poisoned: The Dirty Truth About Your Food on undergraduate students' trust in key food safety stakeholders. A mixed-methods approach was employed, with participants (n=59, 78% female) completing pre-, post-, and nine-day follow-up surveys. Trust levels were measured using a 7-point Likert scale, and paired sample t-tests assessed changes over time. Focus group discussions (~48 minutes each) were transcribed and analyzed using Braun and Clarke's thematic analysis.

Results indicated a significant decline in trust on Food Safety Stakeholders immediately following the documentary, particularly toward restaurants (mean difference =-0.458, $p<0.001$), grocery stores (-0.424, $p=0.003$), and large processors (-0.322, $p=0.025$). While confidence in self-cooking practices rebounded within nine days (-0.32), trust in the U.S. government (-0.186, $p=0.086$) and large farmers (-0.068, $p=0.510$) showed minimal recovery.

Focus group discussions revealed increased confidence in personal food safety practices, with participants reinforcing behaviors such as washing pre-washed lettuce and raw meat. However, while the documentary had an immediate impact, its influence on food safety practices diminished over time. These findings highlight the potential of documentaries to raise awareness but underscore the need for further research on sustaining long-term behavioral change. This study contributes to the understanding of media influence on food safety perceptions and informs future strategies for improving public trust and engagement with food safety education.

Keywords:

Documentary; Foodborne Illnesses; Food Safety; Public Trust; Behavioral Change

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Yaohua Feng (Purdue University)

Other Acknowledgement(s):
Fanny Geraldine Patricia Gozzi (Agriculture)

Celebrate Presentation Abstract Number: 7202

Presentation Time: STEW 206 at 1:00-3:00

iFront Door: Enhancing Community Quality of Life (CQOL) Through Digital Presence in Versailles, Indiana

Social Science

Authors(s):

Yixin Chen† (HHS|JMHC); Ramani Satishkumar‡ (Science|JMHC)

Abstract:

In an era increasingly dominated by digital interactions, a community's online presence significantly influences its perception, attractiveness, and overall quality of life. With the rise of digital platforms, Indiana communities face challenges in managing their online reputation, which directly affects their ability to attract investment, tourism, and new residents. This research highlights the importance of proactive digital management in enhancing community visibility and fostering a positive community image. This study explores the impact of digital footprints on community quality of life (CQOL) by examining the town of Versailles, Indiana, focusing on how effective online presence can drive community engagement, tourism, and economic development. The primary aim of this research is to evaluate and enhance the digital presence of Versailles, Indiana, to improve its CQOL. By conducting a comprehensive digital audit, this study seeks to develop a sustainable model for online reputation management that can be adopted by similar communities. An interdisciplinary team of undergraduate researchers conducted a thorough digital assessment of Versailles, Indiana. This involved analyzing the town's visibility and engagement across various online platforms, including search engines, social media, and location-based services. Also, the assessment was structured around realistic scenarios to evaluate the town's digital effectiveness from multiple perspectives. Data collected were analyzed to identify key areas for improvement in the town’s online strategy. Based on research findings, a tailored digital management plan will develope, focusing on CQOL, enhancing online content, improving social media interaction, and leveraging digital tools to showcase the town’s assets. This study demonstrates the critical role of digital presence in shaping community perceptions and enhancing CQOL. The developed model offers a blueprint for other communities to proactively manage their online reputation, thereby fostering sustainable development and improving overall quality of life. This research underscores the importance of integrating digital literacy and strategic online management in community development practices.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
iFront Door; Community Quality of Life (CQOL); Digital Presence; Versailles

Mentor(s):
Hossein Mousazadeh (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Celebrate Presentation Abstract Number: 7203
Presentation Time: STEW 206 at 1:00-3:00

How Does Prompt Engineering Influence Character Consistency and Bias Mitigation in AI-Generated Biblical Narratives?

STEM

Authors(s):
Yana Sheoran† (Science); Satyam Vipulbhai Dave‡ (Polytechnic)

Abstract:
This research explores the role of prompt engineering in improving character consistency and reducing bias in AI-generated biblical narratives. AI-powered image generation and storytelling tools offer new possibilities for visualizing Bible stories, but challenges such as inconsistent character portrayals and unintended biases persist. Through systematic experimentation with structured prompt strategies—including the XYZ Formula (Character Description, Background/Setting, Situation/Action)—this study evaluates how different prompt designs impact AI-generated depictions of biblical figures.

Using AI models like GPT-4, DALL-E 3, Midjourney, and Stable Diffusion, we analyzed how prompt structuring affects the visual and textual portrayal of key biblical characters, particularly in children's Bible stories. The research focused on Jesus' ministry as depicted in the book of Matthew, assessing AI-generated images for historical accuracy, narrative alignment, and cross-image character consistency. The study also examined bias mitigation techniques, ensuring AI-generated visuals avoided anachronisms and cultural misrepresentations.

Our findings highlight the significance of structured prompting in AI-assisted biblical storytelling, demonstrating how well-defined character descriptions and scene specifications contribute to more reliable and culturally appropriate narratives. This research offers best practices for Sunday school educators, digital illustrators, and AI developers working on faith-based content.

By providing a framework for refining AI-generated biblical narratives, this study contributes to ethical AI storytelling, ensuring that character depictions remain accurate, contextually appropriate, and free from unintended biases.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
AI-Generated Narratives; Prompt Engineering; Character Consistency; Bias Mitigation; Ethical AI

Mentor(s):
Matthew Lanham (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Celebrate Presentation Abstract Number: 7204
Presentation Time: STEW 206 at 1:00-3:00

The Relationship Between Communication and Surgery Success: Analyzing Key Speech Metrics

STEM

Authors(s):
Haochen Feng† (Science)

Abstract:
For the purposes of evaluating the surgeons' skills, effective communication in the operating room is an important yet sometimes understated factor. For instance, a surgeon speaking relatively quickly may ensure that certain steps are completed swiftly and efficiently. On the other hand, the fast rate of speech may cause others to mishear instructions, leading to critical errors. Our research seeks to understand and analyze the correlation between surgeons' non-technical skills and key verbal communication metrics. To do this, we analyzed 36 audio recordings of different medical operations and coaching studies. For each recording, we recorded several key metrics such as total phonation time, speech rate, number of pauses, number of syllables, and other case-related metrics such as the relative speech duration of nurses and assistants, and the content of the speech. Then, we created several different linear regression models that use these metrics to predict various surgery success-related factors. Our preliminary results show a correlation between these communication metrics and the non-technical skill of surgeons. The regression model built to predict the binarized overall rating of the surgeon has an accuracy of 75% and an F1 score of 0.73, much higher than that of random guessing and other naive methods. These results indicate that there is a relationship between communication and surgery results – we may be able to predict the success of surgeries using speech metrics or identify harmful communication patterns in the operating room, although no cause-and-effect relationships can be drawn yet.

Keywords:
Surgery; Medical; Speech; Communication; Regression

Mentor(s):
Denny Yu (Purdue University)

Other Acknowledgement(s):
Gaoyuan Tu (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Celebrate Presentation Abstract Number: 7205

Presentation Time: STEW 206 at 1:00-3:00

Creating a Framework to Integrate LiDAR Data from Caves into Classroom Virtual Reality

STEM

Authors(s):

Siya Chirag Jariwala† (Science|JMHC); Henry J Lee† (Science|JMHC|Graduate)

Abstract:

Field trips are an essential part of courses in Earth, Atmospheric, and Planetary Sciences (EAPS). However, physical and financial constraints make it challenging to guarantee that students can visit all geological settings discussed in the EAPS curriculum. To address this, we are creating a virtual reality (VR) experience that will allow students from EAPS 353: Earth and Planetary Surface Processes to learn about cave environments, a geological feature that is currently not visited during the course. With the goal of developing a realistic VR experience, we are developing a framework that will allow us to not only bring LiDAR data into the VR but also smooth out the LiDAR to create continuous surfaces on the VR space. We are specifically targeting LiDAR data from the Carlsbad Caverns National Park in New Mexico. The integration of the LiDAR data into VR has been taking advantage of the Point Data Abstraction Library (PDAL), a library for manipulating point cloud data, utilized in conjunction with Blender, a 3D computer graphics software to create a mesh that can be leveraged as a Unity3D object, allowing to develop a protocol for integrating LiDAR data into the VR. To smooth the features in the LiDAR data, we have been using a surface reconstruction algorithm, especially the Poisson Surface Reconstruction. These results enable the creation of a realistic VR experience of a cave while allowing future developments in the project, including mapping local caves with LiDAR that can be integrated into VR and even other geological features.

Keywords:

Virtual Reality; Experimental Education; Geosciences; LiDAR Data

Mentor(s):

Caue Sciascia Borlina (Purdue University); Anastasia Kouvaras Ostrowski (Purdue University); Ali Bramson (Purdue University)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7208
Presentation Time: STEW 206 at 1:00-3:00

Predictive Analytics of NBA Championship Performance Metrics: A Comprehensive 15-Year Analysis

STEM

Authors(s):
Srivatsa Kartikeya Kuchibhotla† (Science); Santhosh Vaddi† (Science)

Abstract:
NBA championship success is influenced by a range of factors, from offensive output to an All-Star presence on the team. Analyzing 15 years of championship team data, we identified the most significant metrics using statistical summaries like ranking differentials and averages to predict potential 2025 title contenders and the championship winner. Using data from NBA, TeamRankings, and Basketball Reference, we analyzed offensive and defensive ratings, scoring margin, win percentage, efficiency metrics, effective field goal percentage, and player accolades (e.g., All-NBA selections and MVP voting rankings).

The analysis involved visualizing the data through histograms, scatter plots, and heatmaps using matplotlib and seaborn to highlight trends and correlations between factors and championship success. Although research is ongoing, preliminary findings suggest that defensive factors tend to be less relevant than their offensive counterparts. At the same time, an All-NBA caliber player on the team is almost always necessary for a team to be a championship contender.

Further analysis will provide us with a more conclusive understanding of the relevant metrics and their relations. By identifying the most critical factors for championship success, the research can gain significant insight into strategic planning, player acquisitions, and coaching decisions.

Keywords:
NBA; Championship

Mentor(s):
Tiantian Qin (Purdue University)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7209
Presentation Time: STEW 206 at 1:00-3:00

Locating health facilities to treat Substance Abuse Disorder in Democratic Republic of Congo

Social Science

Authors(s):
Bhavya Lakhina† (DSB|JMHC)

Abstract:
This study contributes to a broader initiative aimed at enhancing the capacity for substance abuse disorder treatment in the Democratic Republic of Congo (DRC) and the US. The purpose of this study was to identify locations of stationary facilities in the Democratic Republic of Congo as part of a two-layer health infrastructure to treat substance abuse.

Two alternative approaches to identifying suitable locations for health facilities were formulated: one considering existing facilities and one without. In both cases, the cycling time from potential facilities to the centers of subdivisions of North-East DRC created for the study was estimated. A subdivision is defined as having access to treatment if its geographic center is within a one-hour cycling distance from a facility. The study found that if existing facilities are not considered, the construction of at least 3 facilities will be required to service more than 10% of the population of Aru. When existing facilities were integrated into the model, the study found that no more than 5 facilities should be constructed.

Keywords:
Substance Abuse; Democratic Republic of Congo; Mixed-Integer Optimization; Facility Location; Public Health

Mentor(s):
Pengyi Shi (Purdue University)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7211

Presentation Time: STEW 206 at 1:00-3:00

Evaluating Cross-Species Generalization Capabilities of Deep Learning Models in Laparoscopic Surgical Tool Segmentation

STEM

Authors(s):

Farren M Martinus† (Engineering)

Abstract:

The increasing availability of publicly accessible laparoscopic surgical video datasets has accelerated the development of deep learning models for surgical tool segmentation. These models hold the potential to enhance surgical training, optimize workflow efficiency, and support real-time decision-making. However, existing datasets are often limited in scope, focusing on specific procedures and species, which restricts the generalizability of these models across diverse surgical contexts. This study examines the efficacy of deep learning models trained on laparoscopic surgical videos from one species (e.g., human) and testing them on another (e.g., porcine) to address challenges in cross-species generalizability. Specifically, we are experimenting with two models: a U-Net-based model and the Transformers for Actions, Phases, Steps, and Instrument Segmentation (TAPIS) model. Transfer learning techniques will be incorporated into the training process to enhance robustness and adaptability across species. Model performance will be evaluated using both qualitative analysis and quantitative metrics, including mean average precision (mAP), Intersection over Union (IoU), recall, and precision. Our findings aim to demonstrate how training data diversity impacts model robustness and provide direction for developing domain-agnostic deep learning approaches for laparoscopic applications.

Keywords:

Laparoscopic Surgery; Surgical Tool Detection; Domain Adaptation; Cross-Validation; Transfer Learning

Mentor(s):

Fiona Kolbinger (Purdue University); Zheyuan Zhang (Engineering)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7212

Presentation Time: STEW 206 at 1:00-3:00

Designing Healthcare Robotics: Biomimetic Prosthetic Hands for Secondary Education

STEM

Authors(s):

Nay Naing† (Polytechnic); Carolina Bobadilla† (Polytechnic)

Abstract:

There is a growing demand to teach marketable engineering and robotics skills in secondary education as the cost of post-secondary education rapidly increases relative to household-income. This research project aims to identify key technical skills needed in a secondary education learning plan on healthcare robots, such as prostheses and exoskeletons. We chose reduced grip-strength in elderly populations as the context for the robot design. Initial designs centered on hand exoskeletons and produced a six-bar mechanism recreating the curling motion of a finger. After various design iterations, the team opted to conform function to the design form and pivoted towards a biomimetic three-finger dexterous robot hand usable for prostheses and human-robot interactions. A configuration allows for each finger to be proportionally controlled by a pressure sensor. Furthermore, each finger has a compliant driving bar, allowing for series-elastic actuation. This study identifies that key skills needed for a proficient design include CAD, mechatronics, soft-robotics, statics, dynamics, mechanics of materials, FEA and mechanism design, the latter three not commonly taught in secondary education. Future work will evaluate how to adapt this project to a 12th grade learning unit.

Keywords:

Healthcare Robots; CAD; Prostheses; STEM Education; Biomimetic Design

Mentor(s):

Andres Torres (Engineering); Mo Rastgaar (Purdue University); Nina Mahmoudian (Purdue University)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7213

Presentation Time: STEW 206 at 1:00-3:00

Expanding on Election Forecasting

STEM

Authors(s):

Thanmaya Pattanashetty† (Science|Graduate); Joseph Michael Cromp† (Science)

Abstract:

Election forecasting is an exciting, yet complex and uncertain process that is often under scrutiny from the public eye. In 2024, we focused on forecasting the U.S. presidential, senatorial, and gubernatorial elections using mathematical modeling. We met this goal successfully and released weekly forecasts on our website and in the Purdue Exponent in the months leading up to the election (https://c-r-u-d.gitlab.io/2024/). Now, we are adjusting our methods with the goal of further increasing our accuracy. For example, the polling data that we work with includes polls of various sample sizes from many different sources. We are testing whether weighting the polls based on sample size increases accuracy. We are also building information about the historical performance of different pollsters into our mathematical models. We will share about this ongoing research and our experience with communicating uncertainty during real-time forecasting.

Keywords:

Forecasting; Mathematical Models; Political Science; Election; Social Science

Mentor(s):

Alexandria Volkening (Purdue University); Nour Khoudari (Purdue University)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7214

Presentation Time: STEW 206 at 1:00-3:00

Recycled to Revived: Giving Plastic a Second Life

STEM

Authors(s):

Jeeranun Poopanead† (Polytechnic)

Abstract:

Plastic waste is a growing environmental concern, but what if discarded water bottles could inspire change? This project transforms single-use plastics into Purdue-branded keychains, demonstrating the power of recycling in a tangible way. By shredding plastic bottles and injecting the material into molds, we can create meaningful items that promote sustainability. Beyond crafting keychains, this initiative is being promoted through a festival aimed at increasing recycling engagement across campus. The event brings students together to raise awareness about sustainability, showcase recycling efforts, and distribute the repurposed keychains as a tangible symbol of change. By engaging the campus community in an exciting and interactive way, we hope to inspire long-term participation in recycling efforts. Additionally, this research explores global perspectives on plastic recycling by reviewing literature from other countries. By examining international recycling policies, consumer behaviors, and technological advancements, we identify successful strategies that could be adapted for local implementation. This initiative bridges innovation with environmental responsibility, proving that small actions can drive big change. By giving plastic waste a second life, we hope to inspire a shift toward more sustainable habits and a future with less plastic pollution.

Keywords:

Sustainable Materials; Plastic Waste Reduction; Waste Management; Upcycling

Mentor(s):

Garam Kim (Purdue University); Do Gyun Kim (Purdue University)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7216

Presentation Time: STEW 206 at 1:00-3:00

Co-designing Student VR Experiences for Geology Course Fieldtrips

STEM

Authors(s):

Hiya Samanta† (Science|JMHC)

Abstract:

Field trips are an integral part of geoscience courses nationwide. However, select locations, such as caves, are often unsuitable for field trips due to accessibility and safety concerns. Virtual Reality (VR) can bridge this gap and fulfill educational goals without the challenges accompanying physical navigation through such areas.

To help address this, we are developing a cave exploration VR to support undergraduate learning around karst environments for an Earth, Atmospheric, and Planetary Sciences (EAPS) class. The VR aims to gamify exploration experiences similar to traditional field trips. Our first development phase is a series of collaborative design workshops. We intend to host two workshops with students who have previously taken the course to effectively connect the educational goals of the class to VR and interactively brainstorm design prototypes for final development.

The first workshop aims to emulate learning objectives of previous field trips in a cave VR. It consists of sensory activities and art-based approaches to allow the participants to reflect on earlier educational trips. The workshop concludes with a roleplay activity where participants act out a trip to an unknown cave. This activity will help us explore potential ways of increasing engagement and create a foundation for workshop two where we get further into the design aspect through storyboarding. The storyboards will allow final ideas to be further defined and give the developers pseudo-prototypes to base designs on. This VR will serve as the gateway for future projects about virtually exploring similar high-risk zones such as volcanoes and glaciers.

Keywords:

Co-Design; Virtual Reality; Geoscience; Caves

Mentor(s):

Anastasia Kouvaras Ostrowski (Purdue University); Caue Sciascia Borlina (Purdue University); Ali Bramson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Celebrate Presentation Abstract Number: 7217

Presentation Time: STEW 206 at 1:00-3:00

Depth Estimation Model for Autonomous Driving

STEM

Authors(s):

Sarah Sawhney† (Engineering); Taehoon Kim† (Engineering); Ian Tseng† (Engineering); David Andrew Slater‡ (DSB|JMHC)

Abstract:

This project enhances depth estimation for autonomous driving by fusing LiDAR and RGB data from the KITTI dataset. We explore three distinct approaches and conduct a comparative analysis. Building on last semester's solution, where a pretrained ResNet-18 was fine-tuned for depth estimation, the first approach develops a custom U-Net trained from scratch, incorporating interpolation to fill gaps in sparse LiDAR data. The second approach improves a CNN-based model by integrating a new data loader that handles variable image and depth map sizes, enhancing preprocessing and performance. The third approach employs a simple custom encoder-decoder CNN that predicts depth maps directly from RGB images. Preliminary results indicate improved depth continuity and clarity across methods.

Keywords:

[no keywords provided]

Mentor(s):

Shreya Ghosh (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Celebrate Presentation Abstract Number: 7218

Presentation Time: STEW 206 at 1:00-3:00

BoilerSketch

STEM

Authors(s):

Anvit Sinha† (Science); Vivan Tiwari† (Science)

Abstract:

This research presents the development of a Java based Android application integrating AI with an interactive whiteboard to enhance computer science education. Traditional text-based learning resources often fail to effectively convey complex programming concepts, leading to gaps in student comprehension. By combining natural language processing with real-time visualizations, this platform provides context-aware AI explanations alongside dynamic graphical representations of data structures, algorithms, and programming paradigms. Grounded in constructivist learning theory, the study explores how an AI-powered tutoring system can enhance engagement, problem-solving skills, and conceptual understanding. Using a mixed-methods approach, the research evaluates the platform in first and second year CS courses, measuring students' ability to visualize concepts and, assess the app's usability through controlled experiments and user surveys. Key components include GPT model integration for contextually rich explanations, whiteboard visualization for real-time interaction, and iterative UI/UX refinement for an intuitive learning experience. Preliminary findings indicate that students benefit from multi-modal explanations, with AI-driven visualizations improving mental model formation and boosting confidence in CS topics. Moreover, AI-assisted tutoring reduces instructional workload while maintaining educational quality. This research demonstrates that integrating generative AI with interactive visualization can create an engaging, scalable, and effective mobile learning environment, making CS education more accessible and personalized.

Keywords:

GenAI; Education; Android App

Mentor(s):

Andres Mauricio M Bejarano Posada (Purdue University); Ethan William Dickey (Science)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Celebrate Presentation Abstract Number: 7219

Presentation Time: STEW 206 at 1:00-3:00

Recycled Plastic Tree Tube Project

STEM

Authors(s):

Christopher Dawkin Tanjutco† (Engineering); Jesse Basham† (Polytechnic); Jackson Thomas St Myer‡ (Polytechnic); John G Burrell‡ (Polytechnic); Spencer Russell Fiddler‡ (Polytechnic); Adan Rosales‡ (Polytechnic)

Abstract:

The aim of this project is to revitalize recycled plastic waste into long-lasting, eco-friendly tree tubes to help smaller trees across Purdue University's campus and the West Lafayette community grow into healthy, mature trees. The project adheres to a structured, four-phase manufacturing process: collecting, shredding, extruding, drilling. The team first collects high-density polyethylene (HDPE) containers from campus and the community. Then, the collected material is shredded using a Precious Plastic shredder into pellet-sized pieces. The shredded material is then put through a Precious Plastic extruder, transforming the shredded material into plastic tubes. Once out of the mold and cooled, holes, measuring 3/8-inch in diameter, are drilled into the top one-foot section of the tubes to provide airflow.

This project is ongoing and concludes by the end of the semester. The following has been completed: CAD design of a spider dye as the extrusion mold, collection of material, and casted parts of the mold. Design iterations have been made to the manufacturing of the extrusion mold. The dimensions were shortened to cut back on material expenditures and increase the efficiency of machining. Furthermore, the first attempt of manufacturing the mold resulted in casted parts.

Currently, the team is working on machining large pieces of aluminum to finish the extrusion mold, developing methods for rapid cooling of the tubes post-extrusion, and communicating with organizations within the university and community to promote the project, join in on the collection efforts, and find an event to place the tree tubes around new trees.

Keywords:

Extrusion; Casting; Plastic; Trees; Manufacturing

Mentor(s):
Devon Julia Pessler (Purdue University); Paul B McPherson (Purdue University)

Other Acknowledgement(s):

Celebrate Presentation Abstract Number: 7220
Presentation Time: STEW 206 at 1:00-3:00

Bridges and Machines in German Media

Humanities

Authors(s):
Grace C Thomas† (Liberal Arts)

Abstract:
Expressionist and Impressionist themes dominated German media during the 20th century and were used to express distress, helplessness, and anger amid war and its aftermath. The culmination of war and its reverberations on the nation's mentality can be seen through film and literature. Two of the most common symbols used in this movement are the bridge and machinery, which are used to represent the connection between life and death, an embodiment of anxiety and despair.

Writers such as Stadler and Böll, who created short poems and narratives, such as "Fahrt über die Kölner Rheinbrücke bei Nacht" and "Wanderer, kommst du nach Spa…" respectively, incorporated these themes into their writing which embodied the struggles faced by civilians in the midst of and after war. This era yielded several literary movements, namely the Expressionist movement between the end of the 19th century and the dawn of the First World-War. Writers used literary devices, such as symbolism, to actualize their struggles for their audience.

While the bridge and train are utilized in literature, the symbolism of machinery is applied in film to express a different experience. In the 1927 film "Metropolis" the laboring class does not hesitate to destroy the machines they've been forced to operate their entire lives. The desperation of the workers to liberate themselves from their cage of servitude is an astounding contrast to the desire for the elitists to keep them trapped there. Understanding this contrast is important to understanding the people during this period, which marks the beginning of the Great Depression.

Keywords:
German Literature; German Media; Expressionism; 20th Century; Post-War

Mentor(s):
Beate I Allert (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Celebrate Presentation Abstract Number: 7221

Presentation Time: STEW 206 at 1:00-3:00

Leveraging Game Mechanics for STEM Education: Enhancing Engineering Skills Through the Pac-Man Robotics Challenge

Creative

Authors(s):

Christian R Tomao† (Engineering|JMHC); Gabrielle Elizabeth Layman* (Engineering|JMHC)

Abstract:

The purpose of this study was to examine the effects of game design on STEM education through a robotics competition called the Pac-Man Challenge. This study follows the schedule of a three-week camp where each week, about 80 new students will take part in the robotics portion of the camp which involves a section of robotics lectures and a robotics competition. Each week, the parameters of the competition and lectures were changed to invoke higher creativity from the students. The results were measured through observations as well as survey data. The survey data showed consistently positive results for the robotics program. For the response “Awesome” from Week 1 to Week 3, there was an increase of 8.78% in Engineering Organization, 0.325% for Robotics Fundamentals, 1.67%% for Robotics Design and Testing, and a 5.61% decrease for Final Robotics Demo. The study analyzed the students' favorite projects, including 3D printing, Arduino, Rollercoaster, and the Robotics Program. Between 1-4 with 1 being the favorite and 4 being the least, the Robotics project was the overall favorite and averaged a 2.271 in Week 1 and a 2.108 in Week 3, which is a 7.73% decrease. The difference between the runner-up and the robotics project in rating was 0.238 in Week 1 and 0.373 in Week 3. Educators in STEM may consider implementing competition-based projects to improve student learning. Educators in STEM may also want to pay close attention to competition parameters, as developing competitive parameters may result in students' stronger understanding of the topic.

Keywords:

Robotics; Education; Game Design; Competition; STEM

Mentor(s):

Jacqueline Linnes (Purdue University)

Other Acknowledgement(s):

Melissa E Hale (Purdue University); Suzanne C Walker (Engineering);

Jack Alexander Martin (Purdue University); Grady Andrews (Engineering)

Celebrate Presentation Abstract Number: 7222
Presentation Time: STEW 206 at 1:00-3:00

The Impact of Air Quality on Real Personal Income: Evidence from U.S. States (2019–2022)

Business Case Study

Authors(s):
Yiwen Zhang† (Agriculture)

Abstract:
This study examines the relationship between air quality (MaxAQI) and Real Personal Income (RPI) across U.S. states from 2019 to 2022 using a two-way fixed effects panel regression model. The analysis controls for economic and demographic factors, including RGDP, RPCE, BIRTHS, POP, RPP, and unemployment rate (RATE), with data sourced from the BEA, EPA, Census Bureau, and BLS.

Results indicate a statistically significant negative relationship between MaxAQI and RPI, suggesting that poorer air quality reduces personal income, potentially due to health-related issues or decreased economic activity. RGDP and RPCE show positive associations with RPI, highlighting the importance of economic activity and consumer spending in income growth. BIRTHS negatively impact RPI, reflecting short-term economic costs of population growth. Unexpectedly, RATE exhibits a positive relationship with RPI, possibly due to omitted variable bias. RPP is statistically insignificant, indicating regional price differences do not meaningfully influence income.

Diagnostics address heteroscedasticity, non-normality, and multicollinearity, with remedial measures such as robust standard errors and variable transformations applied. The findings emphasize the economic implications of air quality, suggesting that policies targeting air quality improvement could enhance personal income, particularly in high-pollution regions. Future research could explore the mechanisms underlying this relationship and potential nonlinear or interaction effects between environmental and economic factors.

Keywords:
[no keywords provided]

Mentor(s):
Michael S Delgado (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9000

Presentation Time: April 8-11, 2025

Modular Soft Assemblies with Independent Cells

STEM

Authors(s):

Eshaan Agarwal† (Engineering|JMHC)

Abstract:

In recent years, soft robots have emerged as a viable bio-inspired alternative to traditional systems, particularly for applications involving human-robot interaction. A primary advantage of soft robots is that they allow for nearly arbitrary continuous deformation by leveraging the nonlinear, large deformation of soft materials under pressure. However, due to the unique properties of soft materials, the deformation of soft robots can be complex and difficult to design and control. For this reason, soft robots must be thoroughly characterized to determine precise actuation upon applied pressures. Moreover, to enable complex motion but retain simplicity of design and control, we propose a modular system with individually-controllable units. We design two different kinds of modular soft actuator unit cells of 3×3×3×3 in^3 —one for bending, and one for linear expansion. Each actuator was characterized experimentally and by means of finite element simulations to ensure robust and controllable actuation. We then demonstrate how multiple copies of these unit cells can be connected to form arbitrary 3D assemblies by coupling to each other mechanically, pneumatically, and electronically. We showcase the versatility of our modular actuators in three applications: a walking assembly, a claw assembly, and a hook assembly. Crucially, our proposed system does not require individual pressure and data lines for each unit. Rather, units are connected only to their nearest neighbors. We anticipate that this approach will enable large modular assemblies for arbitrary motions.

Keywords:

Nonlinear Finite Elements; Soft Robotics; Modular Robots

Mentor(s):

Adrian Buganza Tepole (Purdue University)

Other Acknowledgement(s):

Benjamin Lee Hutchins (Purdue University); Joseph Jia Rong Chen (Purdue University); Patrick Tareg Mansour (Purdue University); Asher Erik Mason (Engineering); Tianyi Zhang (Purdue University)

Virtual Presentation Abstract Number: 9002

Presentation Time: April 8-11, 2025

Matrix Multiplier Engine

STEM

Authors(s):

Pranav Bantval† (Engineering); Arnav Pravinkuma Namdev† (Engineering); Advay Welling† (Engineering); Jai Anand Keskar† (Engineering); Minh Huy Nguyen† (Engineering)

Abstract:

Matrix multiplication is a fundamental operation of machine learning. The purpose of this study is to design and implement a matrix multiplier in System Verilog, simulating it on an FPGA while also implementing communication protocols through an STM32 microcontroller. Overall, this will improve our understanding and knowledge of the digital design process, including design flow, RTL diagramming, and verification. The constraints for this design are a budget of 1000 logic gates, 24 input/output pins, and a max clock rate of 66 MHz. Our design integrates a custom Wallace tree multiplier combined with a ripple carry adder to optimize arithmetic operations within a resource-constrained environment. The system uses SPI to communicate between the STM32 and FPGA, with the microcontroller being the manager device and the FPGA the subordinate device. The STM32 will accept input via UART from an external computer. Our system conducts efficient 3x3 matrix multiplication through pipelining and sends the output back to the computer. The system will be tested by entering example matrices into System Verilog testbenches and comparing the outputs against expected results.

Keywords:

FPGA; Microcontroller; Verilog; Matrix

Mentor(s):

Malcolm Lloyd Seib McClymont (Engineering); Miguel Isrrael Teran (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9003

Presentation Time: April 8-11, 2025

Texture and Mechanical Properties of Human Cortical Bone: Influence of Bound Water Composition

STEM

Authors(s):

Christopher Richard Chin† (Engineering)

Abstract:

The mechanical and structural properties of human cortical bone are influenced by its bound water content, which plays a key role in maintaining bone integrity. Changes in bound water may contribute to bone deterioration, particularly in Chronic Kidney Disease (CKD) patients. This study aims to determine how bound water content affects cortical bone texture and mechanical properties, providing insight into potential early biomarkers for CKD-related bone abnormalities given that there is limited research in the topic. High-resolution HR-pQCT images of cortical bone from CKD patients were collected and preprocessed to ensure data quality. Using 3D Slicer, cortical bone structures were segmented into 90 images for each set (15 slices per section) to remove any excess tissues. The dataset was divided into multiple segments, including higher-order statistical metrics from Fourier and wavelet transformations. Dimensionality reduction techniques identified key features most sensitive to changes in bound water content. Texture analysis was performed to assess structural heterogeneity and potential correlations with CKD-related bone abnormalities. Findings suggest that decreased bound water content is associated with increased cortical bone heterogeneity in CKD patients. Radiomics analysis revealed structural differences not detectable with standard imaging, highlighting bound water as a potential biomarker for early bone deterioration. These results underscore the importance of bound water in bone health and its role in improving early diagnosis and treatment strategies for CKD patients.

Keywords:

Bound Water; HR-pQCT; Chronic Kidney Disease; Radiomics Analysis

Mentor(s):

Youngjun Lee (Engineering); Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9007
Presentation Time: April 8-11, 2025

Computational Arithmetic Logic CALC (CALC)

STEM

Authors(s):

Matthew Du† (Engineering); Jeet Chandresh Jagad† (Engineering); Amogh Shivanand Havanagi† (Engineering); Lucas Michael Mallen† (Engineering); Nicholas Zhang† (Engineering)

Abstract:

Lucas Mallen

Amogh Havanagi

Matthew Du

Nicholas Zhang

Abstract

Digital calculators are fundamental devices found commonly in many devices such as embedded systems and microprocessors. The CALC, or Computational Arithmetic Logic CALC, is a 16-bit 3 function calculator. It can manipulate negative and positive numbers with addition, subtraction, and multiplication operations. This device demonstrates the process of turning an idea into a design ready to be taped out. Each numerical operand is coded as a 16-bit number using 15 bits and a sign bit. The system architecture integrates a decimal-to-binary conversion module for input processing, a binary-to-decimal converter for output generation, and an arithmetic unit that executes operations based on a 2-bit operand code.

A finite state machine orchestrates initial input capture, arithmetic processing, and result output. Input control has debounce functionalities to mitigate signal irregularities from an 8-bit keypad. Then, temporary storage buffers and memory handle intermediate values. The calculated result is displayed using an LCD panel via a custom UART driver. Ultimately, our project represents the building block of modern computation, offering a deeper appreciation for the systems we often take for granted.

Keywords:

[no keywords provided]

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Malcolm Lloyd Seib McClymont (Engineering); Miguel Isrrael Teran (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9008

Presentation Time: April 8-11, 2025

Digital Stopwatch

STEM

Authors(s):

Genci Duraku† (Engineering); Arjun Julius Siderys† (Engineering|JMHC); Jack Spenser Zimmerman† (Engineering); Arina Harlanovich† (Engineering); Noah Everett Desserich† (Engineering); Austin Salomon Guerrero† (Engineering)

Abstract:

Our project is to create a stopwatch that can count in different intervals. It will focus on the design and verification process, which will help us to learn about and gain a better understanding of digital design. The key aspects of our design are an finite state machine (FSM), clock divider, seven segment decoder, and a counter. We intend to display two digits using two seven-segment displays using bidirectional pins. The stopwatch will have two start buttons: one for a 1 second interval and one for a 10 second interval. It will also have a pause button to save its current state using a register, and a reset button to clear the stopwatch back to 0. The design of the different blocks (FSM, clock divider, and counter) will be completed using SystemVerilog. We will also complete testbenches to test our designs before tapeout. Some other features we may add if time allows are a button or buttons to manually increment the timer and a speaker to beep on the maximum value. After our design is complete and verified, we will be using a service called TinyTapeout to tapeout our design. Our circuit will be useful in both teaching hardware design alongside its practical use as a timing piece.

Keywords:

Digital Design

Mentor(s):

Malcolm Lloyd Seib McClymont (Engineering); Miguel Isrrael Teran (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9009

Presentation Time: April 8-11, 2025

Improving Hydroxyl Terminated Poly Butadiene Combustion Characteristics with Boron-Zirconium and Boron-Titanium

STEM

Authors(s):

Aron Pranay Dutia† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Dhruval Natubhai Patel (Engineering)

Other Acknowledgement(s):

Steven F Son (Purdue University); Metin Ornek (Purdue University)

Virtual Presentation Abstract Number: 9010
Presentation Time: April 8-11, 2025

Biodiversity Changes Due to Ecosystem Disturbance and its Impacts on Mesocarnivore Presence in Indiana

STEM

Authors(s):
Alexandra Grace Early† (Agriculture); Sierra Hunnicutt* (Science|JMHC); Lukas Benjamin Kraft* (Agriculture|JMHC); Anaey Gaurang Naik* (HHS|JMHC); Zhixin Cai* (Science|JMHC)

Abstract:
Habitat disturbances significantly impact species populations, and the cause of many of these disturbances can be traced to anthropogenic activities such as logging, prescribed burns, and climate change. Many of these disturbances are prescribed in order to aid in land and ecosystem management. Many of these management practices help to improve the environment quality and encourage vegetation growth and plant species biodiversity. These environmental changes alter species' presence, migration patterns, and access to resources in many ecosystems. Mesocarnivores, including raccoons, coyotes, and bobcats, are of particular interest in studying the effects of habitat disturbances. Research has shown that different mesocarnivore species respond uniquely to disturbances.

While much research has focused on mesocarnivore presence in disturbed environments, fewer studies have examined how changes in biodiversity due to disturbance correlate with mesocarnivore population density. To address this gap, we deployed camera traps and autonomous recording units (ARUs) across Indiana (n=28) to document species presence. In this study, we selected two sites that experienced a pre and post-prescribed burn to understand variation in biodiversity post-disturbance. We will use AI-based tools to assist in identification of species presence. We predict that habitat disturbances will have a negative effect on mesocarnivore populations. Based on the data, we can make changes in the management strategies of these lands to improve the viability of these ecosystems for mesocarnivore species.

Keywords:
Corridor; Ecology; Disturbance; Mesocarnivore; Biodiversity

Mentor(s):
Kristen Marie Bellisario (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9011

Presentation Time: April 8-11, 2025

SoCET-Test Engineering

STEM

Authors(s):

Seongwon Hong† (Engineering); Raghav Srivaths† (Engineering); Benjamin Eunsang Ryu† (Engineering); Henan Wang† (Engineering)

Abstract:

Design-for-Testability (DFT) is essential for ensuring fault detection and efficient test generation in modern SoCs. This project focuses on developing a robust DFT flow for the AFTx07 chip using Synopsys tools.

Last semester, we explored scan chain insertion, ATPG fault models, and scan compression but faced IT challenges that delayed direct implementation. This semester, we are optimizing scan insertion, analyzing testability constraints, and refining ATPG strategies in collaboration with the design flow team.

Key objectives include integrating DFT into a real SoC, assessing clock domain constraints, and aligning test strategies with manufacturing requirements. Our work aims to enhance fault coverage while streamlining test complexity for improved silicon reliability.

Keywords:

Circuit; DFT; Design Flow; Scan Chain

Mentor(s):

Abinands Ramshanker (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9012

Presentation Time: April 8-11, 2025

UVM-Based Verification of RISC-V Multicore Design

STEM

Authors(s):

Adam Jacob Keith† (Engineering); Dev M Patel† (Engineering|JMHC)

Abstract:

In this project, we verified a RISC-V multicore processor using the Universal Verification Methodology (UVM). We developed a comprehensive test plan and architecture that defined the roles of monitors, drivers, and interfaces in relation to the Device Under Test (DUT). Our UVM environment, along with well-designed sequences and tests, enabled a thorough evaluation of the multicore system's core-to-memory interactions. The verification plan included high-level base and corner test cases of directed, pseudo-random (constrained random), and randomized nature. The robustness of the design will be evaluated through coverage based analysis of the test plan execution. This rigorous approach ensured thorough functional coverage and highlighted the system's ability to handle parallelization, strengthening the reliability of the multicore design in managing concurrent operations and complex workloads. While initial results were demonstrated, further system-level coverage and results will be presented at the next symposium. This project highlights the importance of advanced verification techniques in improving the robustness of modern hardware systems.

Keywords:

RISCV Multicore System; Universal Verification Methodology; Functional Coverage; Test Architecture

Mentor(s):

Vishnu Chaithanya Lagudu (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9016

Presentation Time: April 8-11, 2025

Feel and Control: Improving Damping in Tennis Rackets

STEM

Authors(s):

Andrew Hanchen Liu† (Engineering|JMHC); Lucas David Gorretta† (Engineering); Colin H Reilly* (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Tennis; Vibration; Dampening

Mentor(s):

Adeline Nora Ripberger (Engineering); Jan-Anders E Mansson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9018

Presentation Time: April 8-11, 2025

Assessing the Accuracy of a Real-Time Mental Workload Load-Based Measurement Tool: A Pilot Study

STEM

Authors(s):

Jasmine Alyssa Luke† (Engineering); Alpamys Sultanbek‡ (Engineering)

Abstract:

Mental workload (MWL) refers to the mental effort required for processing information and is important for assessing system usability and informing design improvements. It plays a key role in evaluating task performance, problem-solving, and working memory. The purpose of examining task complexity is to better understand how varying levels of difficulty influence cognitive demand. Traditional methods to assess MWL, like the NASA Task Load Index (NASA-TLX), rely on subjective evaluations, while recent advancements utilize physiological sensors for objective, real-time MWL monitoring. These multi-modal methods offer more precise insights into MWL, particularly in high-stakes applications like robot-assisted surgery, where real-time monitoring can optimize training, performance, safety, and reduce errors. This pilot study aims to assess a model for measuring MWL in real-time using multi-modal data. Participants performed arithmetic tasks and the 2-back task at two levels of difficulty based on the complexity of the math problems in a randomized order; easy and hard. Participants wore electroencephalography (EEG) sensors and an eye-tracking device (Tobii Pro Glasses 2) to monitor their physiological responses. In the model, sensor data is combined to give a real-time MWL score from 0 (low) to 1 (high). The goal was to evaluate the feasibility, accuracy, and sensitivity of this model and whether it effectively measures MWL in real-time. To do this, we also evaluated task performance from the arithmetic task and 2-back task along with NASA-TLX scores to determine the model's accuracy. Successful validation will support the use of the model in real-time MWL assessment, helping improve system design and human performance in complex, high-demand environments such as robot-assisted surgery training.

Keywords:

Mental Workload; Mental Workload Modeling; Physiological Sensors

Mentor(s):

Denny Yu (Purdue University); William Christian Zouzas (Engineering)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9019

Presentation Time: April 8-11, 2025

Changes in rural healthcare provider vaccine opinions after the COVID-19 pandemic: A mixed methods study

Social Science

Authors(s):

Alexander McQuade† (Pharmacy|JMHC)

Abstract:

Background:

Vaccines play a critical role in preventing widespread disease outbreaks and mortality. However, since the COVID-19 pandemic, vaccine uptake rates have declined, especially in rural areas. Studies have shown that healthcare providers (HCPs) are the primary source of vaccine information among patients. Still, there has not been conclusive research on how rural HCPs' views on vaccines have changed since the pandemic.

Aims:

This mixed-methods study aims to understand rural HCPs' opinions on the safety and efficacy of general vaccines both before and after the pandemic, and their changes in vaccine recommendations.

Methods:

Healthcare providers will be recruited from professional organizations eligible for vaccine administration. They will be asked to complete an online survey including their demographics, background, practice site information, and personal vaccine opinions. Rural HCPs who had vaccine administration authority before and after the pandemic will be asked to participate in an additional 45-minute virtual interview. In this interview, they will be asked to discuss potential vaccine safety and efficacy concerns. We will ask them to share changes they have noticed in vaccine uptake behavior since the pandemic. A thematic analysis technique will be used to review interview transcripts and develop subthemes and overarching themes.

Implications:

Opinion data shared in the survey and interview could be used to develop vaccine information delivery strategies that ease rural HCP concerns and increase patient vaccine uptake. These insights may shed light on reasons why rural patients have lower vaccine uptake rates than patients in non-rural areas.

Keywords:
Vaccines; Healthcare Providers; Opinions; Qualitative; Interview

Mentor(s):
Soo Jung Jo (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9020
Presentation Time: April 8-11, 2025

UVM Verification of AHB_MUX

STEM

Authors(s):
Yash Mishra† (Engineering)

Abstract:
The purpose of this study is to verify the functionality of an AHB (Advanced High-performance Bus) multiplexer (MUX) system, including its arbiter and address-phase cache, using Universal Verification Methodology (UVM) to ensure reliable performance across diverse operational conditions. The verification process leverages UVM techniques to rigorously test the AHB MUX design through a comprehensive test plan targeting critical behaviors. This includes assessing the arbiter's ability to reset signals like ARB_SEL_PREV and MASTER_SEL when HRESETn is asserted, select the highest-numbered master during multiple requests, and maintain control for locked or busy masters. Additionally, the address-phase cache is evaluated for capturing valid upstream signals when HTRANS is not IDLE, retaining data during busy states, and clearing appropriately when ARB_SEL and HREADY align. The test plan, derived from filtered design logs, also examines the integration of multiple masters, ensuring synchronized arbiter-cache interactions and correct propagation of slave responses (e.g., HRESP, HRDATA) to the requesting master. The AHB MUX is expected to demonstrate robust reset behavior, seamless master transitions, and accurate address-phase signal forwarding, with HREADY_out mirroring HREADY_in under specified conditions. Cached data should bypass invalid states and retain integrity between requests, avoiding interference across masters. These outcomes aim to confirm the system's reliability for high-performance bus arbitration and data handling. Successful verification would imply that the design meets AHB protocol standards, offering engineers confidence in its deployment. Potential implications include refining timing alignments for multi-master scenarios.

Keywords:
[no keywords provided]

Mentor(s):
Mark Johnson (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9021

Presentation Time: April 8-11, 2025

Mushrooms to Mars: Mycoponics™ for Diversified Product Streams in Closed-Loop Environments

STEM

Authors(s):

Simone Xin Moulton† (Engineering|JMHC); Adriana K Sanchez† (Agriculture|Engineering)

Abstract:

Among some of the desired products of the rapidly growing fungal industry are mycoleather, a mycelial alternative to animal leather, and mushrooms, a nutritious addition to the human diet. Traditional commercial fungal cultivation techniques convert massive amounts of biologically derived substrate, such as nutrient fortified sawdust, to waste products. These substrates take up significant volume, require energy-intensive autoclaving, and are not readily available in all locations such as desert, arctic, or space-faring environments. Mycoponics™, a novel substrate-free fungal cultivation system, enables users to grow mycelial leather, robust fruiting bodies, and potential pharmaceutical exudates directly on porous ceramic forms supplied with a liquid nutrient media which may contain recycled components. A demonstration using Mycoponics™ to grow mycoleather over a 3D glove-shaped structure highlights the feasibility of producing intricate forms and functional products, such as clothing components, directly through the growth process. Robustness of the system was demonstrated by a set of chamber-enclosed inoculated Mycoponics™ tubes that were flown from Indianapolis to the Mars Desert Research Station (MDRS) in Utah, underwent a two week research stay, and subsequently flown back to Indianapolis. Upon the return trip, the tubes were separated from the researcher and left unfed in uncontrolled conditions for four days due to a severe snow storm. Upon recovery, the mycelium on the tubes was healthy and had continued to grow through the separation and after their recovery. This study investigates Mycoponics™ production and characterization of mycoleather, fruiting bodies, and the applicability of Mycoponics™ to produce useful products in resource-constrained environments.

Keywords:

Mycoponics™; Mycoleather; Fungus; Sustainability; Space

Mentor(s):

D. Marshall Porterfield (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9022

Presentation Time: April 8-11, 2025

ASIC Implementation of a Digital Audio Synthesizer

STEM

Authors(s):

Nicha Muninnimit† (Engineering); Matthew S Pung† (Engineering|JMHC); Vidyut Karur Suresh† (Engineering); Nhu Thanh Quynh Ta† (Engineering); Peter Alexei Kaya Gretchikha† (Engineering)

Abstract:

This project focuses on the design, verification, and tape-out of a digital audio synthesizer as part of Purdue's Introduction to SoCET (System on Chip Extension Technologies) II team. The synthesizer design includes some key modules: a finite state machine (FSM), wave shaper, pulse-width modulation (PWM) generator, oscillator, frequency lookup table (LUT), keypad encoder, and frequency divider. By providing input through a keypad interface, the system will output an audio signal over a speaker. This input from the keypad determines the operation of the synthesizer, specifically the frequency and the waveshape of the output. The output operating modes consist of square, sawtooth, triangle, and off mode. To create these modes, the wave shaper and oscillator work in tandem as they vary the duty cycle to change the frequency and volume of the output signal. Functional verification is conducted on the design through written testbenches and performing waveform analysis to validate the system's behavior. Ultimately, our goal in this project is to develop a deeper understanding of digital design methodologies, RTL (Register Transfer Level) development, design flow, and verification, which will prepare us to contribute to specialized teams in future digital design projects.

Keywords:

Digital Design; RTL Design; Chip Design; Audio Synthesizer; Design Flow

Mentor(s):

Malcolm Lloyd Seib McClymont (Engineering); Mark Johnson (Purdue University)

Other Acknowledgement(s):

Steve Clayton Rausch (Engineering)

Virtual Presentation Abstract Number: 9024
Presentation Time: April 8-11, 2025

Innovative Flight Training: Balancing Safety and Efficiency in Response to a Pilot Shortage

STEM

Authors(s):
Olivia Olson† (Polytechnic|JMHC); Timothy Michael Nowling‡ (Polytechnic); Daniel Stephen Urbancic‡ (Polytechnic); Zachary Chase Herman‡ (Polytechnic)

Abstract:
The purpose of this study is to address the pilot shortage by exploring alternative training pathways that reduce flight hour requirements while maintaining safety and competency. The central goal is to identify methods that increase the overall efficiency of pilot training. The following research methods are utilized: a literature review of training models/techniques and their effectiveness, qualitative data from interviews with aviation industry professionals, and analysis of the experiences of individuals within the aviation community who have gone through flight training.

The research findings highlight that a significant portion of the professional pilot pathway can involve repetitive flight hours that may not always enhance pilot decision-making and problem-solving abilities. These findings further suggest that professional pilot training could be more effective if focused on developing important skills such as Threat and Error Management (TEM), Crew Resource Management (CRM), and Line-Oriented Flight Training (LOFT), rather than simply accumulating flight hours.

In response, the study proposes an alternative training pathway that reduces the minimum Restricted Airline Transport Pilot (R-ATP) hours from 1,000 to 750 hours. This pathway integrates a TEM-focused ground course, a type-rating course with LOFT and TEM, and the use of Virtual Reality (VR) technology to simulate real-world scenarios. By incorporating these elements, flight schools like Purdue can potentially help address the pilot shortage while simultaneously producing safer and more competent pilots.

Keywords:
[no keywords provided]

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Mentor(s):
Michael Wayne Suckow (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9026

Presentation Time: April 8-11, 2025

AFTx07 External SRAM Connector Board

STEM

Authors(s):

Brady Owen Philhower† (Engineering); Alexander David Forrest† (Engineering)

Abstract:

The purpose of this project is to design a PCB that interfaces an RISC-V-based AFTx07 chip with an Artix-7 FPGA configured to act as off-chip SRAM. The board will include a power supply, programming pins, GPIO pins, status LEDs, an LPC FMC connector for the FPGA, and more. KiCad 8 will be used to design the board and its accompanying circuit schematic. The use of the FPGA as external SRAM will allow the correction of bugs in the memory controller of AFTx07 due to the accessibility and adaptability of the FPGA board compared to standardized SRAM. The FPGA can be configured to work at various operating voltages to meet the specifications of the AFTx07 chip, while off-the-shelf SRAM can only support specific, non-adjustable operating voltages that may not be compatible. The board will also allow for demonstrating the capabilities of AFTx07, including GPIO connectivity and the integrated GPU. It will also allow for in-depth testing and verification of the chip, allowing further advancements and improvements for AFTx08 and beyond.

Keywords:

PCB Design; SoCET

Mentor(s):

Matthew A Swabey (Purdue University)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9027

Presentation Time: April 8-11, 2025

UVM verification module for stack LIFO module

STEM

Authors(s):

Santiago Xavier Pineiros Gavilanes† (Engineering); Anas Zyad Abughali‡ (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

UVM; Stack; Verification; LIFO

Mentor(s):

Vishnu Chaithanya Lagudu (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9028

Presentation Time: April 8-11, 2025

Building Resilience Through Transparency: The Critical Role of Information Access in Public Health Policy

Social Science

Authors(s):

Tejasi Raghuprasad† (Engineering)

Abstract:

This research examines the crucial role of access to information in promoting governmental accountability during public health crises, highlighting how secrecy, disinformation, and malinformation undermine public trust and health outcomes. Historical examples, such as the CIA's MK Ultra program, the crack cocaine epidemic, and the COVID-19 pandemic, demonstrate how the distortion or withholding of information erodes trust in government and adversely affects community well-being. For instance, during the crack epidemic, manipulated narratives justified punitive measures, fostering long-term distrust in affected communities. Similarly, the politicization of health information during COVID-19 led to public confusion and resistance to health guidelines.

Combining historical case study analyses with a scoping review, this research examines ethical breaches in covert operations and the influence of disinformation on public perception and policy failures. It posits that access to accurate information is a fundamental right essential for effective governance and public health. The study underscores the importance of media literacy, transparency in information systems, and open government initiatives to build public trust during health emergencies.

The analysis calls for further research into contemporary contexts and best practices for maintaining transparency, reinforcing the idea that the right to information is a cornerstone of democratic governance and public health resilience. Ultimately, this research aims to inform better policies and health communication strategies that prioritize transparency, fostering public trust and improving health outcomes in future crises.

Keywords:

Information Access; Government Transparency; Public Health Crises; Disinformation and Malinformation; Health Communication

Mentor(s):

Bethany McGowan (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9029
Presentation Time: April 8-11, 2025

Caravel Chip (STARS Chiplet)

STEM

Authors(s):
Aryan Ram Babu† (Engineering); Sanjay Akam† (Engineering)

Abstract:
The increasing accessibility of open-source ASIC design has created opportunities for research and prototyping in semiconductor development. This project presents the design and implementation of a daughter board to interface with the Caravel EFabless chip, providing the necessary power, communication, and memory functionalities. The standardized M.2-CONNECTOR-E ensures compatibility with Caravel's harness, allowing seamless integration with the ASIC.

The board features a USB Type-C receptacle as the primary power source, regulated through two TLV761 voltage regulators to generate the required 1.8V and 3.3V rails. A DSC6001 10MHz MEMS oscillator is incorporated to provide a stable clock signal essential for operation. Additionally, a W25Q32JV non-volatile memory module enables external storage, which may facilitate firmware storage, configuration data, or bootloading capabilities. For communication, the FT232H USB-to-serial/FIFO IC is utilized, offering flexible high-speed data transfer between the ASIC and a host computer via USB.

By assembling these components into a compact and efficient daughter board, this project enables simplified testing and development for Caravel-based designs. This work serves as a foundation for future open-source silicon projects, making ASIC prototyping more accessible to researchers and developers. Future considerations include optimizing power delivery, refining signal integrity, and evaluating additional communication protocols to enhance the board's capabilities. The presented design aims to contribute to the growing ecosystem of open-source silicon, providing a scalable and robust solution for ASIC research and development.

Keywords:
[no keywords provided]

Mentor(s):
Vishnu Chaithanya Lagudu (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9030

Presentation Time: April 8-11, 2025

Refinement of Acrylic Cages for Seizure Research

STEM

Authors(s):

Willard Gabriel Rash Cuevas† (Engineering); Samir Niradbhai Patel† (Engineering); Meghana Sunil Kumar† (Engineering); Jaskarandeep Kaur† (Engineering); Gavin Allen Arner‡ (Engineering); Zachary Gosnell‡ (Engineering); Elliott Samuel Korentager‡ (Engineering); Cohen Scott Meredith‡ (Engineering); Jakob Eric Mikolajczyk‡ (Engineering); Pralhad Prashant Mundargi‡ (Engineering); Gavin Wang‡ (Engineering)

Abstract:

This project focuses on redesigning a specialized cage and creating a mechanical suspension system for a rat implanted with cranial electrodes used to monitor electrical signals during seizures. The primary objective is to minimize strain on the wire while focusing on ease of cleaning and disassembly. This semester we focused on refining our suspension system to reduce strain on the wire, implementing mortise and tenon joints to improve construction of the box, and experimenting with CNC and acrylic annealing to improve structural integrity. These refinements will introduce standardization, while reducing long-term costs of experimentation, and still meet the standards for ethical animal treatment. To make tasks manageable, sub teams were created to allow groups to dive deeper into their topic of research. Moving onto the prototyping phases, the Suspension & Hinge sub team used 3D printing and CAD to create and explore test cases for spring prototypes. The Materials & CNC sub team used an autoclave and desktop CNC milling machine to reduce internal stresses and fabricate parts more efficiently. The Main Box sub team used CAD software, a laser cutter, and a 3D printer to innovate previous designs with improved joint structure and stability. Through these changes, we have created a robust design that will optimize data collection and improve longevity of the cage.

Keywords:

Cage; Electroencephalogram; Rat; Acrylic; Laser Cut

Mentor(s):

Ken Yoshida (Purdue University); Mahdi Ghanati (Engineering)

Other Acknowledgement(s):

Gabriel Thomas Flath-Everhard (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9031

Presentation Time: April 8-11, 2025

Enhancing the Stability of Conductive Bioelectrodes Using Advanced Nanomaterials

STEM

Authors(s):

Ayden Matthew Rosencranz† (Engineering); Charlita Sinmak† (Engineering); Antonio C De Oliveira Segura† (Engineering)

Abstract:

An important class of modern biomedical devices that allow electrical communication between biological tissues and electronic systems is bioelectrodes. However, their stability and performance over time present some challenges, more so in the case of neural and muscular interfaces. This study examines how adding MXenes, conductive nanomaterials, to PEDOT: PSS, a conductive and well-tolerated polymer blend, brings durability and conductivity. The corresponding tests will assess the long-term performance of the PEDOT: PSS electrodes with MXene coatings in a saline solution at a controlled temperature under continuous electrical stimulation. Conductivity and resistance are measured with an oscilloscope. Data is analyzed with MATLAB to take a time progression look at performance. This accelerated aging simulates long-term use of the device and shows changes in degradation, oxidation, and overall stability. Although testing is still in its early days, performance evaluations over the next month should show if the fast saturation is recognized in trends concerning essential structural integrity and conductivity retention values. These promising results should enhance the longevity of certain bioelectrodes by extending their application in medical implants and neural interfaces.

Keywords:

[no keywords provided]

Mentor(s):

Ken Yoshida (Purdue University); Nathaniel Liam Lazorchak (Engineering); Awadh Mubarak M Al Hawwash (Engineering); Babak Anasori (Purdue University)

Other Acknowledgement(s):

Anupma Thakur (Purdue University)

Virtual Presentation Abstract Number: 9032

Presentation Time: April 8-11, 2025

AXI UVM

STEM

Authors(s):

Dogyu Ryu† (Engineering); Moeyad OmerAbdalla Omer† (Engineering)

Abstract:

The Advanced eXtensible Interface (AXI) protocol, part of AMBA architecture, is widely used in modern System-on-Chip (SoC) designs due to its high throughput and efficient handshaking mechanism. To ensure that the AXI-based design is correctly implemented, a robust verification methodology is essential. This project aims to develop a Universal Verification Methodology (UVM) based Verification IP to rigorously test the correctness and compliance of an AXI-based design.

Our verification environment is designed to validate both AXI Master and Slave components independently before integrating them into a complete system. The verification approach follows a structured test plan that covers essential protocol functionalities, including write, read transactions, burst types, exclusive access, and error handling mechanisms.

The AXI UVM verification environment consists of agents, drivers, monitors, and scoreboards to verify protocol compliance effectively. The testbench architecture separates the Master and Slave verification setups to ensure thorough validation and to avoid hidden design bugs before final integration.

The ultimate goal of this verification is to ensure that the AXI design is functionally correct, and ready for integration into larger SoC designs. The results from our test plan will provide confidence in the design's robustness while minimizing risks associated with incorrect AXI behavior.

Keywords:

[no keywords provided]

Mentor(s):

Vishnu Chaithanya Lagudu (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9033

Presentation Time: April 8-11, 2025

Exploring Student Perceptions of Virtual Reality in Higher Education: A Comparative Study with Traditional Lecture-Based Learning

STEM

Authors(s):

Aishani Sakalabhaktula† (Engineering)

Abstract:

This study explores student perceptions of Virtual Reality (VR) compared to traditional lecture-based learning in higher education. Despite VR's potential to transform education, its adoption faces barriers like high costs, technical challenges, and accessibility concerns. With the growing demand for immersive learning tools, particularly in STEM, this research investigates how students perceive VR and identifies strategies for its effective integration. The study involved 40 senior-level technology students at a Midwestern university, randomly assigned to two groups for a three-week module comparing VR and PowerPoint (PPT) lessons. Students completed weekly reflection activities, and their responses were analyzed using thematic analysis.

In the first week, students focused on navigating VR, highlighting challenges such as limited peer interaction, technology distractions, and technical difficulties. By the second week, they reported increased confidence, noting VR's ability to enhance task completion and their desire to improve technical skills. By the third week, students recognized VR's value, appreciating its potential for real-world applications and enhanced collaboration while also valuing traditional lectures. Key themes included the importance of a supportive environment, self-efficacy, and seeing value in VR.

Educators should prioritize creating supportive environments for VR adoption, including onboarding and technical support. Institutions must invest in modern VR hardware and provide technical assistance to ensure smooth implementation. Policymakers should advocate for equitable access to VR, particularly in underserved institutions, to bridge the digital divide. By addressing these considerations, VR can be effectively integrated into higher education, offering immersive and engaging learning experiences that complement traditional instruction.

Keywords:
Virtual Reality; Learning Motivations; Education; Digital Divide; Immersive Innovation

Mentor(s):
Lisa B Bosman (Purdue University)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9035

Presentation Time: April 8-11, 2025

A survey of inpatient nutrition care for people with chronic kidney disease

STEM

Authors(s):

Kara Olivia Shields† (HHS|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Renal; Diet; In-Patient

Mentor(s):

Brandon M Kistler (Purdue University)

Other Acknowledgement(s):

Annabel Biruete (Purdue University)

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9036

Presentation Time: April 8-11, 2025

SLIP Project

STEM

Authors(s):

Jiaming Situ† (Science); Seungho Lee† (Engineering); Khanh Nam Nguyen† (Engineering); Taviish Bothra† (Engineering); Arnav Dushyant Choudhry† (Engineering)

Abstract:

Network communication is a crucial factor in modern computing and embedded systems. This project aims to establish lightweight IP-based communication through UART by implementing Serial Line Internet Protocol (SLIP) on the AFTx07, a custom RISC-V-based microcontroller developed by Purdue's SoCET team. While SLIP has some limitations, its simplicity and low overhead make it a practical solution for embedded environments. However, SLIP alone is only a transport mechanism—this project takes the next step by enabling network-layer functionality through Internet Control Message Protocol (ICMP).

ICMP is a fundamental protocol used for diagnostic and control purposes in networking, allowing devices to verify connectivity and measure network performance. A key milestone of this project is achieving bidirectional ICMP communication with an external auxiliary system running SLIP. By successfully implementing ICMP echo request and reply (ping), this work establishes a crucial foundation for future network applications on AFTx07. Once basic ICMP communication is functional, this project can be extended to support higher-level network interactions, such as querying data or enabling more advanced protocols like TCP and UDP.

To facilitate software development and testing, FPGA-based emulation of AFTx07 is used, allowing verification and debugging before the ASIC is fabricated. This ensures that SLIP-encoded packets are correctly transmitted and received over UART, providing a flexible platform for real-time debugging and system refinement.

The implementation consists of two main steps: developing a SLIP encoder/decoder and integrating it with the AFTx07 networking stack using “Femtokernel” system calls for low-level serial communication. "By successfully demonstrating ICMP communication over SLIP, this project expands AFTx07’s networking capabilities, develop the way for more advanced embedded network applications in the future."

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Embedded System; System on Chip; Serial Line Internet Protocol; Computer Network

Mentor(s):
Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9039
Presentation Time: April 8-11, 2025

Autonomous DQN Drone

STEM

Authors(s):
Shishir Tumma† (Engineering); Aarav B Patel† (Science)

Abstract:
As the need for autonomous systems grows, AI-powered drones are becoming vital for operating in environments not readily available to humans. This study expands on previous efforts utilizing Deep Q-Networks (DQN) in reinforcement learning, emphasizing the drone's capabilities on navigating between designated points. This study's purpose is to develop a drone capable of efficiently exploring confined spaces, avoiding obstacles, and autonomously selecting optimal routes.

We specifically utilize reinforcement learning and reward-driven algorithms to enhance the drone's ability to navigate diverse environments while minimizing collisions. Using the AirSim, simulation platform, our model undergoes continuous training and testing to refine its decision-making capabilities. The adaptability of this model in complex environments highlights its potential in search-and rescue missions as sending more humans may cause more casualties.

This research contributes to the advancement of AI-driven drone navigation, improving efficiency through simulation-based training and paving the way for real-world implementation.

Keywords:
AI; DQN; Reinforcement Learning; Drone; Navigation

Mentor(s):
Shreya Ghosh (Engineering)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9040

Presentation Time: April 8-11, 2025

Derivatization with La3+ facilitates structural characterization of isomeric sugars using mass spectrometry

STEM

Authors(s):

Jorge Vilchez†

Abstract:

Disaccharides play important roles in key biological processes, serving as energy sources, metabolic intermediates, and structural components. The specific conformation and glycosidic linkages significantly influence their function However, distinguishing between disaccharide isomers using mass spectrometry (MS) presents significant challenges because they generate ions with the same mass-to-charge ratio (m/z) and their similar fragmentation patterns in tandem mass spectrometry (MS/MS) using collision-induced dissociation (CID). Accurate identification of these molecules is important for understanding their function in both health and disease.

Complexation of disaccharides with metal cations is commonly used to enhance ionization efficiency. In this study, we explore the complexation of disaccharides with small lanthanum-containing cations to enhance their identification using MS and MS/MS. Using LaCl3, we generate several abundant La-containing cations in solution that undergo complexation with disaccharides. We hypothesized that La3+ could undergo isomer-selective complexation influenced by the arrangement of hydroxyl (OH) groups in the disaccharide. We test this hypothesis by examining the complexation of La-containing cations with three isomeric disaccharides: cellobiose, maltose, and trehalose. We examined the effect of disaccharide structure, LaCl3, concentration, solvent composition, and pH on the complexation. We found that La-containing cations selectively bind to disaccharides with at least three OH groups on the same side of one of the rings, demonstrating isomer-selective binding. Additionally, we explored the fragmentation patterns of La-containing disaccharide complexes, showing that these complexes undergo radical-directed dissociation, providing rich structural information necessary for the identification of isomeric disaccharides. Overall, this study demonstrates that complexation with La-containing cations is a promising strategy for differentiating isomeric disaccharides and enhancing their identification using MS/MS.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Tandem Mass Spectrometry; Isomers; Disaccharides; Metal Adduction

Mentor(s):
Xindi Tang (Science); Julia Laskin (Purdue University)

Other Acknowledgement(s):
Syeda Nazifa Wali (Science)

Virtual Presentation Abstract Number: 9041

Presentation Time: April 8-11, 2025

Explainable AI for Judicial Data

STEM

Authors(s):
Tri Quang Vo† (Science)

Abstract:
[Abstract Redacted]

Keywords:
[no keywords provided]

Mentor(s):
Pengyi Shi (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9042

Presentation Time: April 8-11, 2025

Robot Arm

STEM

Authors(s):

Qinjia Xu† (Engineering); Xiang Fang‡ (Polytechnic)

Abstract:

The proposed product is a programmable robotic arm with four or five degrees of freedom, designed for light assembly. It incorporates servo motors for joint articulation and a microcontroller (STM 32 - based). The arm will be CAD designed and 3D-printed. The control of the robotic arm will be via ROS and USB-C connection.

Keywords:

Robot; PCB; Robotics; Control

Mentor(s):

Abolfazl Hashemi (Purdue University); Zijian He (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9043

Presentation Time: April 8-11, 2025

Creating a Light Sensor Using a Raspberry Pi

STEM

Authors(s):

Helen Yi† (Engineering); Manuela Cardona Meneses† (DSB)

Abstract:

[Abstract Redacted]

Keywords:

Light Sensor; Raspberry Pi

Mentor(s):

Stewart F Bauserman (Polytechnic); Saanvi Singh (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9100

Presentation Time: April 8-11, 2025

Multi-Scale Simulation of Grain-Scale Behavior in Energetics Under Impact

STEM

Authors(s):

Srinath Dantu† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Zherui Martinez-Guo (Purdue University)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9101

Presentation Time: April 8-11, 2025

Outcomes and Adverse Effect Rates of St. Bartholomew's Hospital CAR-T Therapy Patients Versus Clinical Data

STEM

Authors(s):

Alexis Marie Nash† (Pharmacy)

Abstract:

St. Bartholomew's Hospital (SBH) in London began administering Chimeric Antigen Receptor T-cell (CAR-T) therapy to hematology/oncology patients in January 2024. CAR-T is a personalized immunotherapy that modifies a patient's T-cells to target and destroy cancer cells but carries risks such as cytokine release syndrome (CRS) and immune effector cell-associated neurotoxicity syndrome (ICANS). To assess SBH's clinical outcomes, a retrospective analysis was conducted on 13 patients treated with CAR-T therapy between January and October 2024, comparing these results with data from the ZUMA clinical trials (ZUMA-1, ZUMA-3, ZUMA-5, ZUMA-7). The analysis examined factors such as the incidence of CRS and ICANS, tocilizumab dosing, time to disease progression, and cause of death. The findings showed that SBH experienced fewer severe CRS cases (grade 3 or above) compared to the ZUMA trials, suggesting effective management despite a smaller and more diverse patient population. However, the incidence of ICANS was higher and had an earlier onset at SBH, possibly due to patient diversity or differences in treatment settings, indicating a need for enhanced neurotoxicity monitoring. Disease progression occurred in only one patient, highlighting a potential area for further investigation in managing high-risk patients. This data underscores the importance of ongoing comparisons between inpatient settings and clinical trials to refine CAR-T therapy protocols and improve patient care, particularly in managing and preventing ICANS.

Keywords:

[no keywords provided]

Mentor(s):

Ellen M Schellhase (Purdue University); Monica Miller (Purdue University)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9102

Presentation Time: April 8-11, 2025

Analyzing the utility of a new medication administration dashboard for mediation safety at a hospital in London, England

STEM

Authors(s):

Chau Phan† (Pharmacy|JMHC)

Abstract:

Objective: This study evaluates the patterns of missed medication doses over a one-month period following the implementation of a real-time missed dose dashboard to enhance medication safety.

Methodology: A retrospective analysis was conducted on medication administration data recorded in the dashboard from December 1 to December 31, 2024. Descriptive analysis identified the number and frequency of missed scheduled doses, stratified by medication type, ward location, and time of administration.

Results: A total of 13,711 medication orders were analyzed. The most frequently missed medications were paracetamol (n=680, 5.0%), docusate (n=617, 4.5%), and nutritional supplements (n=610, 4.5%). Despite being stocked or available via electronic drug request, co-amoxiclav (n=42, 0.3%) and flucloxacillin (n=35, 0.3%) also had missed doses. The highest frequency of missed doses occurred on 5C (n=1,547, 11.3%), 5A (n=1,242, 9.1%), and 5B (n=1,192, 8.7%). Missed doses peaked during major drug round times, notably at 8 AM (n=803, 5.9%), 6 PM (n=618, 4.5%), and 10 PM (n=546, 4.0%).

Conclusions: Findings indicate that the highest rate of missed doses occurs in wards with potentially high patient volumes or complex care needs. The peak during shift change times suggests that workload management and handover processes may contribute to dose omissions. Paracetamol may be subject to missed doses due to its flexible dosing schedule, while nutritional supplements and docusate may be deprioritized in routine rounds. The relatively low rate of missed doses for critical medications suggests prioritization of high-risk treatments. Future efforts should focus on improving workflow efficiency, reinforcing adherence to scheduled administrations, and optimizing real-time dashboard monitoring.

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Keywords:
Medication Safety; Hospital Pharmacy; Workflow Efficiency; Quality Improvement

Mentor(s):
Ellen M Schellhase (Purdue University); Monica Miller (Purdue University)

Other Acknowledgement(s):

† Presenting Undergrad Author; ‡ Contributing Undergrad Author; * Undergrad Acknowledgment

Virtual Presentation Abstract Number: 9103

Presentation Time: April 8-11, 2025

Evaluation of pain management in an Adult Critical Care Unit following cardiac surgery

STEM

Authors(s):

Cassandra Ruml† (Pharmacy)

Abstract:

This research investigated the heterogeneity of prescribed analgesic medications in post-operative cardiac surgery patients. This investigation served to evaluate and understand current analgesic practices during the post-cardiac surgery period in patients at a hospital in the United Kingdom (UK). Further, this service evaluation also sought to gather patient feedback about their experience of pain, analgesia, and adverse effects to optimize analgesic protocols and education for healthcare professionals within the UK health system. To answer these questions, a real-time observational study was conducted over 4 weeks, during which data related to prescribed analgesics, pain, and nausea were gathered. Data related to pain and nausea were retrieved via patient feedback forms, and included information related to experienced pain, side effects, and overall satisfaction with pain management. Data gathered from this investigation suggests that patients receiving fentanyl experienced greater analgesic benefit, as indicated by lower average pain scores overall (1 and <1). Data also suggests patients taking fentanyl experienced fewer nausea responses than both oxycodone and morphine (5.6 and 1.2 versus 5.4 and 1.1 respectively) proposing it is better tolerated overall. Fentanyl required less adjunctive analgesic coverage from drugs such as codeine or dihydrocodeine, as indicated by fewer “as needed” doses of either medication, suggesting it provides greater initial analgesic benefit

Keywords:

[no keywords provided]

Mentor(s):

Ellen M Schellhase (Purdue University); Monica Miller (Purdue University)

Other Acknowledgement(s):

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