

FALL UNDERGRADUATE RESEARCH EXPO



PURDUE UNIVERSITY

NOVEMBER 17-21, 2025

SCHEDULE OF EVENTS

NOV. 18, 2025 | PMU BALLROOMS

9:00AM-10:00AM Poster Session 1

10:30AM-11:30AM Poster Session 2

12:00PM-1:00PM Poster Session 3

1:30PM-2:30PM Poster Session 4

NOV. 19, 2025 | STEW 214 & 218

9:00AM-5:00PM Research Talks

10:30AM-11:30AM Final Call Session 1

1:30PM-2:30PM Final Call Session 2

NOV. 17-21, 2025 | ONLINE

Virtual presentations

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*Posters sorted by first author's last name each session.
Only presenting authors (italicized) and mentors are listed. Contributing
authors and acknowledgements are listed in the abstract book online.*

POSTER SESSION 1 | 9:00AM-10:00AM

1000 <i>Abdulaziz Hamad Alanazi;</i> Zhihong Chen	1008 <i>Alexander Carnevale; Gabriel</i> <i>Scott Shifflett; Nikitha S Kambi;</i> <i>Manas Kathuria; Arezoo</i> <i>Ardekani; Ryan B Wagner</i>
1001 <i>Abdullah Alkazemi; Zi-Hao</i> <i>Ethan Wei; Kylyne Kuo; Arav</i> <i>Prasanna Ginde; John W</i> <i>Sheffield</i>	1009 <i>Lauren Isabella Carpenter; Orla</i> <i>M Hart</i>
1002 <i>Taylor Caroline Anderson; Casie</i> <i>S Bass</i>	1010 <i>Jordan Hope Cencelewski;</i> <i>Nikolina Latinovic; Dhriti Manish</i> <i>Laddha; Hadi Akbar Rahmani;</i> <i>Mark Wilson</i>
1003 <i>Rebeca Joyce Appelmann;</i> <i>Patrick A Zollner; Shawn</i> <i>Crimmins; Geriann Albers</i>	1011 <i>Alexandre Chan Tome; Brendan</i> <i>V Espinola; Henry N Kuehl; Pin-</i> <i>Yu Chen; Zhihong Chen</i>
1004 <i>Nathan James Arnold; Carly</i> <i>Melissa Frith; Wei-Yun Liu;</i> <i>Prithika Rashmi Gopal; James</i> <i>Michael Goppert; Nicole Adams</i>	1012 <i>Ethan Chieng Chiao; Rohan R</i> <i>Iyer; Jason Dwight McKinney;</i> <i>Vivek vasantrao Wankhade</i>
1005 <i>Davey Lee Avenatti; Preston</i> <i>Michael Down; Alex Michael</i> <i>Shie; Ryan Scott Petranek;</i> <i>Stephen R Leitch</i>	1013 <i>Ian Sung Hin Chiu; Severin</i> <i>Thomas Schneebeli; Anthony</i> <i>Gabriel Mena</i>
1006 <i>Kai Broben Fassino; Ashton</i> <i>Gligich; John William Rolfe</i>	1014 <i>Chao Min Chung; Thomas Allen</i> <i>Greer; Erik Kocinare;</i> <i>Seyedehmarzieh Rouhani</i>
1007 <i>Adrian Daniel Buczkowski;</i> <i>Aryan M Kadakia; Jason</i> <i>Dumaual Lyst; Sooraj Chetput</i> <i>Venkataraghavan</i>	1015 <i>Alexander Raffaele Ciccarelli;</i> <i>Jacob Adam Clark; Rishikesh</i> <i>Reddy Bathina</i>

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1016	<i>Daniel Russell Cline;</i> Christopher Aaron Rice; Chayan Sharma; Kamana Thapa	1030	<i>Sydnie Rose Frost; Hannah Irma Reyes Charles;</i> Casie S Bass
1017	<i>Varda Vongai Coleman;</i> Carla B Rosell	1031	<i>Gabriel Jonathan Fryling; Naviin Ruban Siva; Rohan Cheng Hsiao; Mbissane Latyr Ndir;</i> Stephen R Leitch
1018	<i>Tate James Compton; Lauren Jean Dumaresq; Swetha Hariram Maneri;</i> Steven R Dunlop; Saanvi Singh	1032	<i>Mridulla Ganesh; Soumil Verma; Aditya Hegde;</i> Rishikesh Reddy Bathina
1019	<i>Francis Willow Quinn Corvin;</i> Laura Bowling	1033	<i>Adriana Isabel Garcia;</i> Carla B Rosell
1020	<i>Vivian de Toledo Krainer;</i> Hannah Elise Starr	1034	<i>Thomas Allen Greer; Chao Min Chung; Erik Kocinare;</i> Seyedehmarzieh Rouhani; Mark Johnson
1021	<i>Emma Marie Decker; Emily Katherine Jackson; Emma Cate Bailey;</i> Genell Wells Ebbini	1035	<i>Anthony Edward Gurrieri; Brandon Anthony Farber;</i> Jason Dwight McKinney; Vivek vasantrao Wankhade
1022	<i>Allison Meckenzie Downey; Lydia Ilene Price; Alivia J Meeks;</i> Casie S Bass	1036	<i>Seungho Han; Leah Ye Eun Tak; Ruby Eskinder Woudneh; Jonathan Joseph Johnson;</i> Jaeeun Kim
1023	<i>Alina Marie Dziembowski;</i> Youn jeong Choi; Linda S Lee; Daniel J Foti	1037	<i>Morgan E Henry; Sean Andrew Friddle; Christopher Charles Rubright; Kathleen Marie Soedel;</i> Stephen R Leitch
1024	<i>Tatum Reese Ebbeskotte;</i> Leanne Nieforth; Emilie Mae MacInnis; Sarah Jean Reega	1038	<i>Jackson James Hoese;</i> Beth Elly Baumgartner
1025	<i>Andee Michelle Elenbaum; Sydney Lynn Williams; McKenna Rae Toltzman; Kaitlin Rose Otto;</i> Stephen R Leitch	1039	<i>Gary Huang;</i> Carla B Rosell
1026	<i>Reed Stevens Elphingstone;</i> Molly Noelle Dye	1040	<i>Kierstyn Carolina Hubbard; Megan J Copeland;</i> Francoise Brosseau-Lapre
1027	<i>Lukas Ryan Fisher;</i> Carla B Rosell	1041	<i>Ian William Jack;</i> Xuanying Lai; Christopher Hou Li; Shengwang Du
1028	<i>Colton Joseph Forrest;</i> Richard J Kuhn; Shishir Poudyal		
1029	<i>Antoine Matis Fradet;</i> Daniel Robert Guildenbecher; Amogh Gajanan Natu		

- 1042 *Zhengyi Jiang*; Jason Wade Morphey; Junior Anthony Bennett
- 1043 *Frances Geraldine Johnson*; Alexandria Vincenza Johnson; Gouri Gouri Prabhakar
- 1044 *Emily R Jones*; Jeffrey P Youngblood; Yirou Wang; Darien Anders Dewar
- 1045 *Sanjith Jothi Bala*; Nikhil Sai Kodali; *Gechun Guo*; Andreas Jung; Noah Charles Singer
- 1046 *Pia Kapur*; Matthew Louis Scarpelli
- 1047 *Simarleen Kaur*; Fengqing Zhu; Carla Zoltowski; Soudabeh Taghian Dinani; Edward J Delp; Siddeshwar Raghavan
- 1048 *Dillon Brennan Kay*; Sunghwan Lee
- 1049 *Anna G. Klupshas*; Linda Nie; Majid Khorsandi
- 1050 *Macey Marie Kochert*; Stacy Lindshield
- 1051 *Norah Riley Kopolow*; Yara Zaidoun Hijaz; *Lea Camille Vojslavek*; Stephen R Lindemann; Mariana Guzman Sanchez
- 1052 *Lukas Benjamin Kraft*; Kristen Marie Bellisario
- 1053 *Sara Roslynn Lane*; Pragathi Jha
- 1054 *Braxton RobertJame Larson*; Casey J Krusemark
- 1055 *Gabriel Thane Lechuga*; *Mudit Guglani*; *John Ward Robbins*; *Christopher Samuel Roberts*; Mark Wilson
- 1056 *Ruogu Lei*; Carla B Rosell
- 1057 *Matthew T Lenzmeier*; Ramses Martinez; Jose Alfredo Ocegueda Barraza
- 1058 *Colleen Li*; *Aadit Khurana*; *Tran Le Ngoc Vo*; Nikkhil Vijaya Sankar; Mohammad Reza Jahanshahi
- 1059 *Ying-Wei Lin*; *Kenzo Avery Evans*; *Eli Bradley Ade*; Peter Bermel; Saeed Mohammadi; Zhihong Chen; Joerg Appenzeller
- 1060 *Pooja Madhav*; *Ashlyn Marie Jewell*; *Linda Azucena Ontiveros*; *Anna Victoria Sanders*; Stephen R Leitch
- 1061 *Maria Luciana Mantilla Cajias*; Benjamin Zeidler; Cortland Hannah Johns; Craig Goergen
- 1062 *Seth Thomas McConkey*; *Felix Liu*; *Cecilie Zhang*; Sooraj Chetput Venkataraghavan; Fan Jing Hoon
- 1063 *Skylar Keeley McGuire*; *Mason A Vrshek*; *Karna M Gajjar*; *Lillian Ji*; *Bo Chen*; James Michael Goppert
- 1064 *Lupita Mejia-Garcia*; Christina R Wilson-Frank
- 1065 *Allison Paige Vick Miller*; *Emily Courtney Chan*; Bruno Tesini Roseguini
- 1066 *Walker Andrew Millhoff*; Briony H Horgan

- 1067 *Rachel Marie Miskelly*; Sandro Matosevic; Yuning Liu
- 1068 *Sarah Mohapatra*; Dylan D Patel; Sai Maanasa Gogula; Soudabeh Taghian Dinani; Siddeshwar Raghavan
- 1069 *Madalyn Marie Molnar*; Haleigh Alexandra Tussinger; Casie S Bass
- 1070 *Spencer Andrew Moore*; Shashank Varamballi; Jason Dwight McKinney; Vivek vasantrao Wankhade
- 1071 *Prisha Grace Mungara*; Medhashree Parhy; Rakshit Pradhan; Sumedha Saravanakumar; Amy R Reibman; Haochuan Hu
- 1072 *Tito Shaun Njoku*; Carla B Rosell
- 1073 *Jessica Chinyeaka Nwokeji*; Sarah Adeline Jolley; Lara Nicole Balian; Natalia Maria Rodriguez
- 1074 *Kristen Taylor O'Leary*; Leah Marie Brown; Nicole Marie Welsh; Mary Allison Conway; Erin Alkire Britton
- 1075 *Kaitlin Rose Otto*; Emeline Marie Papp; Ty Emerson Schafer; Caleb Zachariah Brunton; Xing Wang; Keun Jun Park
- 1076 *Sonia Panchal*; Davide Ziviani; Amanda Elizabeth Stone
- 1077 *Hao Tian Pang*; Benjamin Eunsang Ryu; Huan Yi Kuo; Qiming Chai; Zhihong Chen; Joerg Appenzeller
- 1078 *Theo Park*; Rohan Deepak Nachnani; Dan Goldwasser; Tania Chakraborty
- 1079 *Sahil Dhruvan Patel*; Heng-I Chu; Vihaan Reddy Chinthakindi; Mikhail Golovenchits; Timothy Francis Hein; Mark Johnson; Sooraj Chetput Venkataraghavan
- 1080 *Cameron Thomas Patt*; Mark Johnson; Timothy Francis Hein
- 1081 *Nicholas Alexander Peck*; Beth Elly Baumgartner
- 1082 *Tarakanath Peddi*; Aman Katyal; Shawn Chang; Mark Johnson; Isaac P Hagedorn; Andrew Lee Schlabach
- 1083 *Sophia Grace Perevozchikov*; Emmanuel Kweku Mensah; Michael P Sealy
- 1084 *Paresh Pobbati*; Kush Aklank Kodiya; Basant Sharma; Andres Felipe Hoyos Moreno
- 1085 *Ronit Podder*; Anirudh Vummadising; Yung-Hsiang Lu; Yeon Ji Yun
- 1086 *Abigail Elizabeth Preston*; Miriam Marina Barnum; Austin Rory Cooper
- 1087 *Sudarmadhi Rabindran*; Harris J Bras
- 1088 *Grayson Paul Radtke*; Anne Regina Piet; Thatcher Michael Wise; Siddhant Vinay Belgaumkar; Curtis Earl Marshall
- 1089 *Ethan Julian Ramon*; Geetika Chitturi; Vivek vasantrao Wankhade; Jason Dwight McKinney

- 1090 *Sreeja Sai Rao*; Jitika Rajpoot
- 1091 *Eshansh Rawat*; Linda E Haynes
- 1092 *Evelyn Rose Renninger*; David Thompson
- 1093 *Francisco Alejandro Ruiz*; Jason Timothy Emsley; Jay Philip Gannam; Chawin Mingsuwan; Noah William Zimmer; Danny Milisavljevic
- 1094 *Jonathan Samuel Ryan*; Justin Weibel; Boyu Duan
- 1095 *Areesha Fiza Saleem*; Keith A Cherkauer
- 1096 *Kailla Marie Sanchez*; Sidney Ducleroir
- 1097 *Samin Sanjana*; Carla B Rosell
- 1098 *Adam Jair Selby*; Wenzhuo Wu; Pedro Henrique de Souza Barbosa
- 1099 *Katelyn Krishan Shah*; Arina Harlanovich; Kameswari Mantha; Cole Aaron Nelson
- 1100 *Mirza Orunav Shahper*; David Scott Fernander; Michael P Sealy
- 1101 *Shriya Haresh Shirvadekar*; Kyle Robert Alvey
- 1102 *Isabella Grace Shockley*; Ali Bramson
- 1103 *Sara Elizabeth Sinclair*; Catalina Vergara Galarza; Raleigh Warner Burgess; Paraskavas Nikiphoros Mintidis; Stephen R Leitch
- 1104 *Aditya Singh*; Brandon C Chynoweth
- 1105 *Arnav Chandra Singh*; Kriti Kishan Nandakumar; Aahana Dahiya; Sannidhi Agarwal; Fengqing Zhu; Carla Zoltowski; Soudabeh Taghian Dinani; Edward J Delp; Siddeshwar Raghavan
- 1106 *Manaswini Singh*; Tiancong Zhu; Kyung Jun Lee
- 1107 *Benjamin Michael Sisk*; Mark Johnson
- 1108 *Cooper William Springs*; Ethan Mathew Lebon; Matthew Wyatt Baratian; Davi Cordeiro Moreira
- 1109 *Emma Lynn Stump*; Mohamed Mostafa Hassan; Seyedehmarzieh Rouhani
- 1110 *Zachary David Sullivan*; Bernardo Bradley Chalaca Moreira; Thomas Guy Engle; Lucas Erwin Gerbsch; Davi Cordeiro Moreira
- 1111 *Kira Qing Sun*; Courtney Allen Falk
- 1112 *Dev Hiten Suraj*; Michael Douglas Johnson
- 1113 *Angela Anqi Tan*; Lisa B Bosman
- 1114 *Sudiksha Thirumalaivasan*; Catherine Jean Shukle
- 1115 *Eleanor Elizabeth Thompson*; Ria Singh; Payton Scott Baker; Imrul Shahriar; Jeffery J H Nielsen
- 1116 *Eleanor Elise Thumann*; Harris J Bras
- 1117 *Mara Valentina Ugaz Angeles*; Wayne W Campbell

- 1118 *McKinley Kathryn Underhill; Andrea Pires dos Santos*
- 1119 *Marissa Shuluo Urbanek; Kyle Steven Emgenbroich; Vinicius da Paixao Fernandes; Filippa Maria Rodriguez Pinzon; Xing Wang*
- 1120 *Allen Joseph Vidallon; Demetrius Gulewicz; Neera Jain*
- 1121 *Valmik Anand Vyas; Shruti Sharma; Dan Goldwasser*
- 1122 *Zhishan Wang; Kaijie Zhu; Jacob Forrest; Kieran Venkat Desireddi; Brian Sam Lee; Andres Felipe Hoyos Moreno; Reed Joseph Freer; Samuel Labi*
- 1123 *Austin William Watson; Jessica M Mercado*
- 1124 *Gwen Elizabeth Weaver; Karolina Maria Beveridge; Samuel Isaiah Piper; Casie S Bass*
- 1125 *Colin Lucas Wellington; Jose Augusto Heighes Claux; Marcus Victor Page; Swati Raj Rajasekaran; Xing Wang*
- 1126 *Alivia Keler Whitney; Carla B Rosell*
- 1127 *Owen Lee Wise; Ramses Martinez; Jose Alfredo Ocegueda Barraza*
- 1128 *Chi Che Colin Wu; Rishabh Mahesh; Ken Zhang; Soudabeh Taghian Dinani*
- 1129 *Nadav Yaniv; Edgar Robles; Stephen Reeves; Sicheng He; Andy Jung; Noah Daniel Singer*
- 1130 *Ivanna Isabel Yllahuaman Bonifas; Ramses Martinez*
- 1131 *Camryn Anne Young; Harris J Bras*
- 1132 *Yuan Heidi Yue; Julie C Liu; Marisa Ann Egan*
- 1133 *Megan Zhu; Alexandra Li Alderink; Rachel Kalyn Spear; Angela Peng Gao; Davi Cordeiro Moreira*

POSTER SESSION 2 | 10:30AM-11:30AM

- 1200 *Alton Jeffrey Adams; Ellen M Schellhase; Monica Miller*
- 1201 *Haven Marie Bader; Brian Patrick Ha Metzger; Aparna Desai*
- 1202 *Ekam Bhullar; Michael Witt*
- 1203 *William David Boulton; Kabir Jain; Carina Leigh Jacobson; Nicolas Bustamante; Andreas Jung; Heather Nicole Martin*
- 1204 *Manuela Maria Buitrago Cardenas; Laura Gabriela Coy Rodriguez; Elizabeth I Parkinson*
- 1205 *Abigail Catherine Burris; Brian Patrick Ha Metzger*
- 1206 *Bea Olivia Cabot; Cortland Hannah Johns; Benjamin Zeidler; Craig Goergen*
- 1207 *Barbara Soares Cabral; Saad S B Haq*

- 1208 *Siddarth Balaji Calidas; Aadya Rangole; Aya Wael Mohammed Tawfik Elghayaty; Andrew Dominick Angel; Andres Felipe Hoyos Moreno; Reed Joseph Freer; Richard Osita Ajagu*
- 1209 *Jordan Ceron; Jillian Grace Robbins; Francoise Brosseau-Lapre*
- 1210 *Aashna Chandnani; Adrian Hoffert Wolanski*
- 1211 *En-Hua Chang; Eduardo Barocio Vaca; Jordan James Wess Kalman*
- 1212 *Ethan Keid Chen; Micah A Macias; Steven R Dunlop*
- 1213 *Erika Chiommimo; Anya Kanagala; Nicola Jirina Ferrante; Ananya Molugu; Braden Lee Garretson; Danny Milisavljevic*
- 1214 *Jeremy Francis Ciaramella; Andrew Dean Fredette; Austin James Knipp; Matthew David Pelletier; Stephen R Leitch*
- 1215 *Vanessa Claire Cook; Linda E Haynes*
- 1216 *Kaiwaan Porus Dalal; Qingfei Zheng*
- 1217 *Raunak Dani; Timothy Francis Hein; Mark Johnson*
- 1218 *Alok Das; Kiseop Lee*
- 1219 *Adeline Bernice Dering; Tesfaye D Mengiste*
- 1220 *Ishana Didwania; Samuel Jordan Skulsky; Dan Goldwasser; Eylon Caplan*
- 1221 *Marcus Macapodi Douge; Steven R Dunlop; Saanvi Singh*
- 1222 *Juan Camilo Douglas Bolano; Pedro Henrique Magalhaes Cisdeli; Ignacio Antonio Ciampitti*
- 1223 *Jack Drabenstott; Andrew Banko*
- 1224 *Matthew Ryan Dunlap; Stephanie M Gardner; Traven Levar Cargill*
- 1225 *Sara Claire D'Urso; Ashley Mei Hung; Anishka Pateriya; Akhand Bindra; Davi Cordeiro Moreira*
- 1226 *Matthew Ellsworth; Broc Gilland; Andrew Banko*
- 1227 *Weston James Ertel; Jiansong Zhang; Jingyi Lai*
- 1228 *Anna Grace Ewing; Michael Douglas Johnson*
- 1229 *Zixuan Fei; Dhiya eddine Belkadi; Muhammad Mustafa Hussain*
- 1230 *Andrew Owen Fewell; Peter Bermel*
- 1231 *Emery Elizabeth Frey; Monica Miller; Ellen M Schellhase*
- 1232 *Ananya Ganesh; Babe Kwasniak; Andrew Banko*
- 1233 *Sidharth Garigipati; Zahra Ghodsi*
- 1234 *Broc Gilland; Matthew Ellsworth; Andrew Banko*
- 1235 *Anjali Devi Gupta; Bryan J. Duarte*

- 1236 *Paul Michael Hamas; Akram Reda Mahmoud; Owen Chen; Andres Felipe Hoyos Moreno; Reed Joseph Freer; Richard Osita Ajagu*
- 1237 *Hussein Sayed Hanafy; Ahmed Atef Mahmoud Elsheshtawy Elbehiry; Zijian He; Abolfazl Hashemi*
- 1238 *Juliana Harges; Jolene Teresa Lawton*
- 1239 *Kennedy Hecker; Andrew Banko*
- 1240 *Delani J Henderson; Alexis Rae Benson; Casie S Bass*
- 1241 *Jaimison Evelyn Henton; Keith A Cherkauer*
- 1242 *Julio Hernandez; Rafael Monteiro Martins Pinheiro; Haejune Kwon; Mark Johnson; Sooraj Chetput Venkataraghavan; Akshath Raghav Ravikiran; Vinay Jagan*
- 1243 *Abigail Vega Hershberger; Beth Elly Baumgartner*
- 1244 *Nathaniel John Hiatt; Ethan Dewen Louie; Davi Cordeiro Moreira*
- 1245 *Eric Hou; Carla B Rosell*
- 1246 *Adam Benjamin Houser; Sasank Nunna; Kumar Shreyansh; Shreyaa Karan; Davi Cordeiro Moreira*
- 1247 *Dylan Mark Huamani; Annabelle Leigh Bedford; Babak Anasori*
- 1248 *Cole Thomas Hunt; Michael Douglas Johnson*
- 1249 *Spencer William Isbell; Annabelle Leigh Bedford*
- 1250 *Roxsonna Nika Janiszewski; Peter Bermel*
- 1251 *Oliver Thomas Johnson; Ranjie Xu; Xingjian Gu*
- 1252 *Vishnu Ramaraju Kalidindi; Carla B Rosell*
- 1253 *Vigneshvaran Karthikeyan; Carla B Rosell*
- 1254 *Dhruv Roopchand Khatri; Tri Than; Sooraj Chetput Venkataraghavan; Mark Johnson*
- 1255 *Alice Soyeon Kim; Greg Fraley; Jenna M Schober*
- 1256 *Tammy Kong; Sally Chowon Bae; Eddy Zhang; Elisa Chung; Stephen R Leitch*
- 1257 *Joseph Timothy Krittenbrink; Anderson Anousit Varner; John William Rolfe*
- 1258 *Gavin Craig Kulak; Sulav Shrestha; Viswanath Jay Nair; Henry Patrick Merchant; Davi Cordeiro Moreira*
- 1259 *Joseph Richard Kunkel; Michael Douglas Johnson*
- 1260 *Kaira Wing Kwong; Alexandra Madison Chrostowski; Brian Jeffrey Young; Srinidhi Sivakumar; Danny Milisavljevic; Noah William Zimmer*
- 1261 *Anna Thi Le; Linda E Haynes*
- 1262 *Derek Yishio Lee; Sarina Manchirala; Anubhav Majumdar; Nikhil Sai Kolli; Andreas Jung; Noah Charles Singer*
- 1263 *Nana Lee; Tanvi Dhawade; Roy Liu; Junjie Luo*

- 1264 *Seo Young Lee; Sein Kim; Taehong Min; Hongmi Lee*
- 1265 *Brayden S Lee; Mahit Mehta; Steven R Dunlop*
- 1266 *Marisol Andrea Lefort-Liceaga; Catherine Jean Shukle*
- 1267 *Junhee Lim; Timothy G Reese*
- 1268 *Xuanrui Lin; Pranav Boyapati; Arvind Shyam; Luisa Cruz Miotto; Yung-Hsiang Lu; Zihao Ye*
- 1269 *Jacob Charles Long; Chengming Wu; William David Bridgnell; Andres Felipe Hoyos Moreno; Reed Joseph Freer; Richard Osita Ajagu; Samuel Labi*
- 1270 *Jennifer Yunning Lu; Andres Felipe Hoyos Moreno*
- 1271 *Eliza Jane Lutgen; Gonzalo Antonio Silva; Uddipta Sarkar; Kyle Anthony Fernandez; Angel Wang; Davi Cordeiro Moreira*
- 1272 *Aryaa Madan; Ethan Thomas Garcia; Rou Chi Huang; Aidan Daniel Manickam; Xing Wang*
- 1273 *Harshini Madhusudhanan; Clara Cecilia de Groot; Fanyang Meng; Connor David Watson; Hazim Atef El Mounayri*
- 1274 *Jennifer Ngocan Mai; Jessica M Mercado*
- 1275 *Kelly Marie Makovic; Dave A Ceniza; Sai Dhanush Pulligilla; Logan Villena Obrique; Mopelola T Adeola*
- 1276 *Tanuj Santosh Mangalam; Shriya Gupta; Samridh Prabhakar; Ekagra Agarwal; Zhihong Chen*
- 1277 *Isabella Anne Marker; Severin Thomas Schneebeli; Anthony Gabriel Mena*
- 1278 *Suhani Mathur; Kareem AbdelHameed Hassan; Farah Moussa; Shaunabh Bose; Srihith Gangireddygar; Andres Felipe Hoyos Moreno; Richard Osita Ajagu; Samuel Labi; Reed Joseph Freer*
- 1279 *Shresth Mathur; Akshath Raghav Ravikiran; Muhammad Zohaib Ali; Sooraj Chetput Venkataraghavan; Hassan Al-alawi*
- 1280 *Zoe Kathryn Mercer; Kristen Marie Bellisario*
- 1281 *Brookly Elizabeth Miner; Jennifer Adriana Velazquez Cortez; Lauren Elizabeth Chopp; Genell Wells Ebbini*
- 1282 *Grant A Moreland; Kiefer Alexander Bell; Colin Patrick Budreau; Justin Thomas Brady; Davi Cordeiro Moreira*
- 1283 *Alexander Jake Myers; Linda E Haynes*
- 1284 *Aditya Manoj Nair; Weijing Sebastian Chen*
- 1285 *Rishi Venkatesh Natarajan; Gavin Challman; Tanner Reid Oracheff; Kevin Marin; Hantao Zhang; Sarah Ahmed Alharthi; Stephen R Leitch*
- 1286 *Natcha Ngaosuphanvongs; Harris J Bras*

- 1287 *Dominique Nieto Corona*; Linda E Haynes
- 1288 *Yubeen Oh*; *Tanishq Praveen Pauskar*; *Max Ben-Azai Kirschner*; Soudabeh Taghian Dinani; Siddeshwar Raghavan
- 1289 *Ali Ayman Moha Omar*; *Abdulrahman Mohamed Abougendia*; *Salaheldin Elsayed Ibrahim AbdelMoaty*; *Zeyad Mohamed Al Elshafey*; John William Rolfe; Shreyas Sundaram
- 1290 *Dev M Patel*; *Sirui Yang*; *Joseph Allen Sowers*; Mark Johnson; Ayush Singh; Anas Zyad Abughali
- 1291 *Arnab Paul*; Waqas Alam; David Warsinger
- 1292 *Tung Gia Pham*; Ramses Martinez
- 1293 *Brady Owen Philhower*; *Nolan Porter Jones*; *Weichih Hsieh*; Rishikesh Reddy Bathina
- 1294 *Brendan William Polese*; *Rachel Elizabeth Carlson*; *Abigail Claire Smith*; *Mert Ryan Kiroglu*; Davi Cordeiro Moreira
- 1295 *Arthur Prudius*; Seyedehmarzieh Rouhani
- 1296 *Shreya Shrikrushna Pulujkar*; *Sounish Ghosh*; *Andrew Jonathan Savysky*; *Ying-jen Chen*; Reza Babakhani Galangashi; Sourav Das; Brett A Meyers
- 1297 *Vaishnnavi Purram*; David B Janes; Jozue Kim
- 1298 *Akul Ramasubban*; *Andrew Clark Cowen Cerrato*; *Alexander Haitian Zhang*; *Andrew Ryan Davidson*; Andres Felipe Hoyos Moreno; Richard Osita Ajagu; Reed Joseph Freer
- 1299 *Aveena Kuntal Rawal*; Davide Ziviani; Andreas Josef Hoess
- 1300 *Neha Mary Regi*; *Zijing Zhang*; *Shih-En Wang*; *Christopher Cruz*; Davi Cordeiro Moreira
- 1301 *Elian Inigo Turcal Rieza*; *Aayuman Ghangurde*; *Sai Kaushal Sri Viswa Gautham Palaparthi*; *Rohan Shah*; Malcolm Lloyd Seib McClymont; Mark Johnson
- 1302 *Kathryn Anne Roscetti*; Thomas H Siegmund
- 1303 *Arunima Saha*; Ben K D Pearce
- 1304 *Aneesh Sathaye*; Gautam Vivek Khare
- 1305 *Liesel Jeanette Schmidt*; Linda E Haynes
- 1306 *Hannah M Schultz*; Beth Elly Baumgartner
- 1307 *Shrreya Jegata Sethuramalingam*; Linda E Haynes
- 1308 *Priyan Kamlesh Shah*; *Andrew Doru Bogdan*; Weijing Sebastian Chen; Matthew A Swabey; Mark Johnson; Conor James Green
- 1309 *Avantika Shah*; *Anubhuti Mittal*; *Mohamed Mahmoud Zaitoun*; *John Michael Wyman*; Andres Felipe Hoyos Moreno; Richard Osita Ajagu; Reed Joseph Freer

1310 <i>Samarth Sharma; Aiden James McGuiness; Sean Brophy</i>	1323 <i>Brayden Eric Walters; Anh Thi Van Nguyen; Isaac Thomas Dietz; Anoushka Bade; Stephen R Leitch</i>
1311 <i>Mehul Shelke; Vilas G Pol</i>	
1312 <i>Sofiia Shyshkovtsova; Carla B Rosell</i>	1324 <i>Bocheng Wang; Eli Nash Chandler; Ru Yi Cai; Yihao Zhou; Davi Cordeiro Moreira</i>
1313 <i>Shaantanu Sriram; Sebin Ahn; Aayushi Sahgal; Sebastian Bohrt; Sivaranjani Seetharaman</i>	1325 <i>Yimeng Wang; Linda E Haynes</i>
1314 <i>Pim Rae Tee; Ryan Iden Deldar; Gudrun Schmidt</i>	1326 <i>Yize Wang; Junfei Li</i>
1315 <i>Parin Paresh Timbadia; Rishikesh Reddy Bathina; Tri Than</i>	1327 <i>Paul Ryan Warfel; Theodore Walter Moritz; Maxwell Christopher Klug; Reece Robb; Davi Cordeiro Moreira</i>
1316 <i>Helen Claire Torgerson; Michael Douglas Johnson</i>	1328 <i>Kathryn Wegler; Andrew Banko</i>
1317 <i>Tyson Mark Tucci; Syuan-Rang Sean Wu; Po-Wei Lee; Francesco Joseph Facente; Davi Cordeiro Moreira</i>	1329 <i>Jasper Louis Wei; Peter Bermel</i>
1318 <i>Irem Ucar; Santosh Ramesh; Ryce Pi; Zhengyi Jiang; Tae Hong Park</i>	1330 <i>Reilly Cole Wennemar; Kaylie Danielle Spata; Kolton N Logsdon; Casie S Bass</i>
1319 <i>Mara Valentina Ugaz Angeles; Carla B Rosell</i>	1331 <i>Allie Faye Xiao; June E Spalding; Alexander Ritz Clark; Ethan Wayne Scott; Stephen R Leitch</i>
1320 <i>Aditya Verma; Karan Soni; Vishnu Madhav Ratakonda; Philip Louis-Karl Zautke; Johnathan Hong</i>	1332 <i>Ambhranee Yakkundi; Chi Zhang</i>
1321 <i>Hannah Celine Wade; Carla B Rosell</i>	1333 <i>Eric Yixiang Zhang; Paola Godina Salas; Harshini Madhusudhanan; Jadon Conor Salazar; Davi Cordeiro Moreira</i>
1322 <i>Gabrielle Wahjosoedibjo; Andrew Banko</i>	1334 <i>Boyang Zhang; Jiashu Liu; Yung-Hsiang Lu; Yeon Ji Yun</i>
	1335 <i>Sarrah Johar Zojwalla; Linda E Haynes</i>

POSTER SESSION 3 | 12:00PM-1:00PM

1400 <i>Naeem Saeed Bahemia; Katherine Jarriel</i>	1401 <i>Zixuan Bao; Chenke Sun; Yingxin Tan</i>

- 1402 *Joshua John Beigel; Julia Kang; Logan Michael Fossum; Soudabeh Taghian Dinani; Siddeshwar Raghavan*
- 1403 *Pranjal Bhatia; Jaeun Kim*
- 1404 *Vladimir D Bondar; Yulia N Pushkar*
- 1405 *Trisha Boodhoo; euiwon Bae*
- 1406 *Caleb Zachariah Brunton; Jose Jorge Bueso; Jose Manuel Estrada Garcia; Alfonsina Michelle Rodriguez; Davi Cordeiro Moreira*
- 1407 *Benjamin Asa Cabot; Alexis Harroun*
- 1408 *Odalys Joana Campos Vasquez; Elizabeth Louise Kushner; Julia Elizabeth Kassis; Genell Wells Ebbini*
- 1409 *Daniel Michael Carrel; Brady Robert Layman; Megan Leigh Hill; Jeffrey Edward Dick*
- 1410 *Susan Chen; Allison Margaret Neff; Brayden Ryan Zink; Srikar Kolla; Davi Cordeiro Moreira*
- 1411 *Pranav V Chitivel; Ananya Jajoo; Jiansong Zhang; Fan(Aria) Yang*
- 1412 *Leonard Shien Chiu; Michael Ryan Gjorseski; Joshua Ginsté; Artemii Chirkov; Davi Cordeiro Moreira*
- 1413 *Yoonjung Choi; zhi Zhou; Amanda Michelle Lopez; Paul B Brown*
- 1414 *Iszabel Sierra Cohen; Shelby Jo Schambach; Rachel Hope Campbell; Erin Alkire Britton*
- 1415 *Alexander Jonathan Collins; Jason Wu; Evan Ryan Ware; Erin Alkire Britton*
- 1416 *David James D'Amico; Antariksh Mukherjee; Mahimasai Gajawada; Timothy D H Han; Malcolm Lloyd Seib McClymont; Mark Johnson*
- 1417 *Anthia Amalia Davis; Jessica M Mercado*
- 1418 *Francisco Javier De La Victoria Vazquez; Garam Kim; Eduardo Barocio Vaca*
- 1419 *Katherine Kile Degroote; Catherine Jean Shukle*
- 1420 *Konner DeWitt; Marissa Shuluo Urbanek; Christopher Charles Rubright; Angel Wang; Erin Alkire Britton*
- 1421 *Quintin David Dumouchelle; Michael P Sealy; Luz Sotelo*
- 1422 *Carmen Raquel Erickson; Adam Wasserman*
- 1423 *Caleb James Evans; Harshith Morla; Georgios Giannakis; Curtis Earl Marshall*
- 1424 *Brandon Anthony Farber; Tho Le*
- 1425 *Aidan Benjamin Feirstein; Audrey Dickinson; Kristen Marie Bellisario*
- 1426 *Aiden Michael Fernandes; Severin Thomas Schneebeil; Anthony Gabriel Mena*
- 1427 *Jonathan Lester Flinn; Jason T Hoverman; Olivia Ann Biasetti*
- 1428 *Ava Joan Roisi Flynn; Craig Goergen*

- 1429 *Mary Francis; Oluwatomiwa Imosenomen Akintunde; Jai Anand Keskar; Zhenghao Xu; Akhil G Yada; Cole Aaron Nelson; Jacob Chappell*
- 1430 *Marisa Jean Fredrickson; Nathan Tian-Lin Wan; Eliana Elise Roeder; Somya Sakalle; Renee Murray; Frederick C Berry*
- 1431 *Connor Bradley Frey; Priya Adiga; Andrew Thomas Johnson; Chih-Chun Wang*
- 1432 *Josi Laura Gallo; Grace Enpei Chen; Bruno Tesini Roseguini; Bohyun Ro*
- 1433 *Malhar Saurabh Gandhe; Carla B Rosell*
- 1434 *Bryanne Lauren Garcia; Emma Kay Senter; Leanne Nieforth; Sarah Jean Reega; Emilie Mae MacInnis*
- 1435 *Miguel Edoardo Garcia; Yexiang Xue*
- 1436 *Catherine Renee Gemrich; Giacomo Paccagnan*
- 1437 *Sebastian Felipe Gil Eskildsen; James William Pope; Roberto Andres Chinchilla Varela; Juan Antonio Sevilla; Davi Cordeiro Moreira*
- 1438 *Bogomir Vincent Glavan; Leifur Thor Leifsson*
- 1439 *Clara Marie Anne Goffioul; Brett A Meyers; Sourav Das; Reza Babakhani Galangashi*
- 1440 *Julia Ann Gorenstein; Jessica M Mercado*
- 1441 *Bhoomika Kumar Gowda; Annabelle Leigh Bedford; Babak Anasori*
- 1442 *Virginia Alessia Graziosi; Myles Quinn Edwards*
- 1443 *Lauren Elizabeth Grose; Michael P Vermeuel*
- 1444 *Raymond Denver Hammonds; Yeochan Youn; Nathan Lee; Hayden Len Ellis; Andy Jung; Heather Nicole Martin; David Alan Ruiter*
- 1445 *Chloe Grace Hardesty; Brinley Renee Pressler; Shelby Jo Schambach; Josephine Rose Hanas; Stephen R Leitch*
- 1446 *Gracie Rose Harker; Kameron Moding; Ivan Mendoza; Kylie Marie Wilson*
- 1447 *Grace M Heaney; Peter Bermel*
- 1448 *Benjamin Michael Heaviland; Krishna Vadlamani; Yuhui Qin; Cale Lusk Bennett; Erin Alkire Britton*
- 1449 *Aidan Joshua Hershberger; Yutian Ye; Jizheng Li; Cole R Bailey; Davi Cordeiro Moreira*
- 1450 *Luke Wilson Heymann; Bridget A Nobbe; Emma Renee Williams; Alexa Giselle Bonilla; Mark Wilson*
- 1451 *Kinaya Arielle Hines; Robert Pedro Chambers; Somin Yang; Emi Victoria Robinson; Davi Cordeiro Moreira*
- 1452 *Carson Scott Horner; Alex David Santiago Vargas; Dimitrios Peroulis*

- 1453 *Michael Charles Howes; Jonathan R Kuhn; Ulrike Dydak*
- 1454 *Edward Zhaolong Hu; Steven Li; Andrew Yu-en Loh; Sim Seyha Ou; Malcolm Lloyd Seib McClymont; Mark Johnson*
- 1455 *Micah Danel Huckaby; Jacob Randal Patty; Abigail Marie Carroll; Emily Rose Christman; Stephen R Leitch*
- 1456 *Cheyenne Mie Huggins; Mary Anne Smart*
- 1457 *Vandana Dhriti Iyer; Peter Bermel*
- 1458 *Tanya Jain; Jia Varshney; Chengxuan Li; John H Cole; Jack Scarfo*
- 1459 *Lillian Ji; Anh Kim Ho; Joanna Yuping Wu; Jai Nanda Lakamsani; James Michael Goppert*
- 1460 *Abigail Jimenez; Sidney Ducleroir*
- 1461 *Dev Vishwash Joshi; Mirza Orunav Shahper; Waqas Alam; David Warsinger*
- 1462 *Pradyunn Vikram Kale; Junfei Li; Brett Michael Heckman; Rhea Vashishtha*
- 1463 *Gunvanth Reddy Kandula; Hyeonwoo Heo; Milo Li Reed; Adrian Pathupally Mathew; James C Davis*
- 1464 *Dexter McCann Kelleher; Jaime Hyun-Kiu Lee; Benjamin Evan Keim; Anish Reddy Kuthuru; Davi Cordeiro Moreira*
- 1465 *Matthew Christopher Kim; Shihui You; Gabriel Hammond; David Alan Ruiter; Heather Nicole Martin; Andy Jung*
- 1466 *Jozue Kim; Kyle Zhen-Han Wang; Robert James Gentle; Azizul Zikry Mohd Amaluddin; Zhihong Chen; Joerg Appenzeller*
- 1467 *Geuntae Kim; Junfei Li*
- 1468 *Joshua David Klug; Michael Lee; Navya Harini Datla; Rishikesh Reddy Bathina; Sooraj Chetput Venkataraghavan*
- 1469 *Jason Andrew Klutho; Junfei Li*
- 1470 *Taran Sid Koduri; Berra Ulku Kalci; Jiansong Zhang; Megan Amy Rudo*
- 1471 *Kayoon Koh; Trevor Mission Ju; Preston Tang Mo; Yung-Hsiang Lu; Yeon Ji Yun*
- 1472 *Saandiya KPS Mohan; Nikhil Kishore Vaidyanath; Myles Joshua Pristin Querimit; Mixuan Pan; Malcolm Lloyd Seib McClymont; Anand Raghunathan; Sooraj Chetput Venkataraghavan; Fan Jing Hoon; Mark Johnson; Timothy Francis Hein*
- 1473 *Daniel Joseph Kral; Ian George Sellar; Liam Bennett Arnold; Ramiro Jose Gonzalez; Stephen R Leitch*
- 1474 *Hrishikesh Murli Krishna; Edward L Bartlett; Meredith Christine Ziliak*
- 1475 *Gabrielle Ruth LaBelle; Harris J Bras*

- 1476 *Layla Marie Lanari*; Michael Douglas Johnson
- 1477 *Aelish Marie Ligon*; Zoey Zhu Bussick; Eann M Gatuna; Steven R Dunlop; Saanvi Singh
- 1478 *Andruw Kuang-Le Lin*; Carla B Rosell
- 1479 *Pei-Chi Liu*; Yan-Jun Lin; Shraavan Pradeep; Yuanrui Chen; Harshana Weligampola
- 1480 *Chloe Christine Louk*; Jessica M Mercado
- 1481 *Katherine Ma*; Raymond Chi; Aram Kalous; Alexandre Wade Rosental; Fengqing Zhu; Carla Zoltowski; Edward J Delp; Soudabeh Taghian Dinani
- 1482 *Leo Pearson Malachowski*; Bridget Katherine Heindl; Jason Ware
- 1483 *Mathis Malaussena*; Liam Allen West; Alexey Shashurin
- 1484 *Lucas Allen Mathies*; Jasmine Begeske; Sariya Shabnam
- 1485 *Max Elliott Matteucci*; Andrew Logan Oberholzer; Andrew Lawrence House; Ella Sage Dawes; Davi Cordeiro Moreira
- 1486 *Isabella Marie Mayr*; Sadikshya Aryal; Val Watts
- 1487 *Isabella Sophia Metternich*; Linda E Haynes
- 1488 *Ramsey David Frederick Miller*; Jennifer Lynn Brown; Luis A Gomez
- 1489 *Newla Moo*; Alacya Madison Lynch; Kristen Taylor O'Leary; Cydney Allyn Culver; Davi Cordeiro Moreira
- 1490 *Ashley Marie Moseley*; Michael Douglas Johnson
- 1491 *Sameer Ravi Murthy*; Bea Alyannah Magsayo Cortes; Yash Rajendra Ashtekar; Tanay Jain; Andres Felipe Hoyos Moreno; Reed Joseph Freer; Richard Osita Ajagu
- 1492 *Laksh Nagpal*; Robert Maxwell Neitzke; Venya Bhardwaj; Ahmad Hazim Akmal Bin Rosmahidi; Zhihong Chen; Joerg Appenzeller
- 1493 *William Isaiah Need*; Hannah Elise Starr
- 1494 *Kundana Nittala*; Esther L Larson; Emilio Andres Pino; Shree Krishna Tulasi Bavana; Davi Cordeiro Moreira
- 1495 *Cadance William Lucas Ormsby*; Ethan De-Chuan Wang; Layla Isabelle Shihab; Andy Jung; Heather Nicole Martin
- 1496 *Daniel Thomas Osborne*; Jacob Michael Cohen; Marshall Alex Prince; Paulette Arely Fernandez; Stephen R Leitch
- 1497 *Kiley Ann Osswald*; Kyndall Lauren Osborne; Christopher Curless
- 1498 *Nicholas Joseph Ostendorf*; Carlos J Martinez
- 1499 *Preston Daniel Perkins*; Omar Habib Habli; Jeffery Xiaotian Liu; Mark Johnson; Ayush Singh; Anas Zyad Abughali

- 1500 *Kayla Renae Phillips*; Robert Jose Ccorahua santo
- 1501 *Sophia Victoria Pimentel*; Tae Hong Park
- 1502 *Shaheer Raza*; Harris J Bras
- 1503 *Harlie Elizabeth Robbins*; *Sridevi Ramkumar*; Satyajit S Ambike; Jeffrey M Haddad
- 1504 *Madelyn Marie Roberts*; *Alexandra Li Alderink*; *Yilin Xiu*; *Caitlin Yvonne Bain*; Stephen R Leitch
- 1505 *Miranda A Ruvalcaba*; Jessica M Mercado
- 1506 *Bristol Ryan*; *Raechel Thara Davids*; *Rishi Sai Kattunga*; *Thira Rayne Minauskas*; Stephen R Leitch
- 1507 *Ethan William Scheuneman*; *Krish Aggarwal*; *Maha Sohail Chaudhry*; *Arnav Bhatia*; Stephen R Leitch
- 1508 *Amanda Schuler*; Jessica M Mercado
- 1509 *Grace Lauren Scott*; Brandon Keehn
- 1510 *Soham Samir Seksaria*; Shivam Bajaj; Vijay Gupta
- 1511 *Maggie Rose Self*; Michael Douglas Johnson
- 1512 *Ace Setiawan*; *Gavin Patrick Connolly*; *Gabriel John Carlson*; *Sean Patrick Patterson*; Davi Cordeiro Moreira
- 1513 *Jaanav Bhavin Shah*; Rishikesh Reddy Bathina
- 1514 *Milan N Shah*; Jaeeun Kim; Yan Gu
- 1515 *Drish Jaykishan Shah*; *Madhav Amit Arora*; *Quinn Robert Traas*; *Elvin Xuyang Li*; Jaeeun Kim
- 1516 *Ethan Zachary Shatz*; Karthik Sankaranarayanan; Bianca de Paula Macedo
- 1517 *Katherine A Sheehan*; *Breckon Lee Riley*; *Gunit Kaur*; *Benjamin Herbert Withers*; Stephen R Leitch
- 1518 *Yusuf Anis Sherali*; *Shashank Venkata Seerum*; *Sanjay Anthony Jaikaran*; *Jeenay Vipul Dedhia*; Davi Cordeiro Moreira
- 1519 *Kushagra Sisodia*; *Alexander Michael Denysenko*; *Jake Everett McDermott*; *Samuel James Beebe*; Stephen R Leitch
- 1520 *Kayla Nikole Skertich*; Michael I Zimmer
- 1521 *Emily Grace Smith*; Brittany Nicole Heil
- 1522 *Maxwell James Stewart*; Linda E Haynes
- 1523 *Elle Miriah Stowers*; *Lauren Riley Clark*; *Parker Nadaline Sikora*; *Margaret Elizabeth Padgett*; Erin Alkire Britton
- 1524 *Sanjna Aravinda Suresh*; Carla B Rosell
- 1525 *Jakub Szacillo*; Harris J Bras
- 1526 *Ashwin Kazuki Thampi*; *Vera T Gao*; *Aryan Kiran Kumar Chamarajanagar*; *Kaya Tacer*; Yeon Ji Yun; Yung-Hsiang Lu
- 1527 *Sunny Townsend*; *Nicholas Paul Santorelli*; Peter Bermel

- 1528 *Zoe Angela Tu; Ruby Jean Woodson; Avery Hweichi Lee; Nayan Suresh Nair; Stephen R Leitch*
- 1529 *Diya None Vishwakarma; Jitika Rajpoot*
- 1530 *Amber K Wang; Patrick James Herchenbach; Jeffrey Edward Dick*
- 1531 *Minghan Wang; Asavari Deshmukh; Yun-Hsuan Chiu; Yu-En Lee; Timothy Francis Hein; Mark Johnson*
- 1532 *Cole Anthony Werner; William Gray Gattoni; Owen Alexander Hershberger; Grant Thomas Romero; Davi Cordeiro Moreira*
- 1533 *Josephine Lee Whitcomb; Isabella Truly Holloway; Lynette Garcia-Gonzalez; Ellen Nicole Van Dokkenburg; Stephen R Leitch*
- 1534 *Katelyn Rosalie- Elise Wilcox; Jane Ann Mondul*
- 1535 *Sarah Wu; Lucia Barrera Lamagna; Shayna Ashley Ramirez; Kyle Robert Swanson*
- 1536 *Michael Downing Yancy; Diego Alberto Caverro; Nicholas Richard Boyd; Elliott Jameson Soderberg; Davi Cordeiro Moreira*

POSTER SESSION 4 | 1:30PM-2:30PM

- 1600 *Marawan Sultan Mah Abdulsattar; Peter Bermel*
- 1601 *Shams Adigozalzade; Linda E Haynes*
- 1602 *Luis Manuel Alvarez Casillas; Garam Kim*
- 1603 *Ryan Prado Bailey; Athavan Arvind; Leo Jeffrey Janert; Sarah Marie Kolp; Zhihong Chen; Joerg Appenzeller*
- 1604 *Samyukta Balaji; Ellis Reuben Selznick; Ekaterina Tsz Yao; Behruz Izbaev; James G Ogg; Aaron C Ault*
- 1605 *Zoe Michelle Beavers; Catherine Jean Shukle*
- 1606 *Jadyn Marie Befort; Keigo Tomoo; Gregory C Henderson*
- 1607 *Hailey L Benfield; Lawrence Lichtig; Haotian Tang; Genell Wells Ebbini*
- 1608 *Valeria Borja Dorado; Mikalai Artsiusheuski; Enrique Iglesia*
- 1609 *Sophia Elaine Breedlove; Carla B Rosell*
- 1610 *Megan Nicole Broecker; Casie S Bass; Jimmy Dooley; Jon E Ferrel*
- 1611 *Samuel Thomas Burdick; Roland Conrad Wilhelm*
- 1612 *John Nicholas Burns; Reed Ellis Baker; Noah Lee Timonera Federovitch; Yuan Chi Chang; David Michael Barbarash*
- 1613 *Zoe Nicole Campagna; Abigail Elisabeth Gansler; Sparsh Bansal; Brett A Meyers; Reza Babakhani Galangashi*

- 1614 *Logan Carlson*; Kolapo Ajuwon
- 1615 *Cynthia Sarai Castaneda*; Yunfei Gao; Arnav Pravinkuma Namdev; Rishikesh Reddy Bathina
- 1616 *Christopher Timothy Chan*; Aadithya Vasudevan; Yung-Hsiang Lu; Zihao Ye
- 1617 *Harshan Chandrasekar*; Mohammad Rayan Shamsi; Javier Francisco Hurtado; Curtis Earl Marshall
- 1618 *Geetika Chitturi*; Miroslava Marinova Marinova; Kyu Ri Choi; Alexandra Boltasseva; Vladimir M Shalaev; Alexander V Kildishev
- 1619 *Yohaana Chokhany*; Linda E Haynes
- 1620 *Atandrila Chowdhury*; Sudip Vhaduri; Debra Henneberry; Mark Wilson; Julius C Keller
- 1621 *Thomas Zirkle Clark*; Harris J Bras
- 1622 *Samantha Marie Cook*; Michael Douglas Johnson
- 1623 *Matthew Thomas Corson*; Fatema Mustafa Currim; Josephine Maria Brown; Jason R Cannon
- 1624 *Kai J Dhakhwa*; William Paxton Jost; Teck Yee Ng; Hussain Sadiq Alsinan; Stephen R Leitch
- 1625 *Kimberly Marely Echeverria*; Harris J Bras
- 1626 *Kai Ze Ee*; Zach Anthony Barna; Daniel EnYi Yang; Yash Singh; Sooraj Chetput Venkataraghavan; Fan Jing Hoon
- 1627 *Lily Dawn Farmer*; Sudharshan Anandan
- 1628 *Addison M Filipovich*; Trisha Raman; Kassidy L Trent; Laura Sofia Samaniego; Stephen R Leitch
- 1629 *Matthew Douglas Frago*; Sumit Suditya Biswas; Suraj Ketan Patel; Benjamin Tianming Sun; Andres Felipe Hoyos Moreno; Reed Joseph Freer; Richard Osita Ajagu; Samuel Labi
- 1630 *Rohan Mihir Gandhi*; Carla B Rosell
- 1631 *Michael David Gardner*; Brian Patrick Ha Metzger
- 1632 *Joseph Alan Ghanem*; Chase Yungmin Johnson; Jacob Thomas Walter; Sooraj Chetput Venkataraghavan; Fan Jing Hoon; Mark Johnson
- 1633 *Omkar Ghodke*; Peter Alexei Kaya Gretchikha; Joshua Angel Villasol; Evan Runzhao Liu; Mark Johnson
- 1634 *Stefanie Anne Giurcanu*; Carla B Rosell
- 1635 *Keshav Gollamudi*; Honghai Gong; Soham Roy; Noah Charles Singer; Andy Jung
- 1636 *Hannah Cole Hampson*; Adriana May Gardner; Kalesia Renae Smith; Ashley H Meredith

- 1637 *Amogh Shivanand Havanagi; Ammar M Mukadam; Jayaditya Borah; Juneseok Kwon; Mark Johnson; Timothy Francis Hein*
- 1638 *Maya Holguin; Rachel Catherine Parker; Leanne Nieforth; Sarah Jean Reega; Emilie Mae MacInnis*
- 1639 *Jenna N Honnert; Elizabeth Ann Habeeb; Kolton N Logsdon; Casie S Bass*
- 1640 *Emma M Horn; Anjali Iyer-Pascuzzi; Denise L Caldwell*
- 1641 *Connor Bryn Hoy; Jonathan Huang; Taotianchen Wan; Ishank Shekhar; Stephen R Leitch*
- 1642 *Zay Linn Htet; Pranav Bantval; Jia-He Zhou; Justin Yasuumi; Sooraj Chetput Venkataraghavan; Fan Jing Hoon*
- 1643 *Chun-Kang Huang; Uyen Do; Bobby Gu; PO-Tsung Hsu; Eric Younghoon Song; Peter Bermel; Saeed Mohammadi*
- 1644 *Breanna Lee Hutter; Jonathan R Kuhn; Ulrike Dydak*
- 1645 *Jungmin Im; Catherine Jean Shukle*
- 1646 *Hiya Jha; Kian Shiju Kallarakkal; Steven R Dunlop; Saanvi Singh*
- 1647 *Jorge Andres Jola Hernandez; German Mandrini; Ignacio Antonio Ciampitti*
- 1648 *Pranav Teja Kalakota; Carmen Aurora Infante Garner; Maxim Ryan Nepchatov; Trey Vu; Curtis Earl Marshall*
- 1649 *Kurt Andrew Khaustov; Harshitha Pathania; Sophia Victoria Pimentel; Irem Ucar; Tae Hong Park*
- 1650 *Kabeer Singh Khubbar; Samuel Anthony Fiore; Bruno Andres Knize Simon; Aditya Venugopal Nair; Davi Cordeiro Moreira*
- 1651 *Tyler Ken Kikuno; Joseph Alexander Schelb; Brandon B Velasquez Hernandez; Jihong Min; Weijing Sebastian Chen; Matthew A Swabey; Conor James Green*
- 1652 *Seokjae Kim; Evanjaline Sherl Sahaya Rajesh Durai; Hsin-Yu Tsern; Timothy Francis Hein*
- 1653 *Elyse Priscilla Kim; Jacquelyn P Boerman; Isabela Garcia Mendes de Araujo Santos*
- 1654 *Eileen Koh; Amber Kuoiwa Khauv; Cole Aaron Nelson*
- 1655 *Arushi Kolluru; Misty Chen; August William Mauer; Heather Nicole Martin; Andy Jung*
- 1656 *Rishita Korapati; Mia Bell Foulk; Chih-Yu Lee; Varsha Devisetty; Davi Cordeiro Moreira*
- 1657 *Dakota Dawn Kovanda; Leea Marie Persinger; Aidan Mitchell Conley; Ella Marie Horral; Casie S Bass*
- 1658 *Matyas Kubon; Anas Zyad Abughali; Dipali Rebecca Abraham; Ananya Anand Nadkarni; Zixuan Fei; Zhihong Chen; Joerg Appenzeller*

- 1659 *Sophia Rochelle Lehnert; Laura Helen Green; Kathryn Lynn McCloskey; Klaudia Julia Czerwinski; Mark Wilson*
- 1660 *Reilly Siobhan Lustina; Catherine Jean Shukle*
- 1661 *Vitoria Machado Machado Didone; Jack Dorsey Feehan; Ashton Anthony Price; Owen Thomas Edwards; Davi Cordeiro Moreira*
- 1662 *Alyssa Marie Viray Magsino; Meg Catherine Schemanske; Avni Jade Dutta; Genell Wells Ebbini*
- 1663 *Ashish Krishna Mallur; Annika Anders Nelson; Brandon J Moss; Davi Cordeiro Moreira*
- 1664 *Abigail Rose Malott; Alexandra Grace Early; Kristen Marie Bellisario; Abhinav Tyagi*
- 1665 *Shay Joseph Manor; Millan Shah Kumar; Francisco J Montalvo*
- 1666 *Saahil Mathur; Tunazzina Islam*
- 1667 *Dominic Henry Mazurek; William Falk Wahlberg; Braden Thomas Callaway; James Michael Goppert; Worawis Sribunma*
- 1668 *Soham Mehta; Zahra Ghodsi*
- 1669 *Haari Muthukumar; Carla B Rosell*
- 1670 *Moe Wai Yan Myint; Blake Alexander Andrews; Tei Okamoto; Niels van Ritbergen; Timothy Francis Hein; Mark Johnson*
- 1671 *Felicia Jesutofunmi Onawola; Ryan Alan Altman; Abdulrahman Arafat Mohammed Moursy*
- 1672 *Eain Drae Oo; Safa Islam; Seyedehmarzieh Rouhani*
- 1673 *Jaser Ahmed Pallikonda Latheef; Beth Elly Baumgartner*
- 1674 *Abhinav Vijay Pande; Adarsh Narayanan; Rahul Nagisetty; Vivan Nagrath; Andy Jung; Noah Charles Singer*
- 1675 *Jayla Kennedy Parks; Tarek Ibrahim Salama; Omar Ahmed Abdelrady Ismaiel; Daniel Kailin Wu; Santiago Torres Arias*
- 1676 *Julie Thu Anh Phung; Danielle E Soranno*
- 1677 *Hurshal Pol; Kapil Ramswamy Chandramouli; Andrew Patrick Folkers; Sidharth Reddy; Mark Wilson*
- 1678 *Elisabeth Porter; Brittany Nicole Heil*
- 1679 *Myriam Julieth Rangel Miranda; Kiruba Catherine Vincent; Rakesh Agrawal*
- 1680 *Disha Ransingh; Sai Aiswarya Sadagopan; Rishika Ramakrishnan; Jonas Villabroza; Brett A Meyers; Reza Babakhani Galangashi; Sourav Das*
- 1681 *David Alexander Ransom; Carla B Rosell*
- 1682 *Soham Rattan; Charles Chen; James C Davis*

- 1683 *Luis Andre Romero Alvarez*; Eduardo Barocio Vaca; Jordan James Wess Kalman; Garam Kim
- 1684 *Nicolas Raymond Rosy*; Harris J Bras
- 1685 *Eliana Saavedra*; Marisa Ann Egan; Julie C Liu
- 1686 *Karen Vanessa Salazar Salazar*; Morgan Jefferies Robinson; Yang Yang
- 1687 *Emily Grace Marie Saldivar*; Beth Elly Baumgartner
- 1688 *Hector Armando Salinas Gordillo*; Yung-Hsiang Lu; Yeon Ji Yun; Nan Kong; Samantha Sudhoff
- 1689 *Isaiah William Schaefer*; Beth Elly Baumgartner
- 1690 *Bella Irma Schaetzle*; George Panagos; Myra Rawar Khare; Anas Eyad Rafei; Brett A Meyers; Sourav Das; Reza Babakhani Galangashi
- 1691 *Sofia Schumann*; Jason R Cannon; Reeya Tanwar; Fatema Mustafa Currim
- 1692 *Dominic Joseph Sciacca*; Zachary Andrew Lovell; Tyler Arthur Verhaalen; Deep G Patel; Stephen R Leitch
- 1693 *Ellis Reuben Selznick*; Congtian Wu; Samyukta Balaji; Yuanfei Song; James G Ogg; Aaron C Ault
- 1694 *Franklin Shang*; Jack Thomas Willard; Ekam Bhullar; Tanvi Chukka; Thomas Edgar Roth; Samuel Theodore Elkin; Sean Sebastian Ramirez
- 1695 *Mihika Sharma*; Prisha Sunil Banger; Richard Lin; Monish Jonnadula; David Michael Barbarash
- 1696 *Deeya J Sharma*; Weijing Sebastian Chen; Conor James Green; Matthew A Swabey
- 1697 *Shlok Ashish Sheth*; Anisha Bhargava; Ishan D Junnarkar; Youngeun Kwon; Hazim Atef El Mounayri
- 1698 *Tony Shih*; Juan Carlos Verduzco Gastelum
- 1699 *Jabez Soongeui Shin*; Ana Maria Ospina Larrea; Jonathan Lopez; Caitlin Gabor; Ximena Bernal
- 1700 *Diya Singh*; Gaurav Nanda; Jaeil Lee; Xinran Y Lehto; Mark R Lehto; Elizabeth A Richards
- 1701 *Tushar Singh*; Aiden Hughes Sexton; Erhao Chen; Aidan Michael McDonough; William Rowan Cunningham; Mark Johnson; Fan Jing Hoon; Sooraj Chetput Venkataraghavan
- 1702 *Maliyah Ann Smith*; Robin L Tanamachi
- 1703 *Brooke Mia Spindler*; Michael Douglas Johnson
- 1704 *Maxwell Christophe Sprague*; Branden Woojin Cho; David Kim; Rishikesh Reddy Bathina
- 1705 *Lydia Jane Stone*; Jessica Sonia Fortin
- 1706 *Evan Michael Stonestreet*; Zihan Li

- 1707 *Elle Miriah Stowers; Sydney Jo Muller; Emma Grace Day; Emma Grace Dodson; Alexandra Mae Hildreth; Stephen R Leitch*
- 1708 *Jonathan Maxwell Sutjandra; Andrew Christopher Nilsson; Asrar Ul Haq Asrar Ul Haq; Andy Jung; Heather Nicole Martin; Santosh Bhandari*
- 1709 *Jeeya Vijay Thukral; Christopher Aaron Rice; Chayan Sharma; Chenyang Lu*
- 1710 *Quinn Robert Traas; Gabriel Duarte Rengifo; Elvin Xuyang Li; Arya Bhangle; Jaeun Kim*
- 1711 *Miles Alexander Travis; Carla B Rosell*
- 1712 *Shou-Fu Tseng; Tho Le*
- 1713 *Devyani Tyagi; Andy Jung*
- 1714 *Bruno Marcelo Uribe Velazquez; Eduardo Barocio Vaca; Garam Kim; Raul Hector Fuentes Hernandez*
- 1715 *Shreya Veeredhi; Caleb Michael Diekmann; Steven R Dunlop; Saanvi Singh*
- 1716 *William Falk Wahlberg; Dominic Henry Mazurek; Lillian Ji; Braden Thomas Callaway; James Michael Goppert*
- 1717 *Emory Lane Ciula Walker; Kathleen M Ivester; Laurent L Couetil*
- 1718 *Jari L Warner; Arush Sowreddy Medam; Ansh Pahwa; Destinee Walker; Davi Cordeiro Moreira*
- 1719 *Katherine Mae Wenger; Jessica M Mercado*
- 1720 *Madelyn Erin Wurzel; Wenzhuo Wu; Nachiket Vatkar; Hening Xu; Robert Jose Ccorahua santo; Wenzhuo Wu*
- 1722 *Haoyuan Yang; Ireoluwatomiwa David Salako; Jason Dwight McKinney; Vivek vasantrao Wankhade; Alex Ruichao Ma*
- 1723 *Jhih-Chen Yang; Bo-Wei Hsieh; Seyedehmarzieh Rouhani*
- 1724 *Rinyoung Yoo; Carla B Rosell*
- 1725 *Mingrui Yuan; Mohamed Aboelyazed; Qi Zhang; Abinands Ramshanker*
- 1726 *David Michael Yugas; Griffin Xander Kanzeg; Ibrahim Shahid; Marco Alexander Wilson; Samuel Labi; Andres Felipe Hoyos Moreno; Richard Osita Ajagu*
- 1727 *Ashley Zachor; Taotianchen Wan; Erika Marie Graf; Claire Marie Campbell; Erin Alkire Britton*
- 1728 *Sophia Mary Zakar; Harris J Bras*
- 1729 *Yanming Zhou; Jiansong Zhang; Jingyi Lai*

SCAN FOR
ABSTRACT BOOK



Poster Presentation Abstract Number: 1000

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

**Virtual Twin of Semiconductor Fabrication Process
STEM**

Authors(s):

Abdulaziz Hamad Alanazi† (Engineering); Sicheng He‡ (Science); Tanuj Santosh Mangalam‡ (Engineering|JMHC); Shriya Gupta‡ (Engineering); Samridh Prabhakar‡ (Engineering); Ekagra Agarwal‡ (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Digital Twin; CATIA 3D Experience; Semiconductor Fabrication; PVD

Mentor(s):

Zhihong Chen (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1001

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

Powering Hyperscale Data Centers - A Conceptual Design for AI Mission-Critical Workloads STEM

Authors(s):

Abdullah Alkazemi† (Engineering); Zi-Hao Ethan Wei† (Engineering);
Kyllyne Kuo† (DSB); Arav Prasanna Ginde† (DSB); Zoe Chen‡
(Engineering); Parth Dama‡ (DSB); Gabriel Dean Kuchersky‡ (DSB);
Maya R Labonte‡ (Engineering); Francine Yu He Zhang‡ (Engineering);
Sullivan Kelly Mills‡ (DSB)

Abstract:

The rapid growth of AI is driving a surge in data center energy consumption, straining electric grids and raising sustainability concerns. In 2024, about 56% of U.S. data center electricity came from fossil fuels, mainly natural gas. To address reliability and emissions challenges, data centers are adopting on-site generation, microgrids, and demand response programs, while regulators push for greater load flexibility and cost-sharing.

We propose a sustainable 2N+1 power architecture for hyperscale data centers that integrates three independent power layers: the utility grid (N1) as the primary source, a Small Modular Reactor (SMR) such as the Xe-100 as the secondary source, and hydrogen-fueled internal combustion generators (+1) as tertiary backup. The Xe-100 is a Generation IV, high-temperature, helium gas-cooled, pebble-bed reactor that provides 100% dispatchable, carbon-free power.

This hybrid, multi-source microgrid enhances reliability, optimizes cost, and advances sustainability. By combining the grid's affordability with the SMR's baseload stability and hydrogen gensets' flexibility, the 2N+1 design ensures continuous operation even during grid or reactor outages. It replaces traditional N+1 redundancy by addressing not just power continuity but also sustainability and grid stability under rising AI workloads.

As hyperscale data centers expand, efficiency remains critical. Modern facilities target power utilization efficiencies (PUE) near 1.1, compared to the industry average of 1.5–1.7, to maximize computational performance while minimizing environmental impact. The 2N+1 framework offers a pathway toward resilient, low-carbon, and future-proof power infrastructure for AI-driven data centers.

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

Keywords:

[no keywords provided]

Mentor(s):

John W Sheffield (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1002

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

Multispecies grazing effects on internal parasite loads in horses and goats.

STEM

Authors(s):

Taylor Caroline Anderson† (Agriculture)

Abstract:

Multispecies grazing is garnering growing interest as a sustainable pasture management strategy, largely due to its positive impact on forage quality and overall pasture health. Additionally, because most internal parasites are host-species specific, this grazing practice has been recognized as a way to simultaneously reduce anthelmintic use and manage parasites in various livestock species. Our team hypothesized that internal parasite loads would be reduced within both horses and goats when grazed together versus horses grazed alone. To test this theory, during eight weeks of peak summer grazing, we managed one pasture space with two horses and four goats together, and a second pasture with just two horses (no goats). Manure samples were collected as soon as each animal arrived on the property and again every two weeks. Manure samples were evaluated for parasites at the Animal Disease Diagnostic Laboratory. Over the eight-week period, we observed that horses grazed with goats had either no or few strongyle eggs present versus horses grazed without goats had few or many strongyle eggs present. Furthermore, from the beginning to the end eight-week period, we observed the goats having an overall reduction in *Eimeria* oocysts and *Trichostrongyles* eggs, as well as a complete disappearance of *Moniezia expansa* eggs present in manure. Given the limited documentation of co-grazing domesticated horses with small ruminants in the U.S., the findings of this pilot study may offer valuable insights for horse owners and managers, particularly as a way to mitigate the current overreliance on anthelmintics.

Keywords:

Horse; Goat; Grazing; Pasture; Parasite

Mentor(s):

Casie S Bass (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1003

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

Assessing gray fox occupancy along forest edges in Indiana using camera traps STEM

Authors(s):

Rebeca Joyce Appelmann† (Agriculture); Kylee Ann Thorson* (Agriculture); George D Emerson* (Agriculture|JMHC)

Abstract:

In this study, we used camera traps to assess gray fox (*Urocyon cinereoargenteus*) occupancy along forest edges and to evaluate the performance of predictive habitat models. Our objectives were to (1) estimate the proportion of sites occupied by gray foxes and (2) evaluate models incorporating both forest cover and refugia as predictors of occupancy. In addition to the occupancy component, we tested whether chicken manure could serve as an effective lure to increase detections of gray foxes and other mesocarnivores. To address these objectives, we deployed camera traps across North Central Indiana at 15 sites that were identified as areas that both the forest cover and refugia models predicted to be appropriate for gray fox. We restricted sampling to easily accessible locations on public lands. Camera traps monitored each site for two-week sessions between September and November 2025. To estimate the effect of bait on detection at each site we paired a camera baited with chicken manure with an un-baited control camera approximately 50 m away. Preliminary results suggest gray fox occupancy was relatively low. Chicken manure did not increase gray fox detections, but it did attract other mesocarnivores. These findings provide early insights into gray fox habitat use and the effectiveness of lures that can inform future state management decisions and monitoring efforts.

Keywords:

[no keywords provided]

Mentor(s):

Patrick A Zollner (Agriculture); Shawn Crimmins (Agriculture); Geriann Albers (Indiana Department of Natural Resources)

Other Acknowledgement(s):

Laila Alexandra Klang (Agriculture)

Poster Presentation Abstract Number: 1004

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

Autonomous Emergency Response UAV for Rapid NARCAN Delivery STEM

Authors(s):

Nathan James Arnold† (Engineering); Carly Melissa Frith† (Engineering); Wei-Yun Liu† (Engineering); Prithika Rashmi Gopalt (Engineering); Lucas Soldano‡ (Engineering); Owen Jacob Lee‡ (Engineering); Rhys Marie Shilling‡ (Engineering); Sahitya Shivany Satish Kumar‡ (Engineering); Victor Ionut Ene* (Engineering); Parth Kailash Dubal* (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. Brain damage from oxygen deprivation can occur within six minutes, however 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:

Autonomous UAV; Narcan Delivery; Overdose Response; UAV Design; Opioid Crisis

Mentor(s):

James Michael Goppert (Engineering); Nicole Adams (Centers & Institutes)

Other Acknowledgement(s):

Nan Kong (Engineering)

Poster Presentation Abstract Number: 1005

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

Mulhaupts - from B2B to B2C

Business Case Study

Authors(s):

Davey Lee Avenatti† (DSB); Preston Michael Down† (DSB); Alex Michael Shie† (DSB); Ryan Scott Petranek† (DSB); Reagan Luther Collins‡ (DSB|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Digital Marketing; Consumers; Strategic Marketing; Case Study

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1006

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

Payload Release Mechanism For UAS (Purdue Aerial Robotics Team) STEM

Authors(s):

Kai Broben Fassino† (Engineering); Ashton Gligich† (Exploratory Studies|Other); Owen Michael Palmer‡ (Engineering); Marcus Lau‡ (Engineering); Kevin John Resh‡ (Engineering)

Abstract:

Our task as members of the Special Projects and Integration subteam of the Purdue Aerial Robotics Team's Research and Development division was to design a modular wing-mounted payload release system.

Our design philosophy primarily focuses on accommodating different payloads, as PART competes in multiple competitions. When designing our system, we were guided by several criteria and constraints, including modularity, low cost, lightweight design, and simplicity. We also aim to use as few servos and electronics as possible. One place this was critical was the deployment of the payload parachute. We solved this problem by connecting a fishing line to the release mechanism, which removes the cap from the parachute compartment once the slack has been exhausted. The line was then retracted into the release mechanism.

When choosing the methods to use for manufacturing our design, we selected 3D printing for several specific reasons. Of the options available to us, it was much more convenient, as the turnaround time between finishing a prototype and having a final design was shorter than other manufacturing options. The other benefits, including being more cost-effective, allow for the construction of more complex geometries. Only a handful of components come from third-party suppliers.

Our mechanism is simple, cost-effective, and purpose-built to meet PART's needs for a release mechanism in the 2026 competition year.

Keywords:

UAS; Purdue Aerial Robotics Team; Aerospace Engineering; Mechanical Engineering; Payload Delivery

Mentor(s):

John William Rolfe (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1007

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

Non-Blocking DDR4 DRAM Controller for SoCET AI Hardware STEM

Authors(s):

Adrian Daniel Buczkowski† (Engineering); Aryan M Kadakia† (Engineering|Graduate); Jason Dumaul Lyst† (Engineering); Dhruv Roopchand Khatri* (Engineering); Tri Than* (Engineering)

Abstract:

AI accelerator hardware demands very high throughput and bandwidth from memory due to t. However, accessing it is a major bottleneck because each access carries with it very high latency. This incurs heavy stalls when the processor needs to access DRAM in the event of a cache miss.

The current implementation of this controller will stall the system every time a request is processed. This will lead to the system being heavily bound by memory bandwidth.

The non-blocking controller will be able to send multiple independent requests to be processed at the same time. To integrate the non-blocking controller, interfacing components like an AXI-Bus will be designed to handle independent requests across the system. This will allow the SoCET AI hardware team to have a realistic memory interface for benchmarking purposes, and it is also the first step to manufacturing a chip with external memory access capabilities.

To measure the success of this project, we will measure the improvement in the latency and throughput of memory requests between the blocking and non-blocking controllers.

This design is still limited in comparison to modern memory controllers because it will not reorder memory requests for a higher degree of optimization.

This project is a relevant and necessary addition to the SoCET AI hardware team. It will continue to improve the bottleneck of memory latency in high compute processors.

Keywords:

DRAM; Memory Controller; AI Hardware

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1008

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

Modeling Fluidic System to Comprehend Drug Transport in the Maternal-Fetal Membrane STEM

Authors(s):

Alexander Carnevale† (Engineering); Gabriel Scott Shifflett† (Engineering); Nikitha S Kambit (Engineering); Manas Kathuriat (Engineering)

Abstract:

Pregnancy brings out immense physiological changes to the formation of the maternal-fetal membrane, tissue structure, and blood flow, impacting the pharmacokinetics of drugs. These alterations are often understudied due to ethical concerns of exposing pregnant women in clinical trials. To help address this gap, our research studies how fluidic devices can be used to understand the modifications in anatomy caused by pregnancy. Fluidic models uniquely replicate the dynamic and mechanical conditions of the maternal-fetal membrane to understand drug transport within it. To accurately mimic these physiological properties, a cellulose acetate dialysis membrane was fabricated to represent the maternal-fetal membrane structure. Dextran solutions of varying molecular weights (10 kDa and 70 kDa) were prepared and introduced into a well plate fluidic device. Using Fluorescence Recovery After Photobleaching (FRAP), we measured the diffusion coefficient (D) under different flow conditions (1–15 $\mu\text{L}/\text{min}$) and flow durations (5–15 min). These parameters were used to evaluate how flow and exposure time influence dextran mobility and adsorption within the membrane mimic. This fluidic model provides a foundation for studying flow-dependent transport phenomena across the maternal-fetal membrane, offering insight into how pregnancy-induced physiological changes may affect drug delivery. The findings from this system aim to advance our understanding of maternal-fetal pharmacokinetics and support the development of safer and more effective treatments for pregnant patients.

Keywords:

[no keywords provided]

Mentor(s):

Arezoo Ardekani (Engineering); Ryan B Wagner (Engineering)

Other Acknowledgement(s):

Harsa Mitra (Engineering)

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

Poster Presentation Abstract Number: 1009

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

Stress-Driven Regulation of Secondary Metabolites in Tomato STEM

Authors(s):

Lauren Isabella Carpenter† (Agriculture|Engineering)

Abstract:

Plants produce diverse secondary metabolites that support defense, stress adaptation, and ecological interactions. Many, including those in tomatoes (*Solanum lycopersicum*), have notable nutraceutical and therapeutic potential. This study investigated how environmental and chemical stressors influence the expression of key genes in secondary metabolite biosynthesis and how these changes affect antioxidant activity, aiming to identify stress conditions that enhance health-promoting compound production.

Tomato plants were exposed to abiotic and chemical stresses—glyphosate, diquat, metribuzin, mesotrione, cold, UV, and micronutrient deficiency—to mimic environmental challenges. RNA extracted from treated and control plants was analyzed via qPCR for PSY1, GAME1, and GAD2, genes central to carotenoid and alkaloid biosynthesis. Antioxidant activity was assessed using the DPPH radical scavenging assay, and promoter and protein sequence analyses were conducted to evaluate stress-responsive regulation and evolutionary conservation. Diquat and metribuzin treatments upregulated PSY1, GAME1, and GAD2, indicating that oxidative and photosynthetic stress enhance secondary metabolite biosynthesis. Glyphosate and control conditions showed lower expression, suggesting reduced metabolic activity. Antioxidant assays revealed the highest radical scavenging in control and cold-stressed samples, while herbicide stress diminished antioxidant capacity. Promoter analyses identified stress- and hormone-responsive motifs, and protein alignments confirmed conservation across Solanaceae species.

These results demonstrate that environmental stressors can both activate and inhibit secondary metabolite pathways in tomato plants, directly influencing antioxidant potential. Understanding these mechanisms supports strategies to optimize plant systems for enhanced nutraceutical and pharmaceutical production with implications for disease prevention and human health.

Keywords:

Tomato; Metabolites; Nutraceutical; Cancer; Therapeutics

Mentor(s):

Orla M Hart (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1010

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

Assessing and Reducing Mercury Exposure in Museum Workers: A Global Perspective STEM

Authors(s):

Jordan Hope Cencelewski† (HHS); Nikolina Latinovic† (HHS); Dhriti Manish Laddha† (HHS); Hadi Akbar Rahmani† (HHS)

Abstract:

Mercury exposure remains an underrecognized occupational health risk in museum environments. Historically, mercury-based preservatives were used to protect taxidermy, anthropological, and scientific collections, posing long-term hazards to museum professionals through inhalation, dermal contact, or ingestion. This project investigates how such exposures can be reduced through a global comparative approach integrating occupational health, environmental toxicology, and conservation science.

Using a systematic literature review of peer-reviewed studies, technical bulletins, and institutional safety guidelines from the U.S. (EPA, CDC, OSHA, NIOSH) and international bodies (CCI, ICOM), we examine the hierarchy of controls applied to mercury hazards in museum contexts. Environmental and surface data from conservation and storage areas are analyzed in conjunction with institutional policy reviews to assess current risk management practices.

Findings reveal that while mercury levels generally fall below OSHA and NIOSH exposure limits, low-level contamination persists, particularly in enclosed or poorly ventilated facilities. Variability in hazard awareness and mitigation is evident across institutions—larger museums demonstrate stronger control systems than smaller or under-resourced ones.

This research highlights the urgent need for standardized global mercury safety protocols. We propose the development of a “Mercury Safety Toolkit” for museums, featuring risk assessment checklists, ventilation recommendations, and PPE guidelines to reduce exposure risks and protect museum professionals while responsibly preserving cultural heritage.

Keywords:

Mercury Exposure in Museums; Occupational Mercury Hazards;
Museum Conservation Safety; Mercury Used in Museums

Mentor(s):

Mark Wilson (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1011

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

VIP Semiconductors@Birck SPC MIM Team 6 STEM

Authors(s):

Alexandre Chan Tome† (Engineering); Brendan V Espinola† (Engineering); Henry N Kuehl† (Engineering); Pin-Yu Chen† (Engineering); Jae Hun Oh‡ (Engineering); Jin hyung Park‡ (Engineering)

Abstract:

Statistical Process Control (SPC) is a key methodology in semiconductor manufacturing that ensures process consistency, enabling higher device reliability and yield. In this project, SPC techniques are applied to monitor Metal-Insulator-Metal (MIM) capacitors fabrication, essential components in integrated circuits used for analog, radiofrequency, and energy storage applications.

A MIM capacitor functions by separating two conductive layers with a thin insulating layer. When a voltage is applied, opposite charges accumulate on each metal layer, storing energy within the electric field across the dielectric layer. This simple vertical stack allows for high capacitance density and stable electrical performance even at nanoscale dimensions.

One major fabrication challenge involves etching the dielectric layer, HfO_2 , without damaging the underlying Ni metal electrode. When BCl_3 and Cl_2 gases are used during plasma etching, chemical reactions can occur once the HfO_2 layer is fully removed. These reactions form non-volatile NiCl_2 and boron-containing residues that adhere to the wafer surface, compromising electrical contact and reducing manufacturing yield.

To address this issue, three strategies are being evaluated: adding Ar to the plasma to promote physical sputtering and residue removal; switching to Ar based ion milling to eliminate chemical reactions; and implementing a controlled under-etch that preserves a thin HfO_2 remnant to protect the bottom Ni electrode.

Throughout this process, SPC data are collected by recording process parameters, such as deposited HfO_2 thickness and their etch time across multiple wafers, to identify variability and trends. These data enable quantitative analysis and optimization of etch conditions, improving MIM capacitor fabrication reproducibility.

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

Keywords:

SPC; Semiconductor Fabrication; VIP Semiconductors@Birck; MIM Capacitors; Insulator Layer Etching

Mentor(s):

Zhihong Chen (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1012

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

Integrated Chirped Bragg Gratings

STEM

Authors(s):

Ethan Chieng Chiao† (Engineering); Rohan R Iyer† (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; Optics; Bragg Gratings

Mentor(s):

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1013

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

Synthetic Development of Stable 3-Dimensional Frameworks STEM

Authors(s):

Ian Sung Hin Chiu† (Pharmacy|JMHC)

Abstract:

Despite their usefulness in a variety of fields, most self-assembled molecular structures with large cavities (including molecular cages and covalent organic frameworks (COFs)) display limited stability and chemical robustness. Current methodologies employ the use of highly reversible bonds or single reaction-based framework growth, which leads to the formation of structural defects. Other nanomaterials, such as metal organic frameworks (MOFs), show comparable stability to COFs due to their predictable binding confirmation of the metal nodes with the organic linkers. To meet this fundamental challenge, we describe the synthesis of new porous molecular cage structures that exhibit improved stability. We are modeling our system after a previously reported synthesis of hydrazone-linked tetrahedral nanoreactors, which will serve as robust binding nodes, such as in the case of MOFs. We propose that cross-linking these cavities allows for the further enhancement of the stability and functionality in the solid state, by the formation of stable and robust porous 3-dimensional frameworks. Initial studies have shown the formation of a gel-like substance, which shows promise for initial cross-linked framework formation. Further characterization of the frameworks will be done using nuclear magnetic resonance (NMR) spectroscopy, Brunauer-Emmett-Teller (BET) gas absorption and porosity studies, elemental analysis, FTIR spectroscopy, and SEM imaging. We hope to show that the development of a new 3-dimensional framework, which merges the structural stability of MOFs with the functional ability and flexibility of COFs through the employment of robust nanoreactor structures.

Keywords:

COFs; 3-Dimensional Framework; Synthetic Nanomaterials

Mentor(s):

Severin Thomas Schneebeli (Pharmacy); Anthony Gabriel Mena (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1014

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

An In-depth Look at Phase Locked Loop STEM

Authors(s):

Chao Min Chung† (Engineering); Thomas Allen Greert† (Engineering);
Erik Kocinare† (Engineering); Emma Lynn Stump‡ (Engineering);
Mohamed Mostafa Hassan‡ (Engineering)

Abstract:

This work demonstrates the simulation of a phase-locked loop(PLL) for clock generation in the SoCET AFTx07 in TSMC180nm technology using Cadence Virtuoso. The PLL is one of the most important components in modern-day mixed-signal systems. It matches the reference clock in phase and signal, which ensures no frequency or phase error. The PLL aims to have a tunable frequency from 25M to 1G Hz with 5 coarse and 3 fine tunings and a jitter of 500ps. Powered by a supply voltage of 1.8 V. The design consists of a phase frequency detector (PFD), a charge pump with a second-order passive loop filter, a Digital Controlled Oscillator (DCO), and a pulse swallow divider. The architecture offers a compact solution for SoC applications. The group is doing side projects on a low-dropout voltage regulator and an analog-to-digital converter (ADC).

Keywords:

PLL; Phase-Locked Loop; SoC; System on Chip; Semiconductor

Mentor(s):

Seyedehmarzieh Rouhani (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1015

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

Datacenter Network Accelerator: Hardware Kernels STEM

Authors(s):

Alexander Raffaele Ciccarelli† (Engineering); Jacob Adam Clark† (Engineering)

Abstract:

In current Datacenter Network Architecture, RDMA operations are completely executed by the CPU; however, this wastes a lot of cycles, so we need a way to shift the workload off of the CPU. There is a conceptual solution to this in a research paper (a StRoM kernel). These kernels are designated for different AI workloads and datacenter RDMA operations, which reduce CPU cycles wasted on these operations. However, there is no actual RTL and implementation in the paper as it is purely conceptual, hence why we have decided to plan, design, and implement it in SystemVerilog and simulate it on an FPGA. Our innovation is developing unique StRoM kernels that are specific to AI workloads, which will significantly accelerate datacenter network hardware. We currently have plans to implement a GET, SEND, TRAVERSE, and CRC kernel. These kernels will help us to perform the basic actions necessary to accelerate datacenter network acceleration. The measurable outcome is the correctness of our test benching. If all of our testbenches work, then we will know that we have successfully achieved our goal. The limitations of this project are mainly the number of other remote processors we will be able to interact with, and the size of the CPU's memory accesses. If we are able to complete all of our kernels by the end of the semester, we will continue to research and develop more kernels.

Keywords:

Datacenter Network Accelerator; FPGA

Mentor(s):

Rishikesh Reddy Bathina (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1016

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

In Vitro Activity of Repurposed Drugs Against Different Acanthamoeba Strains STEM

Authors(s):

Daniel Russell Cline† (Agriculture|Engineering)

Abstract:

Acanthamoeba spp. are free-living amoebae found in diverse environmental habitats, including soil, dust, and both fresh and salt water. Approximately 23 sequence types (T1-T23) of Acanthamoeba have been identified in nature, that includes both pathogenic and nonpathogenic strains. The pathogenic species are responsible for several severe human infections, including ulcerative keratitis, cutaneous skin infections, disseminated infections that spread throughout the body such as Acanthamoeba rhinosinusitis, and granulomatous amoebic encephalitis (GAE) which infects the brain. Acanthamoeba infections are considered a rare disease, which has limited the development of effective treatments. Because these infections can be fatal and the serious impact they have on patients' lives, it emphasizes the need for better information on effective anti-Acanthamoeba treatments. In this study the optimal seeding density for two Acanthamoeba strains was evaluated. Subsequently nineteen repurposed anti-parasitic drug candidates were tested on the Acanthamoeba strains using the CellTiter-Glo (CTG) assay to assess growth inhibition and evaluate the drug dose-response. We found that when comparing the drug-dose response across different strains, the tested compounds showed strain dependent differences in inhibition activity. Variations in IC₅₀ values among the tested strains indicate that drug susceptibility is influenced by strain specific factors. With this data, this study supports a larger initiative to accelerate drug discovery for Acanthamoeba infections. The resulting data will be integrated into the Repository of Amoeba Drug Activity Records (RADAR), the first open-source database for tracking and analyzing drug efficacy against Acanthamoeba strains in vitro.

Keywords:

Acanthamoeba; Rare Disease; Drug Discovery

Mentor(s):

Christopher Aaron Rice (Vet Med); Chayan Sharma (Vet Med); Kamana Thapa (Vet Med)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1017

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

Effect of Confederate Monuments on Public Spaces

Humanities

Authors(s):

Varda Vongai Coleman† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1018

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

The Hidden Cost of The Olympics

Business Case Study

Authors(s):

Tate James Compton† (DSB|JMHC); Lauren Jean Dumaresq† (DSB|JMHC); Swetha Hariram Maneri† (DSB)

Abstract:

The Olympic Games are designed to unite the world in celebration and competition—but for many host cities, that dream comes at a heavy cost. The Olympics may seem impressive and amazing, but they really are detrimental to many cities and their citizens. Cities often pour billions into new venues and infrastructure that shine for a few weeks, only to sit empty once the Games are over. This project explores a better way forward: a “no-build” Olympics, where the Games are hosted only in cities that already have the facilities they need. By looking at examples like Rio de Janeiro, Athens, Los Angeles, and Paris, this research shows how using existing infrastructure can make the Olympics more sustainable and less damaging to local communities. The goal is simple—to reimagine the Olympics as a global event that builds up cities and helps them develop instead of tearing them down.

Keywords:

Olympics; Economy; Impact; Financial

Mentor(s):

Steven R Dunlop (DSB); Saanvi Singh (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1019

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

Improved visual guides help new learners of grass morphology STEM

Authors(s):

Francis Willow Quinn Corvin† (Agriculture|JMHC)

Abstract:

Understanding grass morphology is essential for agronomy education and farmers' ability to use grass dichotomous keys, yet new learners often struggle to identify grass structures using traditional teaching graphics. This study evaluates the effectiveness of a newly developed visual guide designed to improve comprehension of grass morphology terms. Sixty adult participants will complete a short, hands-on identification activity using two instructional poster formats: a traditional set of diagrams and the new visual guide. Each participant will complete timed identification tasks with both materials, presented in counterbalanced order, followed by an anonymous Qualtrics survey assessing clarity, ease of use, and learning satisfaction. Timing and accuracy data will be compared using paired statistical tests to determine whether the new visual guide enhances learning efficiency. The results will inform future educational design for plant morphology instruction and support the development of more effective visual teaching tools in agronomy and related disciplines.

Keywords:

Agronomy; Grass; Morphology; Teaching; Learning

Mentor(s):

Laura Bowling (Agriculture)

Other Acknowledgement(s):

Keith Johnson (Agriculture)

Poster Presentation Abstract Number: 1020

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

Introduction to Laboratory Techniques STEM

Authors(s):

Vivian de Toledo Krainer† (Science|JMHC)

Abstract:

Laboratory techniques are fundamental to the application of chemistry, yet not all students enter college with prior hands-on experience. This experiment introduced students to essential laboratory practices used throughout the course, including preparation of solutions, serial dilutions, titrations, and data collection, aiming to bridge gaps in prior laboratory experience. Aqueous solutions of calcium chloride (CaCl_2) and sodium bicarbonate (NaHCO_3) were prepared to examine dissolution and temperature change using a digital temperature probe. The combination of these solutions results in formation of a gas and a precipitate. A serial dilution of the CaCl_2 solution was performed using volumetric pipettes and flasks to prepare standard solutions of known concentrations, which were then used in a colorimetric titration with standardized silver nitrate (AgNO_3) to determine chloride ion concentration. Additionally, cross-linking calcium ions with sodium alginate demonstrated how physical interactions change material properties without forming new substances. The experiment provided experience using essential laboratory glassware and equipment, including pipettes, flasks, and probes, while developing confidence in accurate measurement and safe handling. This procedure establishes a foundation of skills necessary for success in subsequent experiments.

Keywords:

General Chemistry; Chemistry Education; Laboratory; Experiment

Mentor(s):

Hannah Elise Starr (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1021

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

The Canopy at Purdue: A Sensory Green Roof for Well-Being and Sustainability STEM

Authors(s):

Emma Marie Deckert† (Agriculture); Emily Katherine Jackson‡ (Engineering); Emma Cate Bailey† (Liberal Arts)

Abstract:

Our project addresses the need for a sensory-immersive, year-round natural space on Purdue's campus, which is a deprivation throughout the harsh winters. We have designed "The Canopy", a four-season green roof on the balcony space of the Purdue Memorial Union (PMU). This project has transformed an under-utilized space into a dynamic sensory environment where students, staff, and visitors can interact with features such as sustainable vegetation and opportunities to engage with sight, sound, scent, and touch.

The Canopy integrates principles from LEED v4.1, WELL v2, and SITES to guide its sustainable and human-focused development. Our idea emphasizes biophilic elements such as native plants, textured greenery, aromatic herbs, and sound-inducing features such as trickling water. Our sustainable strategy includes rainwater harvesting, harsh weather-tolerant vegetation, and Cradle-to-Cradle certified building materials to maintain both environmental regenerative standards, as well as efficient operation.

Success is measured through various measurable outcomes, including stress reduction as indicated by pre- and post-surveys, frequency of space utilization, stormwater retention (L/m²), and biodiversity metrics, such as the species used and the vegetative area covered. The design prioritizes the inclusivity of all users through accessible pathways, ergonomic seating, and adaptable zones for a variety of uses, such as studying and/or relaxing.

Ultimately, The Canopy creates a multisensory environment that enhances well-being, fosters connection, and strengthens the bond between people and place. Merging ecological performance with human health, it transforms Purdue's infrastructure into a living symbol of the university's commitment to sustainability and student wellness.

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

Keywords:

Green Roof; Sustainability; Wellness; Biophilic; Sensory Stimulation

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1022

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

Pre- and Post- Exercise Cutaneous Temperatures STEM

Authors(s):

Allison Meckenzie Downey† (Agriculture); Lydia Ilene Price† (Agriculture|JMHC); Alivia J Meeks† (Agriculture); Alexis Rae Benson‡ (Agriculture); Delani J Henderson‡ (Agriculture); Megan Nicole Broecker* (Agriculture|JMHC); Taylor Caroline Anderson* (Agriculture)

Abstract:

The U.S. equine industry predominantly utilizes horses for their athletic abilities. Understanding the muscle physiology of the horses allows us to better predict, comprehend, and treat various injuries. Prior to exercise, the muscles are in a resting state with low activity, so to prevent injury, there should be a short ten to fifteen-minute warm-up time for these athletes to allow the muscle temperature and blood flow to increase. After extreme exercise, the muscles will experience fatigue, meaning horses should be provided with proper nutritional demands and stalling/turnout management to enhance muscle recovery. In our experiment, the cutaneous temperature of the gluteus, trapezoidal, and pectoral muscles, along with the rectal temperatures, were recorded pre- and post-exercise in five senior geldings. We hypothesize that there will be a significant difference in cutaneous and rectal temperature before and after exercise. Additionally, we hypothesize there will be increased temperatures of the pectoral muscles post-exercise when compared to cutaneous temperatures prior to exercise. These measurements were collected at similar times of day, and the outdoor temperature was recorded to limit variability. We will analyze our collected data to determine if there was a significant difference or not.

Keywords:

Temperature; Horses; Exercise

Mentor(s):

Casie S Bass (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1023

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

Measuring Levels of Ultrashort-chain Per- and Polyfluoroalkylated Substances in Blood Collection Tubes STEM

Authors(s):

Alina Marie Dziembowski† (Pharmacy|JMHC)

Abstract:

Per- and polyfluoroalkylated substances (PFAS) are highly persistent synthetic chemicals that are now ubiquitous in the environment. Due to PFAS stability leading to its environmental persistence, there is concern regarding potential long-term health effects as PFAS accumulation occurs in humans from dietary and inhalation exposure routes. Chronic exposure may lead to adverse effects such as fertility issues or liver damage. Although a wide range of PFAS have been found in human samples, specifically human serum, there remains data gaps for what PFAS are present in human blood. Recent innovation in detection technology has led to the ability to more accurately screen for ultrashort-chain PFAS levels in human samples. Combined with the current increase in ultrashort chain PFAS levels in the environment, detection and reporting of ultrashort-chain PFAS such as trifluoroacetic acid (TFA) have dramatically increased. However, studies on the potential background contamination of ultrashort chains from manufacturing processes or non-essential additives are limited compared to legacy PFAS. This study collected various tubes used for human blood sampling and tested each tube for background contamination of PFAS including TFA, the most challenging ultra-short chain. This study can provide guidance to future researchers on tube selection to minimize background contamination and more accurately gauge PFAS levels in human samples.

Keywords:

Serum; TFA; Human Samples; Contamination; Manufacturing

Mentor(s):

Youn jeong Choi (Agriculture); Linda S Lee (Agriculture); Daniel J Foti (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1024

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

Partners and paws: couples' perceptions of marital satisfaction and family functioning in military households with a PTSD service dog

Social Science

Authors(s):

Tatum Reese Ebbeskotte† (Science|JMHC)

Abstract:

Although prior research has explored how service dogs influence veterans' and spouses' perceptions of family functioning and marital satisfaction, little is known about how these perceptions align within couples. Therefore, this study compared the perceived levels of marital satisfaction and family functioning between veterans with service dogs for PTSD and their cohabitating partners. Veterans and their partners independently completed the McMaster Family Assessment Device (FAD) and the Kansas Marital Satisfaction Survey (KMSS). Couples were analyzed in dyads (N=20) using Pearson's correlation coefficient and matched pairs t-tests to investigate the level of alignment between veteran and partner responses within each dyad. Responses to KMSS indicated a moderate positive correlation between veterans' and partners' marital satisfaction. No significant differences were observed between partners' scores, indicating couples' perceptions of marital satisfaction were generally consistent between partners. In contrast, FAD general functioning analysis showed a weak negative association between veterans' and partners' perceived general family functioning, indicating a mismatch between partners' perceptions of how well the family functioned. In the FAD domain of problem solving, there was no observed correlation between veteran and partner perception, and there were no significant differences in veteran and partner perception. Collectively, these results indicate veterans and their partners held closely aligned views of their relationship, which may reflect resilience within their relationship despite broader challenges. Future research should explore how the implementation of a service dog for PTSD influences both veteran and partner perceptions and alignment of functioning and marital satisfaction.

Keywords:

Military Family; Animal-Assisted Intervention; Service Dog; Family Functioning; Marital Satisfaction

Mentor(s):

Leanne Nieforth (Vet Med); Emilie Mae MacInnis (Vet Med); Sarah Jean Reega (Vet Med)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1025

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

Indianapolis Zoo Consumer Behavior Project

Business Case Study

Authors(s):

Andee Michelle Elenbaum† (DSB); Sydney Lynn Williams† (DSB);
McKenna Rae Toltzman† (DSB); Kaitlin Rose Otto† (DSB)

Abstract:

The Indianapolis Zoo's Partner Ticket Program was established to make admission more affordable while fostering stronger relationships with local organizations. Through this program, employees of partner companies receive a 35–45% discount on tickets, and participation has grown steadily in recent years. However, despite this growth, projected e-ticketing revenue for 2025 has not met expectations.

This study investigates why an increase in account sign-ups has not translated into higher ticket sales and examines whether the issue lies in awareness, promotion, or consumer behavior. Using a mixed-method approach that combines sales data analysis with survey responses from partner employees, the research identifies key factors influencing purchasing decisions and program engagement.

Preliminary findings suggest that while awareness of the program is relatively high, limited internal promotion within partner organizations and a lack of urgency or perceived value may be constraining conversion rates. Additionally, many employees view the discount as a passive benefit rather than an active incentive, underscoring the need for stronger communication and behavioral triggers to drive participation.

Understanding these barriers will help the Indianapolis Zoo refine its outreach strategies, strengthen corporate partnerships, and better align its mission of affordability with sustainable revenue growth. More broadly, the findings provide valuable insights for nonprofit organizations seeking to balance accessibility goals with financial performance through data-informed marketing initiatives.

Keywords:

Marketing; Demographic; Campaign; Strategy

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1026

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

Noise-Reduction in SKNA Signal for Autonomic Dysreflexia Detection STEM

Authors(s):

Reed Stevens Elphinstone† (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, and can lead to symptoms including nausea, sweating, and heart rate changes. Symptoms will continue to escalate until the stimulus is removed, so early detection 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. SKNA is obtained by filtering electrocardiogram (ECG) data between 500–1000 Hz, yielding a millivolt-scale signal that is easily obscured by motion artifacts, muscle activity, and other interference. The objective of this study is to compare three noise-reduction techniques for collecting SKNA signals: (1) reference-based noise cancellation, using motion sensors placed near the electrodes to identify and reduce noise caused by body movement; (2) multichannel filtering, using multiple pairs of electrodes and finds the accurate SKNA signal by isolating the shared heart signal while discarding noise that differs across the different electrodes; and (3) wavelet decomposition, decomposing the signal into layers of different frequencies and removing any layers dominated by slow or high frequency interference. The methods will be evaluated using signal-to-noise ratio (SNR) during activities including rest, talking, and movement and the results will demonstrate optimal noise-reduction technique, enabling reliable SKNA burst detection for an AD detection algorithm and informing design choices for a wearable device in the future.

Keywords:

Wearable Device; Signal Processing; Autonomic Dysreflexia; Nervous System

Mentor(s):

Molly Noelle Dye (Engineering)

Other Acknowledgement(s):
Bradley S Duerstock (Engineering)

Poster Presentation Abstract Number: 1027

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

Self-healing concrete

Humanities

Authors(s):

Lukas Ryan Fishert (Engineering)

Abstract:

Cracks in concrete are detrimental to the strength, durability, load-bearing ability, and impermeability of concrete. (Golewski, 2023, 1). Failures in dams, levees, and spillways-such as the Orville Dam Spillway incident in 2017, which caused \$1 billion in damage- often all have cracked, weathered concrete as a contributing factor to their failure (Zhang, 2024, 2; Monroe, n.d.). Scientists have developed concrete that contains bacteria, and when those bacteria encounter water through cracks in the concrete, they precipitate calcite to fill those cracks (Olujinmi, 2023). This exploratory research investigates the potential usage of bacteria-based self-healing concrete as a superior alternative to traditional concrete. Specifically, the ability of Bacillus-infused concrete in flood control infrastructure is investigated.

This research was conducted through a review of peer-reviewed articles and popular articles. Additionally, Basilisk, a company that produces bacteria-based self-healing concrete, was also analyzed. A synthesis of these sources denoted greater durability and water impermeability, as well as reduced maintenance, to be key benefits. A higher upfront cost and limited large-scale implementation were often listed as the greatest causes of concern. The findings from this research can contribute to the implementation of bacteria-based self-healing concrete into modern infrastructure. This implementation has the potential to be economically beneficial and save many lives.

Keywords:

Flooding; Civil Engineering; Infrastructure; Water; Concrete

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1028

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

Generation of Chimeric Platforms for the Structural Study of HCV Envelope Glycoproteins STEM

Authors(s):

Colton Joseph Forrest† (Science)

Abstract:

Hepatitis C virus (HCV) infects 50 million people worldwide, with one million new cases each year. Often asymptomatic, HCV infections can go unnoticed and develop into chronic issues like liver cirrhosis. HCV is part of the Flaviviridae family and the Hepacivirus genus, with a positive-sense RNA genome about 9.6 kilobases long. The lipoviral nature of HCV, the difficulty of growing it in culture, and the heterogeneity of the virions make understanding its structure challenging. Although structural details about the virion glycoproteins are known, the oligomeric organization and molecular assembly of the glycoproteins on the virion surface remain unclear. In this study, we created a chimeric platform that we believe will help clarify how the HCV E1–E2 glycoproteins organize on the virion surface. We leveraged the ability of Sindbis virus (SINV) to assemble at the plasma membrane to develop an HCV–SINV chimera, replacing the ectodomains of SINV E2 and E1 proteins with those of HCV E1 and E2, respectively. Additionally, the SINV 6K protein was swapped with the HCV P7 protein. In a separate construct, we added a reporter tag (mCherry) at the N-terminus of E2 to track infection and measure particle production. We believe this chimeric platform will enable the E1–E2 proteins to oligomerize, be transported to the plasma membrane, and be incorporated into budding particles. We plan to verify the construct using various biochemical tests to confirm expression of HCV E1–E2 glycoproteins and evaluate their ability to infect Huh7.5 cells of liver origin.

Keywords:

Hepatitis; Sindbis; Glycoproteins; Chimera; Structural Study

Mentor(s):

Richard J Kuhn (Science); Shishir Poudyal (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1029

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

**Characterization of liquid sprays in a micro injector
STEM**

Authors(s):

Antoine Matis Fradet† (Engineering|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Daniel Robert Guildenbecher (Engineering); Amogh Gajanan Natu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1030

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

Does usage of a probiotic influence measurable changes of equine Coronavirus (ECoV), Clostridium A, and Clostridium B? STEM

Authors(s):

Sydney Rose Frost† (Agriculture); Hannah Irma Reyes Charles† (Agriculture|JMHC); Madalyn Marie Molnar‡ (Agriculture); Haleigh Alexandra Tussinger‡ (Agriculture); Megan Nicole Broecker* (Agriculture|JMHC); Taylor Caroline Anderson* (Agriculture)

Abstract:

The gastrointestinal microbiome plays an important role in equine health, impacting digestion, immunity, and resistance to enteric diseases. Horses are susceptible to microbial imbalances that can be caused by stress, dietary changes, antibiotics, or even environmental factors. Imbalances in the microbiome can lead to issues such as colic, diarrhea, and an overall decrease in performance. Two pathogens associated with equine enteric diseases are Equine coronavirus (ECoV) and Clostridium difficile toxins A and B. ECoV is a viral infection that causes fever, anorexia and lethargy, which often lead to gastrointestinal inflammation. C. difficile toxins A and B damage intestinal cells and can lead to colitis and diarrhea in horses. Probiotic supplementation may be one strategy to promote a healthy gut microbiome in horses. Probiotics introduce beneficial microorganisms that improve fiber fermentation, can strengthen the gut barrier, and suppress the growth of pathogenic bacteria. In this study, five geldings were given one pound of ration balancer once a day with no probiotic supplementation for three weeks. Then, each horse was provided the recommended dose of two scoops of ProElite Gutbiome probiotic supplementation with one pound of ration balancer once a day for three weeks. Manure was collected and tested for various enteric diseases, and the results showed that all five geldings were negative for Clostridium difficile A, Clostridium difficile B, and Equine coronavirus. Additional research is necessary to better understand how probiotics influence equine gut health and to provide clear, evidence-based recommendations for horse owners and veterinarians.

Keywords:

Probiotics; Health; Horses

Mentor(s):

Casie S Bass (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1031

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

Strategic Marketing Plan for Millies Thrift Store

Business Case Study

Authors(s):

Gabriel Jonathan Fryling† (DSB); Naviin Ruban Siva† (DSB|JMHC); Rohan Cheng Hsiao† (DSB); Mbissane Latyr Ndir† (DSB); Amin ur Rehman Sheikh‡ (DSB)

Abstract:

The purpose of this project is to develop a strategic marketing plan for Millie's Thrift Store

focused on expanding Millie's reach among younger consumers in the Lafayette area,

particularly high school and college students. As a community-driven nonprofit, Millie's faces

growing competition from larger thrift organizations such as Goodwill and Salvation Army. This

study aims to identify effective ways to enhance Millie's visibility, engagement, and brand appeal

through creative and data-informed marketing strategies that align with its mission and values.

Our team will conduct both primary and secondary market research to understand Millie's

current positioning and its audience's preferences. We plan to distribute surveys across Purdue

University's campus to capture insights on student perceptions, habits, and digital engagement

patterns. Additionally, we will analyze the competitive landscape of local thrift stores. This

analysis will guide our development of promotional initiatives catered to a younger and

tech-savvy audience.

The project will deliver a detailed assessment of Millie's marketing opportunities and propose

creative strategies to increase awareness and drive foot traffic among younger consumers.

Visual collateral specialized for social media marketing will be utilized to attract a younger

audience that is prone to online marketing.

By adopting a youth-oriented marketing strategy, Millie's Thrift Store can strengthen brand

identity, build long-term customer relationships, and ensure sustainable growth while remaining

rooted in its community focused mission. The project will serve as a roadmap for how small

nonprofits can compete effectively in an increasingly digital driven retail environment.

Keywords:

Thrift Store; Marketing; Case Study

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1032

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

Datacenter Network Accelerator: Software Simulation and Verification STEM

Authors(s):

Mridulla Ganesh† (Engineering); Soumil Verma† (Engineering); Aditya Hegde† (Engineering)

Abstract:

Modern datacenter networks are being used increasingly for large-scale AI training, which requires low-latency, high-throughput data movement to support distributed computations across thousands of GPUs. Network Interface Cards (NICs) enable communication by handling packet processing, offloading network functions, and interfacing the end hosts with the network. Training AI workloads involves constant synchronization of model parameters and gradients, creating significant data overhead.

Our team is developing a Smart Remote Memory NIC that supports Remote Direct Memory Access (RDMA) to accelerate memory reads and writes between devices in a datacenter. This NIC builds on the StRoM architecture, which introduced a programmable FPGA-based NIC that offloads computation tasks from the CPU.

Validation is a critical part of our development process, however, existing verification methods depend on testing with FPGA hardware, which is expensive, time-consuming and complicated to set up. To address this limitation, we propose a lightweight Python-based verification framework that models the RTL design of the NIC and replicates the behavior of the FPGA system. This simulation environment allows us to test the design's functionality before hardware deployment and can also act as a secondary server to generate realistic workloads and communicate with the original design. This framework allows for rapid iteration, reduced reliance on physical hardware and increased confidence in the correctness of our design.

Keywords:

Datacenter Networks; RTL Design Verification; Network Interface Card (NIC); Network Architecture

Mentor(s):

Rishikesh Reddy Bathina (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1033

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

Rebuilding trust in science: Effective strategies to combat vaccine-hesitancy.

Humanities

Authors(s):

Adriana Isabel Garcia† (HHS)

Abstract:

Vaccine hesitancy, caused by misinformation and growing anti-science attitudes, has become a major issue in public health. Online misinformation has been shown to deepen fear and distrust of vaccines and, consequently, science; especially to those who rely on social media for health guidance or already feel skeptical towards medicine. Psychological research shows how different populations and people's emotions can play a factor in how they respond to vaccine campaigns. In this exploratory research project, I analyze existing studies and data to identify which solutions are most effective in reducing vaccine hesitancy and how these interventions affect different groups of people. The focus of this research is on comparing strategies like educational campaigns, community engagement, emotional approaches, and trust-building communication methods. To investigate these potential solutions, I reviewed different studies, peer-reviewed articles, and medical journal publications, which included interviews with well-known doctors, campaigns, psychological factors, surveys, etc. The findings contribute to how targeted communication and transparency can help reduce vaccine hesitancy across different populations. This research highlights the importance of rebuilding trust in science to improve public health. It highlights the need for different communication strategies to strengthen confidence in vaccines for future generations.

Keywords:

Vaccine-Hesitancy; Anti-Science; Strategies

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1034

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

An In-depth Look at High-Speed High-Accuracy Pipelined ADCs STEM

Authors(s):

Thomas Allen Greer† (Engineering); Chao Min Chung† (Engineering);
Erik Kocinare† (Engineering); Emma Lynn Stump‡ (Engineering);
Mohamed Mostafa Hassan‡ (Engineering)

Abstract:

Pipelined Analog-to-Digital Converters (ADCs) are widely used in applications requiring both high resolution and high sampling rates, such as communication systems, image sensors, and instrumentation. The pipelined architecture divides the conversion process into multiple stages, each resolving a small portion of the digital output and passing the residue to the next stage for further refinement. This stage-by-stage conversion enables high throughput while maintaining good accuracy and power efficiency. The performance of a pipelined ADC depends strongly on the precision of its sub-ADCs, sub-DACs, and residue amplifiers, as well as the accuracy of interstage gain. Non-idealities such as capacitor mismatch, finite op-amp gain, and comparator offset can significantly degrade overall linearity and effective number of bits (ENOB).

The proposed design will be implemented using TSMC's 180 nm CMOS Process Design Kit, targeting 12-bit resolution and a 400 MS/s sampling rate. The system operates at a 1.8 V supply voltage with an estimated power consumption of 400 mW and a total core area of 1 mm². Each stage employs a 3-bit flash sub-ADC and a 3-bit capacitor-to-capacitor (C2C) sub-DAC, supported by a custom digital timing and correction block to enhance accuracy and throughput. This research focuses on optimizing stage-level gain, power efficiency, and linearity to achieve a robust, high-speed ADC suitable for modern mixed-signal SoC applications.

Keywords:

ADC; Semiconductors; Chip; Virtuoso; System-on-Chip

Mentor(s):

Seyedehmarzieh Rouhani (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1035

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

Ring Modulator as a Temperature Sensor

STEM

Authors(s):

Anthony Edward Gurrieri† (Engineering); Brandon Anthony Farbert (Engineering|JMHC)

Abstract:

This project is a ring modulator used as a temperature sensor. We measure the performance of the modulator based on the use of different materials such as Silicon and Silicon Nitride. We will evaluate the operation of different materials, and observe the wavelength shifts which occur with changing temperature. The performance of the modulator will be measured using the quality factor, free spectral range (FSR). Applications, such as thermal stabilization for better on-chip performance will be explored.

Keywords:

[no keywords provided]

Mentor(s):

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1036

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

Design of a Humanoid Robotic Hand for Enhanced Dexterity STEM

Authors(s):

Seungho Han† (Engineering); Leah Ye Eun Tak† (Engineering); Ruby Eskinier Woudneh† (Engineering); Jonathan Joseph Johnson† (Engineering); Saran Nicole Wagner‡ (Engineering); Veronica Ruan-an Cheng‡ (Engineering); Elijah Francis Guison-Dowdy‡ (Engineering); Yonathan Gur‡ (Engineering); Michael Borokhov‡ (Engineering)

Abstract:

Humanoid robotics requires precise manipulation capabilities to perform tasks similar to human hands. This project focuses on the design, modeling, and electrical/embedded architecture of a humanoid robotic hand with multiple degrees of freedom, aiming to improve dexterity and responsiveness through low-latency per-finger loops and synchronized grasp actuation. The hand is constructed using lightweight materials and actuated with servo motors, allowing for individual finger articulation and coordinated grasping motions. Key design considerations included joint alignment, torque optimization, and ergonomic motion patterns inspired by human anatomy. To inform the motor-driver, sensing, and power strategy, we surveyed existing humanoid robotic hand designs and advancements in robotic grasping algorithms. The hand is being evaluated through simulations, with preliminary results indicating stable grasping of objects of varying sizes and shapes; early prototype trials are planned. This research contributes to understanding mechanical and computational strategies for humanoid manipulation, with potential applications in prosthetics, human-robot interaction, and automation in delicate tasks. Future work will integrate fingertip tactile/force sensing and optimize driver/power electronics for higher efficiency and faster response.

Keywords:

Humanoid Robot

Mentor(s):

Jaeeun Kim (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1037

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

The Future of Wildcat Creek Winery

Business Case Study

Authors(s):

Morgan E Henry† (DSB); Sean Andrew Friddle† (DSB); Christopher Charles Rubright† (DSB); Kathleen Marie Soedel† (DSB); Mallory Kate Rupp‡ (DSB); Madeeha Sadiq‡ (DSB)

Abstract:

Wildcat Creek Winery is currently facing limited local visibility in the Lafayette/West Lafayette area, despite their offering recurring and seasonal events. We believe this visibility challenge stems from a deeper strategic issue: the winery lacks a clearly defined positioning strategy and value proposition that resonates with their local target consumers. Without a clear insight into who the consumers are and what motivates or prevents them from visiting, marketing efforts risk being ineffective. Our study will address this challenge by identifying and profiling the winery's key consumer segments. Understanding consumer motivations, barriers, and perceptions that influence winery engagement, discovering how Wildcat Creek Winery can best position itself and articulate a compelling value proposition to increase awareness, and also providing actionable recommendations for marketing strategies that align with this positioning, including guidance on product launches and event promotions.

To achieve these objectives, we will apply consumer behavior frameworks to analyze consumer attitudes, decision-making processes, and engagement drivers. Our research methods will include survey interviews, secondary data analysis, and small-scale marketing tests. Our expected results will identify issues with the current business model and identify consumer profile. Utilizing these insights, we will recommend a clear positioning strategy for Wildcat Creek Winery and implement evidence-based marketing tactics to strengthen its visibility and appeal to target consumers.

Keywords:

Winery; Case Study; Consumer Behavior; Marketing

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1038

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

Erik Erikson's Eight Stages of Development and their Importance in Family

Social Science

Authors(s):

Jackson James Hoeset† (HHS)

Abstract:

This project discusses the eight stages of psychological development and how a family might use them to change how they care for their children. These stages are important because they highlight the key elements a child needs to fully develop socially and mentally. The first few stages will be the most highlighted in this project, because if these stages are not realized, they can significantly affect a child's development. The project uses a plethora of scientific articles that are medically approved by credible doctors or psychologists. After using diverse sources, it was revealed that even something that might not seem ideal for a young child to do may be vital for their growth. As an aspiring future psychologist, this research can be used to help future patients who are struggling with child growth, whether they are the child or the parents of a child. This research can be important not only to psychologists but also to future parents. This topic should continue to be researched in the future for this reason. For parents, this research can be extremely helpful if they feel uncertain about how to support their child's development.

Keywords:

[no keywords provided]

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1039

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

US Hypersonic Weapons Policy and Appropriate Responses Humanities

Authors(s):

Gary Huang† (Engineering)

Abstract:

Hypersonic (Mach 5+) weapons are a major point of contention in Congress and the defense industry. Proponents argue that the rise of foreign hypersonic threats necessitates increased investment in US hypersonic capabilities, whereas opponents emphasize the dangers that hypersonic weapons pose to strategic stability (Wilkening, 2019, 132). This exploratory research project examines the debate on appropriate hypersonic weapons policy to offer a direction as to how the US should approach hypersonic capabilities. To investigate this issue, I conduct secondary research and analyze recent (within the past year) Congressional reports to establish the current environment surrounding the discussion of US hypersonic weapons policy. By exploring how each argument applies to the current international hypersonic environment, I determine the appropriate course of action that the US should pursue with regards to its hypersonic capabilities.

Keywords:

Hypersonic; Weapons Policy

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1040

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

Phonological Memory Abilities of Preschool-Aged Children With and Without Developmental Speech and Language Disorders STEM

Authors(s):

Kierstyn Carolina Hubbard† (HHS); Megan J Copeland‡ (HHS)

Abstract:

Purpose: We assessed the phonological memory skills of preschoolers to investigate if their language and phonological abilities are related to the type and quantity of errors produced on a nonword repetition test.

Methods: Fifty-four monolingual English-speaking preschool-aged children completed standardized speech and language assessments, including the Syllable Repetition Task (SRT), a nonword repetition test. Participants were classified in one of three groups: (1) typical speech and language development (TD), (2) speech sound disorder (SSD), or (3) both SSD and developmental language disorder (DLD). Accuracy-based performance on the SRT was analyzed by group, assessing rate of errors produced among varied lengths of nonwords (two, three, or four syllables). In addition, we assessed whether syllable order in nonwords impacted quantity and type of errors produced by the participants.

Conclusions: Children with SSD+DLD produced the most errors in repetition of nonword stimuli and produced substantially more errors on third-syllable consonants in four-syllable nonwords than both the TD and SSD group. Additionally, SSD+DLD children produced both consonant and vowel errors during the SRT, while the TD and SSD group only made consonant errors.

Implications: Clinicians should consider utilizing the SRT with preschoolers to assist in identifying language and phonological difficulties in children who have limited intelligibility.

Funding: This research was supported by the National Institute on Deafness and Other Communication Disorders (NIDCD) under Award Number R21DC016142 granted to Françoise Brosseau-Lapré.

Keywords:

Child Speech; Child Language; Nonword Repetition; Phonological Memory

Mentor(s):

Francoise Brosseau-Lapre (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1041

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

High-Optical-Depth Cold Atom Ensemble for Narrowband Entangled Photon Generation STEM

Authors(s):

Ian William Jack† (Engineering|JMHC); Stephen Feiyang Wang‡
(Engineering)

Abstract:

This project aims to generate narrowband entangled photon sources as building blocks for quantum networks and quantum computing. We use spontaneous four-wave mixing (SFWM) in cold atomic ensembles to produce momentum-entangled photon pairs, which are later converted into polarization entanglement using waveplates and beam displacers. The SFWM process inherently features an embedded electromagnetically induced transparency (EIT) structure, which enhances nonlinear interaction efficiency, increases photon-pair generation rate, and enables narrow-bandwidth photon pairs.

A high optical depth (OD) atomic ensemble is crucial since both photon-pair generation rate and coherence time scale proportionally with OD. In our setup, a two-dimensional dark-line magneto-optical trap (MOT) cools and traps 87Rb atoms, serving as the nonlinear medium. OD is determined by atomic density and ensemble length. By removing the magnetic field gradient along the z-axis, the atomic cloud elongates, increasing the interaction length and thus OD.

To raise atomic density, a dark-line repump beam is applied to reduce atom reheating caused by fluorescence scattering from the trapping beams. In addition, depopulation and decoupling optical pumping techniques efficiently transfer atoms to the desired ground state. With these optimizations, we achieve $OD = 154$, corresponding to more than 108 atoms within an ensemble of 1.7 cm length and 400 μm width, providing a high-quality medium for efficient, narrowband entangled photon generation.

Keywords:

Entangled Photon Source; Magneto-Optical Trap (MOT); Optical Depth (OD); Spontaneous Four Wave Mixing (SFWM)

Mentor(s):

Xuanying Lai (Science); Christopher Hou Li (Science); Shengwang Du (Engineering)

Other Acknowledgement(s):

Adi Bhatnagar (Engineering)

Poster Presentation Abstract Number: 1042

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

Advancing Gesture-Based Instructional Videos for Statistical Learning: From Design to Experimental Testing STEM

Authors(s):

Zhengyi Jiang† (Science)

Abstract:

Statistical learning is a central component of STEM education, yet students frequently experience challenges in grasping abstract topics such as central tendency, variability, and regression. Traditional instructional methods often rely heavily on symbolic or textual explanations, which may fail to promote deep conceptual understanding. Research in embodied cognition suggests that gestures can serve as cognitive tools that bridge the gap between abstract reasoning and intuitive experience. By pairing spoken language with physical representations, gestures can make invisible ideas visible by enhancing both engagement and comprehension. This research builds upon previous research progress, which focused on designing gesture-based instructional videos for statistics learning. Spontaneous gestures were collected, identified and categorized using McNeill's representational gesture framework, and then formed the foundation for a series of intentionally designed gestures aligned with key statistical concepts. These gestures were produced by collaboration with University of Illinois and Purdue Envision Center, and will then be embedded into prototype instructional videos through professional post-production techniques, including green-screen keying, background compositing, and audio equalization. The fall phase also expands this design into a testing framework through a randomized controlled trial (RCT). The trial aims to empirically evaluate how gesture-augmented videos influence learners' conceptual understanding by doing interviews with pre and post-tests. Ultimately, this project bridges cognitive science and educational technology by transforming embodied learning into applicable instructional design. Through systematic testing and iterative refinement, the work seeks to establish empirically grounded design for integrating gestures into multimedia instruction for interactive educational tools that enhance statistical reasoning.

Keywords:

Embodied Cognition; Statistical Learning; Video Production; Randomized Controlled Trial (RCT); Data Collection

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

Mentor(s):

Jason Wade Morpew (Engineering); Junior Anthony Bennett
(Interdisciplinary & Special Programs)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1043

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

Investigation of the Cloud-Nucleating Properties of Atmospheric Microplastics (AMPs) STEM

Authors(s):

Frances Geraldine Johnson† (Science)

Abstract:

Atmospheric microplastics (AMPs), synthetic airborne pollutants, are emerging as a new class of aerosols with potential impacts on cloud formation, weather, and climate. These ubiquitous particles can originate from both primary (manufactured) and secondary (fragmented) sources and exhibit wide variation in size, shape, and chemical composition. Although typically hydrophobic and not traditionally considered effective agents of cloud nucleation, recent evidence suggests that AMPs may act as ice-nucleating particles (INPs) and cloud condensation nuclei (CCN) under certain conditions. Once in the atmosphere, AMPs change through photolysis, oxidation, and other weathering processes that alter their chemical and physical properties, potentially enhancing their ability to interact with water vapor and initiate cloud droplet or ice crystal formation. To investigate the impact of these changes, we will make use of the Spectrometer for Ice Nucleation (SPIN) and Cloud Condensation Chamber (CCN) to observe the ice-nucleating and cloud-condensing ability of pristine (unaged) MPs compared to MPs that have been subjected to controlled atmospheric aging through ozone and UV treatments. This investigation will allow us to directly assess how chemical and structural changes impact AMP cloud-nucleating activity under simulated atmospheric conditions. Examining how aging influences AMP behavior in clouds will provide valuable insight into the role of microplastics in aerosol-cloud-climate interactions, and contribute to a broader understanding of how AMPs may influence precipitation, cloud radiative properties, and climate processes.

Keywords:

Atmospheric Microplastics; Atmospheric Aging; Ice-Nucleating; Cloud-Condensing; Aerosol-Cloud-Climate Interactions

Mentor(s):

Alexandria Vincenza Johnson (Science); Gouri Gouri Prabhakar (Science)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1044

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

Engineering the Next-Generation Cereal Bag: Enhancing Cellulose Nanofiber Films with Protein Additives for Fully Biodegradable Packaging STEM

Authors(s):

Emily R Jones† (Engineering)

Abstract:

Single-use plastics are a common source of waste generated by everyday consumption. Americans consume, in cereal bags alone, up to enough plastic film to cover a football field about 264,000 times each year. This project provides an effective alternative solution for biodegradable packaging using cellulose nanofibers (CNF). The goal of this experiment was to increase CNF's film barrier properties while maintaining the mechanical strength by comparing the addition of three biodegradable additives: starch, whey protein, and soy protein. These cast films were then characterized by Water Vapor Transmission Rate (WVTR), Water Vapor Permeability (WVP), and tensile testing. To make a cereal bag equivalent film, the cast CNF films were laminated between Poly(butylene succinate-co-adipate) (PBSA), which is a biodegradable film, making this multi-layered film entirely biodegradable. The results showed that the film with whey protein had the lowest WVTR at 888 g / day / m². The soy protein film had the smallest WVP of 46,660 g ? m / m² ? day ? kPa. The whey protein had a lower WVTR than soy protein but a higher WVP, this is due to the WVP being normalized by thickness of the film in comparison to WVTR. Both whey and soy protein formulations delivered the highest ultimate tensile strength of about 70 MPa. By comparison, the starch additive was not advantageous for the transmission rate, permeability, and the mechanical strength properties. This research establishes the CNF-protein formulation necessary for laminating with PBSA to create multi-layered, high-performance, and sustainable packaging film capable of serving as a realistic substitute for conventional plastic cereal bags.

Keywords:

Cellulose Nanofibers (CNF); Biodegradable Packaging; Protein Additives; Water Vapor Transmission Rate (WVTR); Cereal Bag

Mentor(s):

Jeffrey P Youngblood (Engineering); Yirou Wang (Engineering); Darien Anders Dewar (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1045

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

A Comparative Analysis of Quanvolutional and Classical Neural Networks for Natural Disaster Image Classification STEM

Authors(s):

Sanjith Jothi Bala† (Science); Nikhil Sai Kodali† (Science); Gechun Guo† (Science)

Abstract:

Quantum Machine Learning offers a new paradigm in data analysis in domains where classical methods face limitations. This study investigates the efficacy of a hybrid quantum-classical machine learning model, the Quanvolutional Neural Network (QCNN), for the classification of natural disaster imagery. Implementing the PennyLane library, our model employs quantum circuits which are used to extract various features from a public Kaggle dataset. The central objective is to robustly benchmark the performance of the QCNN against a standard classical CNN. We hypothesize that the quantum layers from the hybrid model will extract complex image features inaccessible to classical filters, leading to an increase in classification accuracy or similar performance to the CNN with fewer parameters. We aim to use this information to further clarify the advantages that quantum machine learning models have in real world applications.

Keywords:

Quantum Machine Learning; Quanvolutional Neural Network; Image Classification; Hybrid Quantum-Classical Model; Natural Disaster Imagery

Mentor(s):

Andreas Jung (Science); Noah Charles Singer (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1046

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

Evidence of Possible Bystander Effects after Grid Radiation Therapy in Vitro STEM

Authors(s):

Pia Kapur† (HHS|JMHC)

Abstract:

The purpose of this study was to investigate the effects of spatially fractionated radiation therapy (SFRT) grids on mammary cancer cells (4T1) in vitro and determine which of these grids is the most effective at inhibiting cell proliferation. This study tested two grids: a single pillar grid, which had a total area of 50.27 mm and a 20 pillar grid with a total area of 40.21 mm. The study utilized multiple growth inhibition assays, which required culturing 4T1 cells, irradiating them with 2 gray and 8 gray radiation – with and without the SFRT grids – and counting them at two different time points. There was an average 21.4% and 1.19% decrease from the expected growth rate for the single pillar grid with 2 gray radiation and 8 gray radiation respectively. For the 20 pillar grid, there was an average 51.1% and 42.2% decrease from the expected growth rate for cells treated with 2 gray and 8 gray radiation respectively. Overall, the 20 pillar grid seemed to show more evidence of bystander effects than the single pillar grid. This study implies that SFRT grids may induce some bystander effects in 4T1 cells due to the deviation from the expected growth rates. These findings contribute to a better understanding of how a non-uniform radiation dose influences tumor cell response and highlight the potential of SFRT as a strategy for optimizing therapeutic outcomes in cancer radiotherapy.

Keywords:

In vitro; Growth Inhibition Assay; Pillar; Radiation; Whole Beam

Mentor(s):

Matthew Louis Scarpelli (HHS)

Other Acknowledgement(s):

MacKenzie Rachelle Coon (HHS); Jessica Leigh Veenstra (HHS)

Poster Presentation Abstract Number: 1047

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

Boiler Dining Image and Evaluation Tracker (DIET)

STEM

Authors(s):

Simarleen Kaur† (Engineering); Arnav Chandra Singh‡ (Science); Kriti Kishan Nandakumar‡ (Engineering); Sannidhi Agarwal‡ (Science); Aahana Dahiya‡ (Engineering)

Abstract:

Many adults today struggle to accurately track the nutritional content of their meals due to time constraints, lack of nutritional knowledge, and the inconvenience of manual logging. Addressing this issue will lead individuals to make more informed dietary decisions and promote healthier lifestyles. Through our work, we present an intelligent dietary tracking application that generates nutritional information from user-uploaded meal images automatically. The app leverages computer vision and Purdue's dining court data, to identify foods, estimate portion sizes, and provide nutritional values. Through the connection of a mobile-based user interface with a data inference pipeline, this system applies advanced dietary assessment research to practical use, fostering nutritional awareness and healthier eating habits among the students and staff of Purdue University.

Keywords:

Computer Vision; Nutrition Tracking; Image Processing; Mobile Application; Machine Intelligence

Mentor(s):

Fengqing Zhu (Engineering); Carla Zoltowski (Engineering); Soudabeh Taghian Dinani (Engineering); Edward J Delp (Engineering); Siddeshwar Raghavan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1048

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

Activation Energy of Electronic Conduction in p-type Tin Oxide STEM

Authors(s):

Dillon Brennan Kay† (Polytechnic)

Abstract:

P-type SnOx ($1 < x < 2$) is a promising oxide semiconductor for displays, chemical sensors, and oxide-based bipolar applications like p-n junctions and logic devices. However, the development of p-type oxide electronics is severely hindered by difficulty in achieving stable p-type conductivity, limited understanding of carrier transport mechanisms, and lack of reliable temperature-dependent electrical performance.

Particularly, activation energy for charge carrier conduction in SnOx remains insufficiently characterized, limiting rational design of high-performance devices. Previous studies reported inconsistent electrical properties, and most are conducted only at room temperature or in limited environments, making it difficult to decouple intrinsic carrier activation from surface adsorption or extrinsic doping effects.

Consequently, the fundamental activation behavior of charge carriers in p-type SnOx is still unclear. In this work, SnOx thin films were fabricated using dc magnetron sputtering followed by controlled annealing.

Electronic properties of the films were systematically investigated by measuring conductivity across a wide temperature range (up to 245 °C) under air ambient conditions. The temperature-dependent conductivity data were used to construct an Arrhenius plot and extract the activation energy associated with charge carrier conduction. This activation energy provides direct insight into the dominant carrier transport mechanism in p-type SnOx. The extracted activation energy establishes a quantitative reference for intrinsic carrier promotion in p-type SnOx and can be compared with future conductivity measurements under different atmospheres (e.g., oxygen-rich, reducing, inert) to distinguish intrinsic and extrinsic effects. These findings lay the groundwork for rational defect engineering and improved control of p-type conduction in oxide electronics.

Keywords:

Oxide Semiconductors; P-Type Oxides; SnO; Charge Conduction; Activation Energy

Mentor(s):

Sunghwan Lee (Polytechnic)

Other Acknowledgement(s):

Yuxuan Zhang (Polytechnic)

Poster Presentation Abstract Number: 1049

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

Manganese (Mn) doped bone equivalent phantoms for in vivo neutron activation analysis STEM

Authors(s):

Anna G. Klupshast† (Science)

Abstract:

Creating bone-equivalent phantoms doped with fixed amounts of interest elements is essential for accurately quantifying trace elements such as manganese (Mn) and other toxic heavy metals in human bone using in vivo neutron activation analysis (NAA). Bone phantoms serve as calibration standards that mimic the elemental composition and density of real bone for interpretation of NAA spectra. To achieve bone equivalence, calcium sulfate (CaSO_4) is selected as the primary material due to its similarity to human bone. However, chemical impurities in commercially available CaSO_4 can introduce unwanted trace elements which complicate calibration and spectral analysis. The goal of this project is to create a set of Mn-doped bone equivalent phantoms with minimal Mn contamination. Different grades of CaSO_4 with various purities were compared. Trace element analyses showed that lower-purity samples contained significant concentrations of additional metals, including Mn, while high-purity CaSO_4 minimized spectral contamination. Based on these findings, 99.9% pure CaSO_4 was selected for the new series of Mn-doped bone-equivalent phantoms. These phantoms are expected to improve measurement accuracy in NAA studies, enabling more reliable assessment of Mn in human bone in vivo.

Keywords:

Bone Phantoms; In Vivo Neutron Activation Analysis; Toxic Heavy Metals; Calcium Sulfate; Mn-Doped Bone Equivalent Phantoms

Mentor(s):

Linda Nie (HHS); Majid Khorsandi (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1050

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

Determinants of Sugar Concentrations in the Foods of Wild Chimpanzees: Does drying technique matter?

Social Science

Authors(s):

Macey Marie Kochert† (HHS)

Abstract:

Food nutritional composition is a determinant of foraging behavior in wild chimpanzees, but collecting food samples in remote locations without laboratory infrastructure creates challenges for accurately quantifying nutrient concentrations. In this study, we focus on assessing the potential effect of different field drying techniques used to preserve plant food samples prior to sugar analysis. Field drying as a method of nutrient preservation is widely used, but techniques vary within this method and comparisons of such techniques are not well understood. We compared sugar concentrations of wild food (e.g., fruits, leaves, flowers) samples that varied in drying technique between different field seasons. Food samples were collected fresh and brought back to camp the same day to be measured and dried. Samples were dried in either a gas oven, a solar dehydrator, or an electric dehydrator, and all were operated at a low controlled temperature (<50 °C). Field dried samples were brought back to the United States and analysed for sugar concentration using the phenol-sulfuric acid assay. We are currently comparing sugar concentrations across drying techniques. This study quantifies sugar concentrations to estimate sugar intake and food selection in wild chimpanzees, and more broadly, informs field methodologies in primate nutritional ecology.

Keywords:

Anthropology; Nutritional Ecology; Drying Techniques; Sugar Concentrations

Mentor(s):

Stacy Lindshield (Liberal Arts)

Other Acknowledgement(s):

Patricia A Jaynes (Agriculture)

Poster Presentation Abstract Number: 1051

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

Optimization of In Vitro Fecal Fermentation

STEM

Authors(s):

Norah Riley Kopolow† (Science); Yara Zaidoun Hijaz† (Science|JMHC);
Lea Camille Vojslavsek† (Science)

Abstract:

In vitro fecal fermentation simulates gut fermentation processes in a controlled environment which can help to analyze gut microbiome responses. In vitro fermentation preparation is a time-consuming process, as fecal samples sit for long periods of time before being added to the experiment. The aim of this project is to evaluate the efficacy of different in vitro preparation methods, and to determine whether the variations in sample preparation affect fermentation kinetics: gas and pH. The method of preparing in vitro tubes involves adding carbon sources, fortified buffer and inoculation with donor fecal bacteria before capping and sealing tubes in an anaerobic environment. Fermentation kinetics were measured at hours 2, 4, and 6. To optimize time, tubes were prepared in anaerobic conditions and placed in a refrigerator overnight before receiving a donor sample. Once the donor sample was received, the sample was immediately diluted and injected into the sealed tubes using a 1mL syringe and fermentation kinetics were measured. Different carbon sources that were used in this experiment were wheat arabinoxylan, inulin, resistant maltodextrin, resistant starch, and wheat bran. Across all substrates, both preparation methods showed a similar decline in pH and an increase in gas over time, indicating overall comparable activity. Arabinoxylan and inulin showed the steepest decreases in pH, whereas wheat bran and resistant maltodextrin showed a more gradual decrease. No significant difference was observed between preparation methods. Identifying these patterns gives valuable insight into optimizing in vitro fermentation protocols for future studies.

Keywords:

Microbiome; Dietary Fiber; Fermentation

Mentor(s):

Stephen R Lindemann (Agriculture); Mariana Guzman Sanchez (HHS)

Other Acknowledgement(s):

Denisse Victoria Gutierrez Pionce (Agriculture); Giorgia Rutigliani (HHS)

Poster Presentation Abstract Number: 1052

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

**Comparing Wildlife Diversity and Activity in Wetlands and
Floodplain Habitat in North Western Indiana
STEM**

Authors(s):

Lukas Benjamin Kraft† (Agriculture|Engineering|JMHC); Jordan
Ma'sandra Sue Hinkle* (Agriculture|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Wetlands; HiFi Lab; Floodplains

Mentor(s):

Kristen Marie Bellisario (JMHC)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1053

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

**Towards a Global Conflict Heat Map Informed by Climate
Change Stressors
STEM**

Authors(s):

Sara Roslynn Lane† (Science|JMHC)

Abstract:

Creating a probabilistic global "heat map" predicting where climate-induced conditions will create environments conducive to civil conflict, enabling preventative action and optimized resource allocation for conflict mitigation.

Keywords:

Climate Change

Mentor(s):

Pragathi Jha (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1054

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

Developing a DNA encoded library to target CBX8 STEM

Authors(s):

Braxton RobertJame Larson† (Science|JMHC)

Abstract:

This study aims to prepare a library of diamines for screening in a DNA encoded library to develop a peptide with a high affinity for binding with the CBX8 receptor and druglike properties. To accomplish this, we prepared a DNA molecule with a 12-carbon linker and reacted it with glutaric anhydride to form a scaffold to test diamines. We believed that this would largely mimic the binding conditions of the peptide. We then preformed an overnight reaction to attach the diamines to this scaffold to test for binding. We used LCMS to determine if the reaction was successful. At this moment, we have screened 31 unique diamines and plan to screen a total of 94. We have found that this reaction is robust, working for a wide variety of diamines. We then plan to test the worst binding diamines on the peptide before preparing an assay to test the binding of a library of the peptides with the different diamine groups bound to determine which has the highest affinity for the target peptide. This could allow us to find a molecule which works well as a drug for the CBX8 target. This could allow us to treat various cancers, particularly those involving cell type alteration and stem like behavior.

Keywords:

DNA Encoded Libraries; Cancer; Drug Development; CBX8 chromodomain

Mentor(s):

Casey J Krusemark (Pharmacy)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1055

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

The effect of Dichloro-diphenyl-trichloroethane throughout the years and currently in the workplace with museum workers. STEM

Authors(s):

Gabriel Thane Lechuga† (HHS); Mudit Guglani† (HHS); John Ward Robbins† (HHS|JMHC); Christopher Samuel Roberts† (HHS)

Abstract:

Dichlorodiphenyltrichloroethane, also known as DDT, is one of the best examples of a pollutant with impactful bioaccumulation in history. The novel, "Silent Spring" by Rachel Carson, brought light to its significance and toxicity to birds. In today's world, the impacts of DDT can still be seen and felt, including in the museum workplace. This made us wonder, what are the ecological, economic, and health effects of the synthetic insecticide DDT, and how have these effects impacted museum workers? We plan to achieve our goal via a literature review. Our sources will include peer-reviewed scientific articles regarding the past, present, and future effects of the chemical insecticide, DDT. We will use various published journal articles to bring light to as much accurate information as we can. We expect to find that the high levels of use of DDT in the past affect museum workers today due to the required handling of artifacts. DDT research of today can bring back to light the harmful effects of DDT in today's world and the need for elevated procedures when it comes to handling artifacts. Furthermore, this could introduce the need for more research to find better workplace standards and safety policies in museums.

Keywords:

DDT; Museum; Toxicology; Occupational Health; Pesticides

Mentor(s):

Mark Wilson (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1056

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

Exploring the Possibilities of Artificial Intelligence in Modern Airliner Piloting Systems Humanities

Authors(s):

Ruogu Lei† (Engineering)

Abstract:

Ever since the Wright brothers' monumental first flight on a North Carolinian beachside, aviation has consistently been in a state of perpetual technological evolution. In the modern airliner, a wide variety of software ensure that pilots are able to provide the safest flight possible. Now, as artificial intelligence has evolved into a world-wide phenomenon, the aviation industry is facing another technical dilemma: should artificial intelligence be implemented into the cockpit, and if so, how? This preliminary research project aims to uncover the methods of which AI can be utilized within modern piloting systems. To investigate this pressing concern, this project conducts a preliminary literature review, examining several AI piloting assistance implementations proposed by a variety of accredited researchers. In doing so, this research will provide insights into the growing concern of aviation safety, demonstrating several possible implementations of new technologies that will serve to improve pilot awareness, risk reduction, and thus overall aviation.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1057

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

Wearable Piezoelectric Bone-Conduction Systems for Spatial Directionality and Awareness STEM

Authors(s):

Matthew T Lenzmeier† (Engineering|JMHC)

Abstract:

As the world becomes increasingly connected through the Internet of Things, the ability for real-time safety information to be transmitted to people is quicker and more robust than ever. However, much of this information can be disruptive in an occupational setting such as construction, where full attention to the surrounding environment is paramount to safety. Technology such as phones or smartwatches can visually distract from hazards, while in-ear headphones block off environmental sound. Bone-conduction headphones offer a solution to these issues, allowing users to passively listen to both the transmitted information and the environment. By adding spatialized audio capabilities to these headphones, workers could receive navigational cues to aid in emergency evacuation and hazard avoidance. However, the limitations of bone conduction such as a lower frequency range and crosstalk have meant that spatialized audio systems for bone conduction are much less developed than their in-ear counterparts. This project aims to develop a piezoelectric-actuator based bone-conduction headset that can track a worker's location and orientation to provide spatial audio for navigation. The headset will be able to be interfaced with occupational PPE such as a helmet, allowing for minimal interference between the user and their environment. Special attention will be paid to mitigating the bone-conduction limitations through methods ranging from signal filtering and sound design to actuator placement. Performance will be evaluated through a VR simulation of an industrial fire scenario in Unreal Engine, where a successful headset will provide increased evacuation quickness and efficiency while minimizing user discomfort and distraction.

Keywords:

Bone Conduction; Spatial Audio; Wearable Electronics; Occupational Safety

Mentor(s):

Ramses Martinez (Engineering); Jose Alfredo Ocegueda Barraza (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1058

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

Data Management for Smart Cities

STEM

Authors(s):

Colleen Li† (Science); Aadit Khurana‡ (Polytechnic); Tran Le Ngoc Vo† (Science)

Abstract:

The deployment of computer vision for pothole, crack, and general road condition detection generates massive volumes of image and sensor data. Efficiently managing this information is critical for enabling scalable model training, validation, and field deployment. This project focuses on the data management and system architecture required to store, query, and visualize terabytes of road segment data derived from vision-based condition assessment pipelines. Evaluation and testing were conducted on multiple data storage and retrieval strategies to determine optimal configurations for balancing storage efficiency, query latency, and interoperability with machine learning workflows. In addition to evaluation, an interactive dashboard was implemented to visualize road segment and road condition data efficiently. This work establishes a framework for managing large-scale road condition datasets, enabling reproducible and efficient development of AI-driven infrastructure monitoring systems.

Keywords:

Data Storage Optimization; Interactive Visualization Dashboard; AI-Driven Infrastructure; Query Latency; Road Condition Detection

Mentor(s):

Nikkhil Vijaya Sankar (Engineering); Mohammad Reza Jahanshahi (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1059

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

Process Development and Characterization of Through-Silicon-Vias (TSVs) Using Photoresist Soft Mask Etching for Advanced Packaging STEM

Authors(s):

Ying-Wei Lin† (Engineering); Kenzo Avery Evans† (Engineering); Eli Bradley Ade† (Engineering); Rex Wu‡ (Engineering); Sebastian Hunter Hamilton‡ (Engineering)

Abstract:

This project focuses on developing a fabrication process for Through-Silicon Vias (TSVs) using photoresist as a soft mask during silicon etching. TSVs enable vertical electrical interconnections in 2.5D and 3D advanced packaging, improving signal speed and integration density. Instead of traditional hard masks such as oxide or metal layers, a photoresist soft mask offers a simpler and more cost-effective approach.

The process involves spin-coating and patterning photoresist to define via openings, followed by deep reactive ion etching (DRIE) to create high-aspect-ratio vias. Key parameters such as etch depth, sidewall angle, and selectivity between silicon and resist are characterized to evaluate performance.

By optimizing photoresist thickness and etch conditions, this study aims to improve etching precision and resist durability while maintaining process efficiency. The results contribute to a practical and scalable TSV fabrication method suitable for advanced packaging and heterogeneous integration applications.

Keywords:

Through-Silicon Vias; Advanced Packaging; Semiconductor Fabrication

Mentor(s):

Peter Bermel (Engineering); Saeed Mohammadi (Engineering); Zhihong Chen (Engineering); Joerg Appenzeller (Engineering)

Other Acknowledgement(s):

Huan wen Mao (Engineering)

Poster Presentation Abstract Number: 1060

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

Reimagining Nostalgia: A Marketing Roadmap for SDI Innovations

Business Case Study

Authors(s):

Pooja Madhav† (DSB); Ashlyn Marie Jewell† (DSB); Linda Azucena Ontiveros† (DSB); Anna Victoria Sanders† (DSB); David M Rebmann‡ (DSB); Madison Nicole Gaydos‡ (DSB)

Abstract:

The purpose of this study is to assist School Datebooks, a division of SDI Innovations, in leveraging the unexpected virality of a nostalgic planner on TikTok to drive sales and deepen consumer engagement. The primary objective is to bridge the gap between awareness and purchase by crafting emotionally resonant marketing strategies that appeal to both Millennials and Gen Z. Our methods include audience research and behavioral analysis for both target markets, and the development of targeted digital campaigns across social media, email, and paid media platforms. While SDI owns the right to the original viral design, the absence of the original artwork presents a creative challenge. Our deliverables will include a comprehensive marketing roadmap tailored to each demographic, emphasizing authenticity and emotional connection over aggressive sales tactics. These deliverables aim to create a stable understanding of the target market based on consumer behavior research. The implications of this project extend beyond immediate sales, offering SDI Innovations a sustainable strategy for digital presence growth and long-term brand loyalty. Additional materials will include sample content, campaign outlines, industry reports, and demographic insights to support implementation.

Keywords:

Marketing Research; Emotional Marketing; Community Connection; Consumer Behavior; Digital Marketing Strategy

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1061

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

Analysis of Doxorubicin-Induced Cardiotoxicity Using Echocardiography and Dobutamine Stress Test STEM

Authors(s):

Maria Luciana Mantilla Cajias† (Engineering); Bea Olivia Cabot‡ (Science); Wilhelm S Smith‡ (Engineering); Anna Julie Astrid Webb‡ (Science); Aasish Chowdary Karuturi‡ (Science|JMHC)

Abstract:

Doxorubicin, a widely used anthracycline, has been associated with cardiac dysfunction; heart-failure risk after anthracycline therapy has been reported as high as 50% over six years. We aimed to characterize acute doxorubicin-induced cardiotoxicity using speckle tracking echocardiography at rest and after dobutamine. Eleven male C57BL/6J mice received one intraperitoneal dose of doxorubicin (DOX; 25 mg/kg body weight), and six control mice received equal volumes of saline. A Vevo3100 ultrasound system (FUJIFILM VisualSonics) collected images at baseline, day 2, and day 7; dobutamine stress was performed on days 2 and 7 with post-stress reacquisition. 2D images were analysed using Vevo Lab software and 4D images were analyzed using a custom MATLAB program. Quantified parameters included ejection fraction, cardiac output, fractional shortening, stroke volume, chamber diameters, wall thicknesses, mitral inflow indices (e.g. E/A ratio) and global longitudinal strain (GLS). Because DOX is associated with dilated cardiomyopathy, we expect reduced ejection fraction and cardiac strain, early remodeling (LV enlargement and wall changes), and impaired diastolic filling (lower/abnormal E/A), potentially more pronounced under dobutamine. Preliminary results could suggest a greater increase at day 2 in GLS in DOX versus controls, followed by a sharp GLS decrease at day 7, 4D ejection fraction shows a similar biphasic pattern, and no trends seen in 2D ejection fraction. Further replicates are needed to confirm observations. Identifying dysfunction with speckle-tracking at rest and under dobutamine may improve early diagnosis and guide timely cardioprotective treatment of anthracycline-induced cardiotoxicity.

Keywords:

Doxorubicin; Cardiotoxicity; Echocardiography

Mentor(s):

Benjamin Zeidler (Engineering); Cortland Hannah Johns (Engineering); Craig Goergen (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1062

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

Custom GPU Implementation for Graphics Workload Acceleration STEM

Authors(s):

Seth Thomas McConkey† (Engineering|JMHC); Felix Liu† (Engineering);
Cecilie Zhang† (Engineering); Aditya S Hebbani‡ (Engineering); Andrew
James Larkins‡ (Engineering)

Abstract:

With the rise in popularity of highly parallel workloads, traditional CPUs, which prioritize general purpose computing and low-latency operation, are no longer optimal solutions for processing graphics and machine learning programs. We propose a custom GPU architecture to address this. There is a lack of open-source GPU implementations that are specifically optimized for low-power, low-cost applications. The key innovation of this project is creating a backend GPU architecture that can support scheduling optimizations implemented in the frontend architecture and custom compiler, while minimizing power consumption and area. To accomplish this, we propose a register file design containing two banks, a single read port, and a single write port. We include a small, software-controlled register file cache (RFC) to reduce accesses to the register file. Our design introduces MSHR buffers to reduce memory access time, specialized functional units to compute arithmetic operations, and a writeback buffer to reduce pipeline stalls and increase throughput, while balancing area. Tests will be conducted on the target workload of rendering a spinning cube to measure frames per second, theoretical power consumption, and maximum clock frequency. We aim to achieve a 500MHz clock frequency on a 90nm MITLL process node. A cycle-accurate simulator will be implemented first to verify the validity of our proposed design choices. Next steps include implementing our final design in

synthesizable RTL for simulation of computing the target workload.

Keywords:

[no keywords provided]

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering); Fan Jing Hoon (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1063

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

Purdue VIP Windracers: Aerodynamic Optimization for Fixed Wing UAV STEM

Authors(s):

Skylar Keeley McGuire† (Engineering); Mason A Vrshek† (Engineering); Karna M Gajjar† (Engineering); Lillian Ji† (Engineering); Bo Chen† (Engineering)

Abstract:

The overall focus of our research covers the development and testing of a lightweight, unmanned fixed-wing aircraft capable of operating autonomously on a large scale using the Purdue Unmanned Aerial Systems Testing Facility (PURT). The work we are conducting is iterative, with the ideal outcome being a miniature aircraft capable of autonomous control for both commercial and defense applications.

The significant issues with the existing model of our aircraft, based on a UMX Night Vapor frame, lie in the safety of its landing gear and its limited ability to respond to inputs affecting pitch and yaw. The landing gear configuration was modified by relocating the dual-wheel assembly from the forward position to the rear of the triangular support structure to improve stability and weight distribution during landing. To resolve the aerodynamic inefficiencies of the current model, we fashioned ailerons to enable a

more effective rolling mechanism.

Servo pushrods in the past configuration suffered from elastic bowing under load. The rearward displacement of the dual wheel main gear in the triangular landing gear shifts

the aircraft's mass toward the empennage, allowing for shorter pushrods that reduce flexural deformation and thereby increase the efficiency of each servo on the aircraft. Optimizing the structural efficiency of our model plays a crucial role in its aerodynamic performance, stability, and overall flight capability. Improvements to the mechanical frame—reinforced structural members, optimized landing gear geometry, and shortened control linkages—directly contribute to the feasibility and durability of its operation. The results of this research advance the design principles underlying small-scale aircraft construction and provide a framework for future developments in structural integrity,

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

reliability, and flight performance across diverse operational conditions.

Keywords:

UAV

Mentor(s):

James Michael Goppert (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1064

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

Investigation of the application of Hemoglobind™ to improve detection of nitrate in hemolyzed ocular fluid samples STEM

Authors(s):

Lupita Mejia-Garcia† (Science)

Abstract:

Nitrate toxicosis, characterized by an excess of nitrate intake, can cause significant health risks in both animals and humans. In animals, especially ruminants such as cattle, high nitrate levels can cause methemoglobinemia. The lack of oxygen in blood results in a brownish tint to the skin, especially around the eyes and mouth. If left untreated, this condition can be life-threatening. Currently testing for nitrate toxicosis in ruminants involves the use of post-mortem ocular fluid and a color-based semi-quantitative test in the form of strips. Due to the nature of this testing method the presence of high levels of hemoglobin in the samples renders inconclusive results. The post-mortem ocular fluid samples extracted can be hemolyzed, impeding the detection of nitrate. This study focuses on a new method to reduce the degree of hemolysis in post-mortem ocular fluid samples therefore improving the ability to test for nitrate toxicosis. By utilizing Hemoglobind™ to reduce the degree of hemolysis, the detection of nitrate improved while not interfering with the detection of nitrate. Determining the percent deduction of hemoglobin was accomplished utilizing an indirect ELISA for bovine hemoglobin. A ratio of Hemoglobind™ to post-mortem ocular fluid of 2 to 1 decreases the hemoglobin levels in the ocular fluid by 45.45% to 69.07% depending on the degree of hemolysis. The higher concentration of Hemoglobind™ was shown to have no binding specificity for nitrate. This study provides a new method for improving detection of nitrate in hemolyzed ocular fluid samples in suspect cases of nitrate toxicosis.

Keywords:

Clinical Toxicology; Comparative; Nitrate; Hemoglobin; Post-Mortem

Mentor(s):

Christina R Wilson-Frank (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1065

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

Hotfoot: Effects of Combined Foot Heating and Compression for Type 2 Diabetes STEM

Authors(s):

Allison Paige Vick Miller† (Science|JMHC); Emily Courtney Chant† (Science|JMHC); Josi Laura Gallo‡ (Agriculture|JMHC); Grace Enpei Chen‡ (Agriculture|Engineering|JMHC); Luke Thomas Benner‡ (HHS|JMHC); Brandom Jeishryel Brisueno Lopez‡ (HHS)

Abstract:

Type 2 diabetes (T2D) affects approximately 131 million people, with up to 25% developing a diabetic foot ulcer (DFU). Standard care is demanding and often leads to recurrence, highlighting the need for simple, affordable adjuncts to improve foot perfusion and wound healing. We evaluated the feasibility of a boot-like device that combines intermittent pneumatic compression and heat during a single 60-minute session. Adults aged 55 years or older were grouped based on HbA1c levels into Controls (HbA1c below 6.5%, n=14) and T2D (HbA1c 6.5% or higher, n=6). The device was worn on both legs; one leg was randomly assigned to receive treatment, while the other served as a control. Blood velocity and diameter in the popliteal artery were measured using Doppler ultrasound every 10 minutes during a 60-minute session. The treatment effect was calculated as the change from baseline to 60 minutes in the treated leg minus the change in the control leg.

Differences between groups were analyzed with independent t-tests. Popliteal blood flow in the treated leg increased by $22.6 \pm 19 \text{ mL} \cdot \text{min}^{-1}$ (Controls) and $29.5 \pm 38 \text{ mL} \cdot \text{min}^{-1}$ (T2D) after 60 minutes (both $p < 0.05$), while untreated legs showed minimal change (4.4 ± 26 and $9.2 \pm 9.8 \text{ mL} \cdot \text{min}^{-1}$, respectively). There were no significant group differences in the change from baseline for popliteal blood flow ($p = 0.40$). A single session with this simple, home-amenable device acutely enhances leg blood flow in older adults with and without T2D. Future studies are needed to determine whether repeated use improves foot perfusion and wound oxygenation in people with DFUs.

Keywords:

Type 2 Diabetes; Popliteal Artery; Heat Therapy

Mentor(s):

Bruno Tesini Roseguini (HHS)

Other Acknowledgement(s):

Carolyn Marie Bakx (Interdisciplinary & Special Programs); Ernesto Ramirez (HHS); Eloisa Herrera Ospina (HHS)

Poster Presentation Abstract Number: 1066

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

Mapping and Classification of Boulders in the South Pole-Aitken Basin STEM

Authors(s):

Walker Andrew Millhoff† (Science); Isabella Grace Shockley* (Engineering)

Abstract:

The purpose of this research was to map the locations of boulders at several sites of interest in the Moon's South Pole-Aitken Basin, as well as to classify them by topographic and geologic features. The goal in the creation of these maps was to provide information for traverse planning and sample collection for NASA's proposed Endurance mission. Regions of interest were identified according to the science objectives of Endurance, with an emphasis on sites that covered multiple science objectives and lacked previous mapping. Boulders at these sites were then manually identified using imaging from the Lunar Reconnaissance Orbiter's Narrow Angle Camera. For each site, these boulders were then classified by both local features such as craters and rilles, as well as by wider geological context from the United States Geological Survey's unified geologic map of the Moon. Boulders were prevalent at all sites and a significant majority of boulders were found on or near craters, though many were also found associated with other features. There was no observed correlation between boulder density and optical maturity or mineral abundance. Boulders were distributed evenly between different geological regions. Boulders could be a ready source for sample collection in a variety of locations and local traverse planning could involve travel between boulder fields. Boulders are also a potential risk for rovers, as they may serve as an impediment to the path of a rover. Boulders are frequently associated with other hazards, such as steep slopes.

Keywords:

Boulders; South Pole-Aitken Basin; Moon; Mapping; Traverse

Mentor(s):

Briony H Horgan (Science)

Other Acknowledgement(s):

Ali Bramson (Science); Kelsey Prissel (Science)

Poster Presentation Abstract Number: 1067

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

Genetic Engineering to Target CD9 on NK cells for Glioblastoma Multiforme Immunotherapy STEM

Authors(s):

Rachel Marie Miskelly† (Science|JMHC); Khanh Ha Nguyen‡ (Science|JMHC); Pablo Arriagada Turrent* (Science|JMHC)

Abstract:

Glioblastoma Multiforme (GBM) is one of the most deadly forms of brain cancer, for which there is no cure. GBM is highly resistant to common cancer therapies, and, as a result, a growing area of research is focusing on immunotherapies. NK cells in particular have shown promise in targeting GBM, due to their innate ability to eliminate GBM tumors. However, NK cells often fail due to dysfunction induced by brain tumors, primarily through upregulation of inhibitory receptors. One such receptor which our lab has found is CD9. NK cell inhibition in the TME can be overcome through genetic engineering. While this approach has shown promise, NK cells are difficult to genetically engineer, necessitating more effective methods to introduce functional genes into NK cells.

To overcome this inhibition in the GBM TME, we pursued a two-pronged approach: developing more efficient vectors to genetically engineer NK cells, and using CRISPR-based approaches to target specific genes to improve NK cell activity.

Specifically, we have been developing integrated viral vectors for high efficiency NK cells based on the Baboon viral envelope. In addition, we identified that knocking out CD9 improves NK cell cytotoxicity, leading us to genetically target this receptor in human NK cells. We hypothesize that targeting of CD9 with integrated viral vectors can lead to superior anti-GBM function by NK cells. Our ongoing work focuses on characterizing the role of CD9 on human NK cell function in GBM and functionally assessing viral vectors to genetically target this receptor for improved GBM immunotherapy.

Keywords:

Glioblastoma Multiforme (GBM); Natural Killer (NK) Cells; Immunotherapy

Mentor(s):

Sandro Matosevic (Pharmacy); Yuning Liu (Interdisciplinary & Special Programs)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1068

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

VIP AI4DR: Disaster Tweet Classification Using Machine Learning for Real-Time Relief Efforts STEM

Authors(s):

Sarah Mohapatra† (Science); Dylan D Patel‡ (Engineering); Sai Maanasa Gogula† (Engineering); Yubeen Oh‡ (Engineering); Tanishq Praveen Pauskar‡ (Science); Max Ben-Azai Kirschner‡ (DSB)

Abstract:

When natural disasters strike and lives are in danger, every moment counts. With current technology, it remains difficult for rescue teams and first responders to accurately and efficiently provide relief. Every second lost is time that could have been used towards saving lives and preventing further damage. We propose that efficiency and accuracy in the relief efforts of first responders can be greatly increased through the use of artificial intelligence (AI) and social media. This research project focuses on the classification of crisis-related posts from X (formerly known as Twitter) using the CrisisMMD dataset, with feature extraction techniques such as term frequency-inverse document frequency (TF-IDF) to train machine learning models for use in these situations. The outcome of this project is a model that predicts the type of assistance needed during disasters based on real-time information from X. To accomplish this, we utilized term frequency-inverse document frequency (TF-IDF) weighting to generate tokenized input features. We employ a double-layer structure that combines logistic regression and SoftMax regression to build a model that identifies whether a tweet contains informative content and categorizes it based on the specific type of disaster related information it conveys. If put to use in disaster relief situations, the model will be able to evaluate new posts on X based on their informativeness and then decide which category the informative posts belong in to provide critical information that will aid disaster relief efforts in real time.

Keywords:

Text Classification; Machine Learning; CrisisMMD Dataset; PyTorch; Supervised Learning

Mentor(s):

Soudabeh Taghian Dinani (Engineering); Siddeshwar Raghavan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1069

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

Enteric health management in horses: can probiotics impact various disease-causing microorganisms?

STEM

Authors(s):

Madalyn Marie Molnar† (Agriculture); Haleigh Alexandra Tussinger† (Agriculture); Sydnie Rose Frost‡ (Agriculture); Hannah Irma Reyes Charles‡ (Agriculture|JMHC); Megan Nicole Broecker* (Agriculture|JMHC); Taylor Caroline Anderson* (Agriculture)

Abstract:

Having a healthy gut is important in both humans and animals. Within horses, having a healthy gut can correlate to overall health. Probiotics are being used, with increasing frequency, to provide horses with a healthy enteric system. Without a healthy gut, horses have an increased risk of poor nutrient absorption, weight loss, colic and diarrhea, gastric ulcers, and behavioral changes. *Lawsonia intracellularis*, *Neorickettsia risticii*, and *Salmonella enterica* are all bacteria that infect the digestive system of mammals. In equine, *L. intracellularis* infects intestinal enterocytes, which causes hyperplasia and thickening of the intestine walls. *N. Risticii* primarily infects the large colon of horses and causes inflammation, also known as colitis. *S. enterica* colonizes the small intestine, cecum, and colon. All three bacteria show clinical signs of diarrhea in both foals and adult horses. Each is treated with specific antibiotics and supportive care. In this study, five horses have been given a 3-week period without treatment of the probiotic followed by a three-week treatment of ProElite Gutbiome probiotic with one pound of balanced feed. After three weeks of being on the supplements, we collected manure and it was tested by the Animal Diagnostic and Disease Laboratory at Purdue University. The results presented to be negative for the three pathogens for the first 3 weeks without treatment. The study is currently at the treatment period. Pathogenic presence will be analyzed after both periods to discover the effects of probiotics in gut health maintenance to prevent potential pathogenic threats.

Keywords:

Health; Horses; Probiotic

Mentor(s):

Casie S Bass (Agriculture)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1070

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

Geometric Optimization of Mach-Zehnder Interferometers for Enhanced Photonic Sensor Performance STEM

Authors(s):

Spencer Andrew Moore† (Engineering); Shashank Varamballi‡
(Engineering)

Abstract:

The Mach-Zehnder Interferometer (MZI) is an essential component in integrated optics, widely used in high-precision sensing and modulation by converting optical phase differences into measurable intensity changes. Conventional MZI designs rely on predictable, straight, and symmetric waveguide branches, which limits performance, as the precise geometry (including bends, tapers, and varying cross-sections) significantly dictates the propagation constant and device sensitivity. This senior design project systematically investigates how controlled variations in MZI branch geometry affect critical performance metrics. Through geometric parameterization and 3D numerical simulation (utilizing advanced photonic tools like Lumerical), we will quantify the trade-offs between geometric complexity and key parameters, including sensitivity, insertion loss, and fringe visibility. The primary objective is to establish a geometrically optimized MZI design that maximizes sensitivity while maintaining acceptable loss, leading directly to improved performance for integrated photonic sensor applications.

Keywords:

[no keywords provided]

Mentor(s):

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1071

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

**Benchmarking Motion Estimators on Single-Camera Cow
Footage
STEM**

Authors(s):

Prisha Grace Mungara† (Science); Medhashree Parhy† (Science);
Rakshit Pradhan† (Science); Sumedha Saravanakumar† (Engineering)

Abstract:

Motion estimation is a key tool used in analyzing animal behavior, offering an automated method to monitor animal conditions and streamline livestock handling. Current motion estimators are typically evaluated using synthetic datasets or videos supplemented with LiDAR or stereo cameras. In this work, we aim to evaluate existing motion estimators on real cattle footage, captured under simple, single-camera settings. To do so, we construct a baseline reference motion grounded with human-labeled keypoints in order to measure the accuracy of popular motion estimation models without additional equipment. This research lays the groundwork for benchmarking motion estimator assessments on animals in a more realistic, practical environment.

Keywords:

Computer Vision; Motion Estimation; Optical Flow

Mentor(s):

Amy R Reibman (Engineering); Haochuan Hu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1072

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

The Benefits and Limitations of Robots in Housing Construction Humanities

Authors(s):

Tito Shaun Njoku† (Engineering)

Abstract:

The paper examines the growing use of robotics in the housing construction industry, exploring how they automation transforms safety, productivity and sustainability in the field. To investigate this issue, I conducted a preliminary literature review using a combination of popular sources and peer-reviewed secondary sources that explored the integration of automation technology to the housing construction. Sources were analyzed to identify recurring benefits, challenges and future trends. Findings suggest that robotics are essential to the housing construction due to their high productivity and increased safety. However, barriers that automation will face in the field are the high initial cost, lost of human jobs, and being incompatible with company's standards. The findings conclude that while robots have promising solutions to housing construction challenges, addressing the cost and their advancement is crucial to their adoption.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1073

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

Evaluating the Impact of Community Health Worker-Led Education on the Cervical Cancer Knowledge and Attitudes Seen in People Experiencing Homelessness

Social Science

Authors(s):

Jessica Chinyeaka Nwokeji† (HHS); Sarah Adeline Jolley† (HHS|JMHC)

Abstract:

Cervical cancer can be prevented and treated when detected early through screening, yet people experiencing homelessness (PEH) have higher mortality rates and lower screening rates compared to housed individuals. This is due to the unique multilevel barriers that PEH face, such as limited access to quality healthcare, low health literacy levels, and mistrust in healthcare providers. Community health workers (CHWs) are trusted sources that provide health education and outreach to people in this population. As part of a larger study aiming to bring cervical cancer screening to homeless shelters, we aim to examine the impact of CHW-led education on cervical cancer knowledge and attitudes in PEH.

We implemented CHW-led cervical cancer education sessions designed for women aged 25-65 experiencing homelessness at two homeless shelters in Indiana. A 9-item questionnaire was conducted before and after education, and at months one, three, and six to assess knowledge gains and retention. Preliminary results showed that mean knowledge scores increased significantly between pre- and post-intervention sessions (5.73 to 8.03, $p < 0.001$). Knowledge gains slightly decreased over time but remained above pre-test scores up to 6 months post-intervention. Nearly a quarter (22%) of participants felt they were not at risk for cervical cancer pre-intervention, declining to 14% post-intervention. Additionally, there was a 12% increase between the participants who felt that getting screened for cervical cancer was important pre- and post-intervention. The results of this study demonstrate the critical need to leverage CHW-led education in homeless shelters and reduce cervical cancer knowledge gaps among PEH.???

Keywords:

Cervical Cancer; Underserved Populations; Cancer Screening; Community Health Worker; Self-Sampling

Mentor(s):

Lara Nicole Balian (HHS); Natalia Maria Rodriguez (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1074

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

Sipping on Strategy: Identifying Early Adopters for a Premium Tasting Subscription Service

Business Case Study

Authors(s):

Kristen Taylor O'Leary† (DSB); Leah Marie Brown† (DSB); Nicole Marie Welsh† (DSB); Mary Allison Conway† (DSB)

Abstract:

Terroir Tasting Co., a pre-launch premium subscription service, offers a curated selection of tasting boxes featuring region-specific small-batch wine, beer, and spirits. These tasting boxes are designed to connect consumers with the culture and producers of America's diverse terroirs. Despite having a unique value proposition, the company faces many pre-launch challenges regarding its primary target market, resonant messaging, and a viable market entry strategy, limited to a \$5,000 launch budget.

This research project addresses the central problem of how to effectively identify and target an initial customer segment to validate demand and guide a cost-effective launch. The study pursues three main objectives: (1) to define the most promising early adopter segment based on psychographic, demographic, and behavioral data collected from secondary sources, (2) to test and refine the company's value proposition to determine the most compelling messaging, and (3) to evaluate cost-effective marketing channels to formulate a strategic launch plan. The findings from this research will provide Terroir Tasting Co. with an evidence-based plan to limit risk in market entry, optimize its limited marketing spend, and establish a strong foundation for sustainable growth.

Keywords:

[no keywords provided]

Mentor(s):

Erin Alkire Britton (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1075

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

Improving Parts Order Accuracy Through Production Data Analysis

Business Case Study

Authors(s):

Kaitlin Rose Otto† (DSB); Emeline Marie Papp† (DSB); Ty Emerson Schafert† (DSB); Caleb Zachariah Brunton† (DSB); Joshua Petzer‡ (DSB|JMHC); Viswanath Jay Nair‡ (DSB)

Abstract:

This study analyzes production data from a foreign car manufacturer to develop a predictive tool that links monthly changes in production volumes to corresponding adjustments in parts orders. The objective is to quantify how fluctuations in vehicle orders influence overseas parts orders, particularly for components that have already been planned or shipped. The dataset spans 2024 and 2025, encompassing varying production levels and material quantities. As production months approach, flexibility in output decreases, revealing consistent overproduction or underproduction trends depending on the vehicle model. By capturing these dynamics, the tool aims to improve demand forecasting and optimize parts procurement, thereby enhancing supply chain efficiency and minimizing inventory discrepancies.

Keywords:

Production; Forecaste; Fluctuations; Analyze; Overseas

Mentor(s):

Xing Wang (DSB); Keun Jun Park (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1076

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

Investigating Embedded Sensing in Metamaterials for Thermal Management Applications STEM

Authors(s):

Sonia Panchal† (Engineering|JMHC)

Abstract:

Pumped two phase cooling can significantly improve the heat dissipation capabilities in thermal management systems, though maldistribution issues and fluid flow instabilities hinder their performance. In-situ sensing is often not satisfactory for real-time flow monitoring and detection of anomalies in heat exchangers due to challenges associated with integrating physical sensors. Functional metamaterials can be designed to react to various stimuli based on these interactions by utilizing properties found in multi-stable and shape-morphing structures. This research focuses on the design space and functionalities of 3D-printed polymer laminate composites made of conductive and non-conductive materials with sensing and memory capabilities. The structures use conductive filaments to measure resistance changes in response to temperature change. The differences in thermal expansion coefficients can be used to achieve passive actuation at controlled temperatures. Thermoplastic polyurethane (TPU) and polylactic acid (PLA) square composite samples are modeled using finite element analysis to predict displacement direction and magnitude based on various printing parameters, and these results are validated with cyclic temperature testing in an environmental chamber while measuring displacement. The results of the model are validated with updated material characterization tests analyzing pre-strain and storage modulus. This contributes to the goal of creating a system of bistable passively actuating sensors that can respond to temperature and pressure inputs to create a more robust thermal management system.

Keywords:

Metamaterials; Composites; 3D Printing; Bistable; Actuating

Mentor(s):

Davide Ziviani (Engineering); Amanda Elizabeth Stone (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1077

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

**Metal-Insulator-Metal Capacitor Manufacturing and Design |
VIP SPC MIM Team 5
STEM**

Authors(s):

Hao Tian Pang† (Engineering); Benjamin Eunsang Ryu† (Engineering);
Huan Yi Kuo† (Engineering); Qiming Chai† (Engineering); Kevin Yu‡
(Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Statistical Process Control; Metal-Insulator-Metal Fabrication;
Semiconductor Manufacturing; Capacitor

Mentor(s):

Zhihong Chen (Engineering); Joerg Appenzeller (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1078

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

SimianSight: Multi-modal Vision-Language Model Framework to Monitor and Predict Ape Behaviors STEM

Authors(s):

Theo Park† (Science|JMHC); Rohan Deepak Nachnani‡ (Science)

Abstract:

Recent advancements in AI have shown great promise in understanding human behaviors, but the application of these methods for studying animal behavior remains largely unexplored. Historically, manual analysis of wildlife behavior has not only proven slow and expensive, but it has also been limited by human perception and bias. Integrating AI can transform the process into an automated pipeline capable of producing predictive insight, providing a valuable discovery for our understanding of animals and a tool to conserve their habitat.

In this paper, we introduce a multi-modal framework to automate the analysis and prediction of chimpanzee behaviors. Our framework leverages a fine-tuned vision-language model (VLM) to convert the visual data into textual descriptions. In parallel, corresponding audio is processed to detect acoustic context, and we use the reasoning abilities of LLMs to produce an accurate and nuanced analysis of the animal behaviors. We also release a rich multi-modal dataset of chimpanzee behavior in the wild.

Our framework is designed to decipher complex social interactions and emotions exhibited through visual cues, body language, and vocalizations. By continuously learning from the multi-modal patterns, the system can identify behavioral patterns and predict subsequent actions. The predictive nature of our pipeline transforms animal behavior analysis from a passive research into a proactive conservation agent, enabling time-sensitive intervention and understanding of primate language.

Keywords:

Artificial Intelligence (AI); Vision-Language Model (VLM); Large-Language Model (LLM); Wildlife Conservation; Ape Behaviors

Mentor(s):

Dan Goldwasser (Science); Tania Chakraborty (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1079

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

AI Hardware Compiler STEM

Authors(s):

Sahil Dhruvan Patel† (Engineering); Heng-I Chu† (Engineering); Vihaan Reddy Chinthakindi† (Engineering); Mikhail Golovenchits† (Engineering)

Abstract:

Any processor system, including our AI accelerator needs instructions to function, and writing those instructions in pure assembly is time-consuming and inefficient. In prior designs, we have attempted to create a compiler using LLVM, a set of production compiler and toolchain technologies, to translate C code to the target ISA, which proved difficult due to the extensiveness of the LLVM code base, as well as the difficulty of adding hardware-specific optimization techniques. To address these challenges, we propose a custom compiler based on PPCI (Pure Python Compiler Infrastructure) by modifying the frontend side of the compiler – adding vector instruction types and operators – and also creating a custom backend architecture specific to our hardware requirements, which would allow the code generator to output our target ISA. The compiler can also be configured to address hardware data and control hazards by combining independent instructions into VLIW (Very Long Instruction Word) packets with explicit per operation latency modeling, dependency topological arrangement, and register bank-aware allocation. The packets are limited to 4 instructions, including up to 2 vector operations, due to bandwidth and hardware area constraints. Overall, the proposed compiler offers an easy-to-use and efficient solution by significantly speeding up development of AI kernels, as well as moving the burden of code optimization onto the software.

Keywords:

Compiler; Optimization; ISA

Mentor(s):

Timothy Francis Hein (Engineering); Mark Johnson (Engineering); Sooraj Chetput Venkataraghavan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1080

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

DFT for AFTx08

STEM

Authors(s):

Cameron Thomas Patt† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

DFT; ASIC; Test Engineering; MBIST; Scan Chains

Mentor(s):

Mark Johnson (Engineering); Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1081

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

R.I.C.E: Is it Really The Best?

STEM

Authors(s):

Nicholas Alexander Peck† (HHS|JMHC)

Abstract:

For nearly fifty years, R.I.C.E, a treatment plan for injuries that stands for rest, ice, compress, and elevate, has been believed to be the best treatment for injuries such as a sprained ankle. However, research in the past decade has begun to dismantle this reasoning, and introduced new trains of thought. Through a review of the current literature, multiple treatments were found for injuries that may be more effective than R.I.C.E. These include hydrotherapy, physiotherapy, as well as Mulligan's Mobility. Ultimately, there is not a consensus on the best treatments, but the majority of research agrees that components of R.I.C.E paired with movement allow for the most effective treatment.

Keywords:

R.I.C.E.; Treatment; Literature Review; Movement

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1082

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

Parameterizable Universal Verification Methodology testbench for Floating Point Unit Module STEM

Authors(s):

Tarakanath Peddi† (Engineering); Aman Katyal† (Engineering); Shawn Chang† (Engineering); Aarsh Nishant Dave‡ (Engineering)

Abstract:

This project details the development of a comprehensive verification environment for a Floating Point Unit (FPU) using the Universal Verification Methodology (UVM). An FPU is a major component in computer processors. It performs operations on floating point numbers, which use a scientific notation-like format on a certain number of bits to represent decimal numbers at varying accuracy levels. These operations are important to many fields such as science and AI, where efficiency is important due to the exponentially increasing number of computations required. For example, the Ariane 5 Rocket exploded due to numeric overflow, causing a failure in the guidance system, leading to a \$370 million loss. UVM is a standard architecture for verifying hardware designs, used to standardize verification and remove the necessity of building a testbench from the ground up for each new module or change to a module. In this methodology, a sequencer generates test scenarios packaged as transactions, which a driver applies to the hardware, while a monitor observes the output. Concurrently, a predictor calculates the expected outcome, enabling a scoreboard to compare the actual and predicted results to automatically verify the design's correctness. So far, we have implemented a predictor made in C. We are testing addition, subtraction, multiplication, division, and rounding. Looking into the future, we hope to implement parameters in our testbench for different types of floating point specifications such as FP16, FP32, BF16. This is a novel undertaking, allowing us to throw different FPU module designs into our testbench.

Keywords:

UVM; FPU; Verification; Testbench

Mentor(s):

Mark Johnson (Engineering); Isaac P Hagedorn (Engineering); Andrew Lee Schlabach (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1083

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

One-Directional Flow Systems for Nutrient Transport in Cultured Meat Scaffolds STEM

Authors(s):

Sophia Grace Perevozchikov† (Engineering); David Scott Fernander* (Engineering|Graduate)

Abstract:

The demand for animal protein among our society is rapidly growing, however the land and other resources required to produce animal protein are limited. This dilemma has inspired the interest in cultured meat to complement traditional livestock farming. Cultured meat is the process of artificially producing meat by growing cells directly on scaffolds. The success of cultured meat relies on the transportation of sufficient nutrients into the cells and the removal of metabolic waste. To enable these processes, one-way flow channels can be integrated into the scaffold architecture. This research aims to develop a passive one-way flow system that carries nutrients into the cells while removing waste from the cells via microcarriers. A tesla valve is a passive one-directional flow channel that could be miniaturized for microcarrier transport within the scaffold. To manufacture the scaffolds, 3D printing was used because of its ability to rapidly fabricate complex structures with high resolution. Different iterations of tesla valve designs were produced to understand the kinematics of microcarriers within the channels. The results from this study will ultimately aid the fabrication of large tissue constructs by improving nutrient delivery and waste removal between the surface and core of cultured meat scaffolds.

Keywords:

Scaffold; Tesla Valve; One-Directional Flow; Cultured Meat; Cellular Agriculture

Mentor(s):

Emmanuel Kweku Mensah (Engineering); Michael P Sealy (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1084

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

Go Kart Track Localization

STEM

Authors(s):

Paresh Pobbati† (Engineering); Kush Aklank Kodya† (Science); Basant Sharma‡ (Science|JMHC)

Abstract:

This study investigates how Global Positioning System (GPS) and Inertial Measurement Unit (IMU) readings can be used together in order to localize an autonomous go kart. Localization refers to the process of finding an object's location and orientation in its environment. This is important for the go kart, as if it wants to drive through an area it needs to know where it is and what is around it. To begin, we used a UBlox GPS module for the GPS readings. However, the GPS is only capable of reporting a position once every second. Due to the high-speed nature of racing, this was not enough, and a 9 degrees of freedom IMU sensor was added to solve this problem. The IMU can provide data like acceleration and angular acceleration in order for us to get an accurate reading on the kart's location. We find that this combination is very successful in mapping the track when enough satellites are visible. The data from the IMU is incredibly useful, as only relying on one method has downsides. The GPS may not report data fast enough, and the IMU is not reliable over long distances. However, by integrating the IMU data and processing it with a Kalman filter and correcting our position with the GPS data, we believe we can localize the kart over a long distance to a precise degree, which is vital for any automated task such as racing.

Keywords:

Localization; Inertial Measurement Unit; Global Positioning System

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1085

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

Robotic Glockenspiel Research Abstract

STEM

Authors(s):

Ronit Podder† (Science); Anirudh Vummadising† (Engineering); Shivoy Sharma* (Engineering); Arnav Adi Vemula* (Engineering)

Abstract:

This project aims to develop a robotic glockenspiel capable of autonomously performing music by actuating solenoid-driven strikers controlled through C++ programs. The primary objective is to reproduce musical performances with timbral, emotional, and dynamic qualities comparable to those of human musicians. To accomplish this, the solenoids were installed beneath the keys of the instrument and computerized to convert digital note data as MIDI files to play each note at the correct timing and duration. Very soon, the system will be able to play simple melodies such as "Twinkle, Twinkle, Little Star" with accurate synchronization and sound quality and demonstrate the successful integration of mechanical hardware and software control. This article focuses on the versatility of robot instruments to expand musical access in educational, creative, and automated performance scenarios. Future advancements will look for more efficient control over power and more precise sound quality and duration.

Keywords:

Solenoid; Robotic Instrument; Music Technology; Instrument Automation; Robotic Glockenspiel

Mentor(s):

Yung-Hsiang Lu (Engineering); Yeon Ji Yun (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1086

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

Balancing Science and Society; Finland's Solution to Nuclear Waste Management Using Onkalo, the World's First Deep Geological Repository

Social Science

Authors(s):

Abigail Elizabeth Preston† (Engineering)

Abstract:

Finland's Onkalo facility, the world's first operational deep geological repository (DGR) for spent nuclear fuel, represents a rare and instructive success in the global challenge of long-term nuclear waste management. In contrast to stalled initiatives like Yucca Mountain, a proposed DGR first proposed in the 1970's in the United States, Onkalo offers critical insights into the conditions that enable progress in this technically and politically complex and intertwined domain. Through an analysis of archival documents, national policy frameworks, safety case materials, and interdisciplinary social science literature, four key contributors of success emerge: Finland's historically stable and pragmatic approach to nuclear energy policy; early, transparent, and sustained public consultation processes that fostered trust and social license; deliberate incorporation of local heritage, environmental stewardship, and municipal consent into repository siting; and rigorous adherence to technical excellence in design, monitoring, and long-term safeguards. Collectively, these factors created a resilient and adaptive governance structure equipped to handle uncertainty, capable of building legitimacy, and guaranteeing public and institutional support over decades. As other nations confront the enduring question of how to manage high-level radioactive waste, Onkalo serves as a powerful case study encompassing replicable mechanisms, demonstrating that technically sound and socially acceptable solutions are achievable when science, engineering, and community engagement are deeply integrated from the outset.

Keywords:

Nuclear; Repository; Policy; Engineering; Public

Mentor(s):

Miriam Marina Barnum (Liberal Arts); Austin Rory Cooper (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1087

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

The Human Cost of Optimization: Designing for Fairness and Focus in the Digital Workplace STEM

Authors(s):

Sudarmadhi Rabindran† (Engineering)

Abstract:

Modern workplace technologies are increasingly built on a logic of optimization that maximizes efficiency, scalability, and measurable productivity. Yet these same design priorities can unintentionally compromise fairness, attention, and well-being. This research examines how the scientific principles that inform system design can also reveal its unintended consequences. The first focus draws from automation bias and human–algorithm trust in cognitive psychology to analyze AI-driven hiring and evaluation tools. By prioritizing quantitative efficiency, these systems often reproduce the social biases they were meant to eliminate. The second focus applies cognitive load theory to collaboration platforms such as Slack and Microsoft Teams, investigating how rapid communication cycles and task switching create an “invisible workload” that fragments focus and increases mental fatigue. Synthesizing insights from human–computer interaction and ethical design frameworks, this project introduces the concept of responsible optimization, a model for designing technologies that balance computational efficiency with human equity and cognitive sustainability. Through this interdisciplinary approach, the study aims to bridge technical and psychological perspectives to reimagine digital workplace systems that are not only high-performing, but also fair, focused, and humane.

Keywords:

Automation Bias; Human-Algorithm Trust; Cognitive Load Theory; Ethical Design; Responsible Optimization

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1088

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

Design and Implementation of Magnetic Shielding in a Low-Voltage Hall-Effect Thruster for Small Satellite Applications STEM

Authors(s):

Grayson Paul Radtke† (Engineering); Anne Regina Piet† (Engineering); Thatcher Michael Wise† (Engineering); Siddhant Vinay Belgaumkar† (Engineering); Arthur Elliott Gabrilovich‡ (Engineering); Bhavya Sai Vemuri‡ (Engineering|JMHC); Preethi Munipalle‡ (Engineering)

Abstract:

Hall-effect thrusters use crossed electric and magnetic fields to ionize and accelerate propellant, producing efficient electrostatic thrust. However, conventional unshielded designs suffer from wall erosion that limits lifetime; introducing magnetic shielding redirects energetic ions away from the channel walls, mitigating erosion and improving efficiency. This work investigates magnetic shielding and magnetic-field topology optimization for a compact Hall-effect thruster using simulation-driven design. Design targets for the project include 5 mN of thrust, 1000 s specific impulse, 15 percent total efficiency, argon propellant, a 150 V discharge, and a 50 W power budget. Using ANSYS, we generate high-resolution 3D and 2D vector-field maps of the thruster magnetic topology and perform parametric sweeps over geometric variables such as chamfer angle, chamber height, and coil configurations. From these maps we assess wall-normal field components and predicted ion-wall flux, and identify parameter sets that minimize wall interactions while maintaining an accelerating channel field suitable for efficient ion acceleration. Following simulation and fabrication, we will validate the optimized designs in a vacuum chamber by measuring particle impact distributions and erosion proxies during hot-fire testing. The expected outcome is a low-voltage Hall-effect thruster with potential application in low-Earth-orbit satellite missions, including CubeSats, where compact and efficient propulsion systems are critical.

Keywords:

Hall Effect Thruster; Magnetic Shielding; Electric Propulsion; Magnetic Field Topology; Propulsion

Mentor(s):

Curtis Earl Marshall (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1089

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

Simulation and Optical Characterization of Microring Resonators for Integrated Silicon Photonics STEM

Authors(s):

Ethan Julian Ramon† (Engineering|JMHC); Geetika Chitturi‡ (Engineering|JMHC)

Abstract:

Integrated silicon photonic devices have seen a rapid increase in usage, becoming essential to optical networking and growing in popularity for uses such as optical interconnects, quantum computing, and sensing. Among such devices, few components are as ubiquitous as the ring resonator, which has found applications in filters, modulators, reflectors, and more. A recent effort at Purdue University's Birck Nanotechnology Center has involved fabricating microring resonators with varying design parameters. However, these devices have yet to be characterized optically. This work simulates and characterizes the fabricated ring resonators to understand the relation between device design and behavior. We employ Ansys Lumerical simulations to predict ring resonator spectral response. These results are then compared to our optical response measurements of the fabricated ring resonators. Ultimately, we determine the non-idealities in device performance resulting from fabrication considerations and suggest compensation strategies in the design process.

Keywords:

Ring Resonator; Simulation; Optical Characterization; Silicon Photonics

Mentor(s):

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

Other Acknowledgement(s):

Samuel James Sheeder (Purdue University)

Poster Presentation Abstract Number: 1090

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

Investigating Lipid Droplet Accumulation in iPSC-Derived Microglia STEM

Authors(s):

Sreeja Sai Rao† (HHS)

Abstract:

Microglia are resident immune cells of the brain. Microglia is able to shape development, clear debris, and regulate inflammation. In Alzheimer's disease, microglia accumulates near plaques and shifts into a disease-associated state. A common feature is the buildup of lipid droplets (LDs) in microglia. These neutral lipid-storing organelles help protect cells during stress. However, too many LDs can impair microglia's function. Instead of needing to obtain primary human microglia to investigate this, we can make human microglia from induced pluripotent stem cells (iPSCs), and optimize the conditions for LD induction in them. Therefore, in order to differentiate the iPSCs into microglia, we followed an 18-day protocol. During days 0-4, the iPSCs were aggregated to form embryoid bodies, and were treated with BMP4, VEGF, and SCF to induce mesodermal commitment. During days 4-11, the culture was supplemented with SCF, M-CSF, IL-3, FLT3L, and TPO to promote hematopoietic progenitor formation. Finally, during days 11-18, the cells were maintained in FLT3L, M-CSF, and GM-CSF to expand myeloid precursors, yielding free-floating microglial progenitors for downstream maturation. Building off of the protocol, we want to model Alzheimer's relevant LD accumulation in iPSC microglia, therefore, we will optimize the treatments using lipopolysaccharides (LPS), oleic acid, and amyloid beta to induce LDs. Additionally, we plan to use small-molecule inhibitors and degraders to reduce LDs. Overall, this project focuses on finding the most efficient way to both induce and reduce LDs in iPSC-derived microglia for disease modeling.

Keywords:

Pluripotent Stem Cells (iPSCs); Microglia; Lipid Droplets (LDs)

Mentor(s):

Jitika Rajpoot (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1091

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

Trying to find a backup home: detecting habitable exoplanets using data science STEM

Authors(s):

Eshansh Rawat† (Science)

Abstract:

The search for habitable exoplanets is one of the most fascinating areas of modern astronomy. Space missions like Kepler and TESS collect massive amounts of data, giving scientists new ways to find planets that might support life. My research focuses on how data science is used to identify potentially habitable exoplanets. Using a literature review approach, I plan to explore how different data science techniques, like machine learning and data analysis, help detect and study these planets. I will also compare how these new data driven methods differ from traditional approaches like transit and radial velocity observations. In addition, I will look at some of the challenges involved, such as dealing with incomplete data, false positives, and limitations in predictive models. By reviewing existing research, I hope to understand how data science is improving the accuracy and efficiency of exoplanet discovery. This project will show how combining astronomy and data science can help scientists learn more about planets beyond our solar system and bring us closer to finding potentially habitable worlds.

Keywords:

Exoplanets; Data Science; Astronomy; Machine Learning; Habitability

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1092

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

Development of LENN for Targeted Nucleic Acid Therapeutics STEM

Authors(s):

Evelyn Rose Renninger† (Science|JMHC); Hayden Schneider‡ (Science|JMHC); Peyton E Tanoury‡ (HHS); Bryn Regan Cook‡ (Science)

Abstract:

Precision delivery of high-potency therapeutics remains a significant challenge in the drug delivery field. This is typically achieved using antibody-drug conjugates or field-effect agents like ligand-targeted radiotherapeutics; however, current nucleic acid therapeutics have focused on balancing the effective release of contents with the stability of the molecule itself instead of the downstream problem of target specificity. Previous efforts have focused on either viral delivery vehicles that can be efficient, but suffer from safety and multiple infusion limitations or non-viral systems that are often safer but less efficient. Layer-by-layer elastin-like polypeptide nanoparticles (LENN) offer a renewable, stable, and effective delivery of various sizes of nucleic acids into targeted cell types in a receptor-specific manner. This research focuses on the creation of different γ -cyclodextrin arginine conjugates for LENN construction that are designed to maximize cargo retention and release. It also examines the most effective methods of purifying these conjugates for formulation into polyion complexes prior to coating with elastin-like polypeptides through host:guest interactions. This method for nucleic-acid delivery offers multiple advantages, such as targetability, cargo size adaptability, tolerability, and bio-manufacturability that is difficult to achieve with other delivery vehicles.

Keywords:

[no keywords provided]

Mentor(s):

David Thompson (Science)

Other Acknowledgement(s):

Joydeep Rakshit (Science); Feng Qu (Science)

Poster Presentation Abstract Number: 1093

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

Identification of Tidal Disruption Events from the Zwicky Transient Facility STEM

Authors(s):

Francisco Alejandro Ruiz† (Science); Jason Timothy Emsley† (Science);
Jay Philip Gannam† (Science); Chawin Mingsuwan† (Polytechnic)

Abstract:

Tidal Disruption Events (TDEs) are intensely luminous flares of radiation that occur when a star passes close enough to a supermassive black hole (SMBH) to be ripped apart by the SMBH's tidal forces. TDEs are useful for probing the extreme mechanisms around black holes, yet they are both rare and difficult to classify amongst many transient alerts because of their similarities to other transients like Active Galactic Nuclei (AGNs). Here, we develop a data-filtering algorithm to isolate potential TDE candidates from alert streams provided by the Zwicky Transient Facility (ZTF). We construct a suite of filters designed to target key observational characteristics of TDEs, including proximity to the host galaxy's nucleus, sufficient photometric sampling, and the theoretical fits to a transient's light curve, to isolate a set of TDE candidates. Subsequent visual inspection and the application of a Machine Learning Filter to aid in narrowing down a TDE transient. This framework demonstrates how large-scale data streams can be efficiently processed and filtered to identify rare phenomena and builds a foundation for future sky surveys like Rubin Observatory's Legacy Survey of Space and Time.

Keywords:

Tidal Disruption Events; ZTF Transient Alerts; Data Filtering Criteria; Theoretical Fit Models; Machine Learning Models

Mentor(s):

Noah William Zimmer (Science); Danny Milisavljevic (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1094

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

**Topology optimization of flow structures for cooling multi-
chip modules
STEM**

Authors(s):

Jonathan Samuel Ryan† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

CFD; Topology Optimization; Electronics Packaging; Heat Transfer;
Cooling

Mentor(s):

Justin Weibel (Engineering); Boyu Duan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1095

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

Relationship of Phosphorus and Bloom Conditions on Lake Mississinewa during Summer 2025 STEM

Authors(s):

Areesha Fiza Saleem† (Agriculture|JMHC)

Abstract:

Areesha Saleem, saleema@purdue.edu

Keith Cherkauer, cherkaue@purdue.edu?

Isaac Bradford, ibradfo@purdue.edu?

Nileshwari Yewle, nyewle@purdue.edu

Harmful algal blooms (HAB) pose significant ecological and human health risks by causing eutrophication and releasing toxins in freshwater ecosystems. This project is part of a larger NASA funded grant that aims to quantify and predict the occurrence of HABs in Indiana lakes using remote sensing (spectral reflectance) and laboratory analysis. This project focused on chlorophyll-a (chl-a) and total phosphorus concentrations obtained from laboratory analysis of water samples collected in summer 2025 from Mississinewa Lake. All lab analysis was conducted using standard EPA methods. Results showed a marginally positive correlation (R^2 value of .23) between chlorophyll-a and total phosphorus. Furthermore, a marginally positive correlation (R^2 of .15) was observed between total phosphorus and PO_4 concentrations. The surface water of Mississinewa experienced large amounts of algae with high chl-a concentrations followed by microcystin. Microcystin is a byproduct of algal death, so a high concentration suggests a prior presence of a HAB. Additional research needs to be done on the pre-bloom conditions that led to high nutrient and chlorophyll-a levels. In the future, biogeochemical data will be analyzed with remote sensing parameters to develop a machine learning model for HAB risks in the lake.

Keywords:

Harmful Algal Bloom; Biogeochemical State; Indiana; Cyanobacteria; Chlorophyll-A

Mentor(s):

Keith A Cherkauer (Engineering)

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

Other Acknowledgement(s):
Isaac Henry Bradford (Agriculture)

Poster Presentation Abstract Number: 1096

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

How do Early Interventions Reduce the Effects of Adolescent Mental Health Social Science

Authors(s):

Kailla Marie Sanchez† (HHS)

Abstract:

Adolescent mental health is an important determinant of lifelong well-being, shaped by the essential period of brain development. Often, adolescents are not provided with the most beneficial treatment or may not receive treatment due to the lack of resources and systems. This research study investigates the most beneficial early interventions for adolescents with mental health concerns. These findings were gathered from primary sources found through the Purdue Libraries. It is indicated that multidisciplinary and multimodal approaches are the most beneficial in reducing developmental and lifelong effects on mental health and life outcomes within adolescents. These findings advocate for more integrated practices across education, healthcare, community systems, and families to enhance outcomes, address more complex needs effectively, and reduce care barriers.

Keywords:

Adolescent; Mental Health; Multidisciplinary Interventions; Multimodal Approach

Mentor(s):

Sidney Ducleroir (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1097

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

“Do You Love Me, ChatGPT?”—The Digital Age of AI Intimacy and Teenage Addiction

Humanities

Authors(s):

Samin Sanjana† (Engineering)

Abstract:

In the 2013 film *Her*, a lonely man falls in love with an Artificial Intelligence (AI) persona. This film, once classified as science fiction, now feels more like a glimpse into our reality. Teenagers and adults today are building emotional relationships with AI, treating chatbots as friends, therapists, and even lovers. Many teenagers now share every detail of their personal lives with AI characters and systems like ChatGPT. In fact, an average user spends 93 minutes on AI companion apps, which is 18 more minutes than what an average user spends on TikTok (Tiku). These apps are freely accessible to users of all ages, although they allow conversations that include explicit or inappropriate content. This is becoming a huge problem because AI “partners” can feel perfect in ways human relationships never will. Such over-reliance could lead to anxiety and even disconnection from family and friends because AI will always take the users' side (Ho et al. 12). The increasing normalization of AI relationships reflects a broader crisis of digital dependency that remains largely unacknowledged. The purpose of this exploratory research project is to examine how teenagers are falling for perfect AI “partners” and the implications of such relationships on human connections. To investigate this issue further, I collected related data from existing scientific literature and news sources. Ultimately, this research calls for greater awareness among parents, guardians, and the general public about the psychological and social risks of AI companion apps to prevent the growing addiction among teenagers.

Keywords:

Artificial Intelligence; Addiction; Friends; Chatbots; Teenagers

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1098

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

Real-Time Health Monitoring: A Wireless System for Triboelectric Sensor Data Acquisition and Analysis STEM

Authors(s):

Adam Jair Selby† (Engineering|JMHC)

Abstract:

Wearable technology is changing the way health data is collected and used. Triboelectric sensors provide a promising alternative to traditional photoplethysmogram devices because they are lightweight, flexible, and capable of producing self-powered signals. The challenge is that these sensors generate very small currents, which require amplification, filtering, and signal conditioning before the data can be used in a meaningful way.

This project creates a system that allows triboelectric sensors to function as reliable, wireless health monitors. On the hardware side, I designed and simulated amplification and filtering circuits in KiCad, then assembled and tested them on breadboards to confirm performance. These circuits condition the small sensor outputs into stable signals that can be digitized and processed. On the software side, I developed Bluetooth communication and a user interface to wirelessly transmit, visualize, and analyze the health data in real time.

By combining hardware and software, the project improves usability, reduces power needs, and supports accurate monitoring across diverse users. The broader impact lies in providing a low-cost, energy-efficient alternative to bulky commercial monitors, making health tracking more accessible and comfortable. This work shows how triboelectric sensors can move from lab concepts to practical healthcare tools, supporting continuous and remote monitoring that benefits patients and providers.

Keywords:

[no keywords provided]

Mentor(s):

Wenzhuo Wu (Engineering); Pedro Henrique de Souza Barbosa (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1099

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

Memory Controller Integration on a RISC-V SoC STEM

Authors(s):

Katelyn Krishan Shah† (Engineering); Arina Harlanovich† (Engineering);
Kameswari Mantha† (Engineering); Andy Hanjun Hu* (Engineering);
Nicha Muninnimit* (Engineering)

Abstract:

A memory controller is a critical component in modern System-on-Chip (SoC) architectures, responsible for managing data transfers between the processor and memory devices. It handles read and write operations, timing control, data buffering, bus arbitration, protocol handling, and error correction, ensuring that memory accesses are handled reliably.

This project focuses on integrating a memory controller into a RISC-V System-on-Chip, AFTx08, and evaluating its functionality through simulations and testing on FPGAs. The controller aims to optimize communication between the processor core and on-chip memory by handling issues with latency and data throughput.

Throughout this semester, our team has been investigating a bug in the memory controller integration that affects read and write operations when combined with the full system. Our goal is to verify data consistency between the individual and full-chip simulations of the SRAM controller. Current efforts are focusing on validating its integration with the SoC bus by ensuring correct signal mapping and communication with on-chip memory. Our team is also finalizing RTL integration and verifying timing closure to confirm that the controller meets setup and hold timing constraints at SoC clock frequency. The controller's functionality will also be validated using real memory chips on FPGA hardware. Once integration and verification are complete, the design will be handed off to back-end teams for synthesis, floorplanning, and routing.

Keywords:

System-on-Chip; SRAM Controller; RTL Design; FPGA; Hardware Verification

Mentor(s):

Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1100

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

Light and Layers: art in additive manufacturing STEM

Authors(s):

Mirza Orunav Shahpert† (Engineering)

Abstract:

This project showcases a collaborative display of lithophanes created by Mechanical Engineering students during the Additive Manufacturing and Art Study Abroad Program in Paris and Rouen, France. The goal was to design and fabricate an illuminated installation that highlights both student creativity and the department's additive manufacturing capabilities. The final design features a 3 ft by 4 ft frame holding 30 3D-printed lithophanes arranged in a grid and backlit by an LED panel to form the Purdue "Fast P." The system was developed using department resources and designed for easy updates, allowing new lithophanes produced each Maymester to be swapped into the display. This project not only celebrates the intersection of engineering and art but also provides a lasting exhibit to inspire future participants in the program.

Keywords:

Additive Manufacturing

Mentor(s):

David Scott Fernander (Engineering); Michael P Sealy (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1101

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

Should Schools Require Annual Dental Checkups?

STEM

Authors(s):

Shriya Haresh Shirvadekar† (HHS)

Abstract:

Dental health is often overlooked, especially in young adults, yet it is a critical component of their overall physical and psychological health. Many children experience untreated oral health issues such as cavities and gum disease, leading to tooth pain and school absences. This paper explores whether schools should require annual dental health checkups for students. Through a review and synthesis of recent research, this paper examines the benefits, as well as the limitations of mandating dental exams for children in schools. Research suggests that early detection of dental health issues and taking preventative measures can improve overall oral health, academic performance, and reduce long-term healthcare costs. Although mandatory annual dental checkups would provide major health and educational benefits, challenges related to treatment access may arise. Access to affordable follow-up treatments and resources is required to ensure effective outcomes. Future research should focus on the long-term impacts of requiring annual dental checkups within schools and cost-benefit analyses. These findings suggest that school-based dental health initiatives can play a vital role in improving children's health.

Keywords:

[no keywords provided]

Mentor(s):

Kyle Robert Alvey (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1102

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

Planning safer routes for a future rover on the Moon by integrating radar-based surface roughness with slope maps STEM

Authors(s):

Isabella Grace Shockley† (Engineering); Walker Andrew Millhoff* (Science); Kylee Rene Dodd* (Science)

Abstract:

The Moon preserves a record of early solar system history that has since been erased on the Earth. The lunar South Pole Aitken (SPA) basin is among the oldest and largest impact structures and is central to answering fundamental questions about the timing and nature of planetary formation and evolution. The importance of SPA basin motivated NASA to develop a mission concept, called Endurance, which would send a rover to traverse the basin and collect samples from it. To accomplish mission objectives, it is vital that the traverse route minimize the technical risks associated with navigating the terrain while maximizing science yield. An initial route was based mostly on avoiding surface slopes $>17^\circ$. However, radar data, such as that being collected by NASA's Lunar Reconnaissance Orbiter (LRO) mission, offer additional information on hazards, such as surface roughness at centimeters-to-meters scales. Here, we investigate ways to integrate radar-based roughness metrics with slope mapping into rover traverse planning, and we compare our results to traverses based purely on elevation/slope metrics. We also compare how results are affected by use of different elevation products: one created from merging LRO altimetry with Japanese Kaguya mission data and another from the Chinese Chang'e-2 mission. We find stable, low-risk route options where the two elevation models show the same gentle slopes and radar-based roughness is low. However, some areas generate divergent routes depending on the inputs, demonstrating the need for more/better data there. Our work provides a transparent and reproducible basis for de-risking Endurance surface operations.

Keywords:

Lunar; Moon; Rover

Mentor(s):

Ali Bramson (Science)

Other Acknowledgement(s):

Briony H Horgan (Science); Kelsey Prissel (Science)

Poster Presentation Abstract Number: 1103

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

The Dog Run Case Study

Business Case Study

Authors(s):

Sara Elizabeth Sinclair† (DSB); Catalina Vergara Galarza† (Liberal Arts);
Raleigh Warner Burgess† (DSB); Paraskavas Nikiphoros Mintidis†
(DSB|JMHC); Aiden James Deckard‡ (DSB); Everly Echo McKenzie‡
(DSB)

Abstract:

[Abstract Redacted]

Keywords:

Marketing; Small Business; Case Study

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1104

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

Feasibility of Low-Cost Hypersonic Vehicles for Second-Mode Instability Data Collection STEM

Authors(s):

Aditya Singht† (Engineering)

Abstract:

Second-mode waves are the dominant source of boundary layer instability and transition in hypersonic vehicles near 0-degree angle of attack, yet simulations cannot accurately predict where transition will occur on the surface of a vehicle. Collecting more experimental data can lead to amplitude-based transition models that would streamline and improve the hypersonic design process. Most existing hypersonic vehicles are prohibitively expensive, making it extremely difficult to collect second-mode wave data in a flight test. However, low-cost vehicles capable of achieving hypersonic speeds are becoming increasingly common, especially at academic institutions and startup companies, presenting a potentially untapped resource in hypersonic flight test. In this study, we aim to determine if these low-cost vehicles are likely to experience second-mode instabilities, and if these instabilities are measurable. We utilized STABL, a computational package capable of computing mean-flow and stability characteristics, to simulate second-mode growth rates and frequencies from the nose cones of multiple academic and industrial rockets at various points in their trajectories. Integrating the estimated second-mode amplification rate over a vehicle body produces N-factor plots, which can be compared to historical flight data to predict if transition might occur, and estimated frequencies can be evaluated against COTS sensor specifications to assess measurement feasibility. If these low-cost hypersonic vehicles exhibit measurable second-mode instability, they could provide a unique opportunity to collect valuable data on hypersonic transition, enabling the development of improved transition models and improving the development of future hypersonic vehicles.

Keywords:

Hypersonic; Aerodynamics; Flight Test; Computational Flow Dynamics; Boundary-Layer Stability

Mentor(s):

Brandon C Chynoweth (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1105

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

Boiler Dining Image and Evaluation Tracker (DIET)

STEM

Authors(s):

Arnav Chandra Singh† (Science); Kriti Kishan Nandakumart (Engineering); Aahana Dahiya† (Engineering); Sannidhi Agarwal† (Science); Simarleen Kaur‡ (Engineering)

Abstract:

Many adults today struggle to accurately track the nutritional content of their meals due to time constraints, lack of nutritional knowledge, and the inconvenience of manual logging. Addressing this issue will lead individuals to make more informed dietary decisions and promote healthier lifestyles. Through our work, we present an intelligent dietary tracking application that generates nutritional information from user-uploaded meal images automatically. The app leverages computer vision and Purdue's dining court data, to identify foods, estimate portion sizes, and provide nutritional values. Through the connection of a mobile-based user interface with a data inference pipeline, this system applies advanced dietary assessment research to practical use, fostering nutritional awareness and healthier eating habits among the students and staff of Purdue University.

Keywords:

Computer Vision; Nutrition Tracking; Image Processing; Mobile Application; Machine Intelligence

Mentor(s):

Fengqing Zhu (Engineering); Carla Zoltowski (Engineering); Soudabeh Taghian Dinani (Engineering); Edward J Delp (Engineering); Siddeshwar Raghavan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1106

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

Engineering 2D Materials for Controlled Quantum Defects with ML Assistance STEM

Authors(s):

Manaswini Singh† (Science); Priya Mishra‡ (Science); Sagarika Menon‡

Abstract:

Atomic-scale quantum defects in solid-state platforms hold immense promise for the next generation of technologies in quantum science and computation. Exploring their full potential requires exceptional control over defect creation, placement, and coherent behavior. Two-dimensional materials, especially hexagonal boron nitride (hBN), offer compelling platforms due to their atomically smooth surface, wide bandgap, and tunable heterointerfaces. We utilize Scanning Tunneling Microscopy (STM) to probe engineered quantum defects in hBN with atomic precision, focusing on fabricating hBN/graphite heterostructures compatible with STM measurements. Isolated few-layer graphene and hBN flakes are obtained through scotch-tape exfoliation and assembled into heterostructures using Polypropylene-Carbonate (PPC) stamps. PPC films supported on cushion-like PDMS enable the sequential pickup and assembly of thin hBN and graphite layers over a thick hBN base on a silicon wafer, producing atomically flat and clean interfaces critical for STM studies. We are also developing new stacking methods that improve cleanliness and reproducibility, facilitating the fabrication of more air-sensitive materials. Furthermore, we're developing a machine learning system integrated with a motorized microscope that automatically captures images of hBN/graphene flakes, detects their thickness, number of layers, and shape, and classifies them for stacking suitability. This system not only speeds up exfoliation and assembly but also helps predict the functionality and behavior of resulting heterostructures. A model that predicts the number of graphene layers from optical images is already trained and operational. By integrating all aspects of our experimental journey, our work will establish a pathway for exploring engineered quantum defects in 2D systems with atomic precision.

Keywords:

2D Materials; Machine Learning; Nanofabrication; Quantum Science; Quantum Defects

Mentor(s):

Tiancong Zhu (Science); Kyung Jun Lee (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1107

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

CSME Polymorphic Logic STEM

Authors(s):

Benjamin Michael Sisk† (Engineering|JMHC); Aiden Hughes Sexton‡ (Engineering); Sahil Mitra‡ (Engineering); Luke J Ferrer‡ (Engineering|JMHC); Minghan Wang‡ (Engineering)

Abstract:

The computer hardware industry spends billions of dollars annually on design, but few measures exist to prevent reverse engineering and IP theft. In the prevalent fabless business model, companies must share complete design specifications with third-party or overseas manufacturers, creating opportunities for piracy, overproduction, and counterfeiting. Historically, rapid innovation has mitigated these risks, but this is becoming problematic with the deceleration of Moore's law and growing design complexity. To address these challenges, our research focuses on polymorphic logic, which is a method of designing hardware that cannot be reverse engineered by physical inspection.

Logic locking is a related hardware security solution, utilizing key-controlled XOR gates to mask chip functionality. However, satisfiability (SAT) attacks efficiently find the correct key value. Anti-SAT blocks attempt to increase the number of required SAT attack iterations to recover the key, but are vulnerable to removal attacks due to their isolation. In contrast, polymorphic logic gates offer significant protection from SAT attacks and can be uniformly distributed within a design to prevent removal attacks. Polymorphic logic enables transistors to switch between PMOS and NMOS modes using a key, and can be physically implemented using Schottky-barrier-field-effect transistors.

The SoCET polymorphic logic team has already demonstrated polymorphic logic's obfuscation capabilities for combinational circuits and the automatic synthesis of polymorphic designs. Our current focus is on improving the efficiency of the synthesis algorithms as well as extending polymorphic logic to designs with sequential elements. Our objective is to create a tool that automatically applies polymorphic obfuscation to designs.

Keywords:

SoCET; Hardware Security; Digital Design; Design Flow; Synthesis

Mentor(s):

Mark Johnson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1108

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

Data Analytics for Transparent Health Insurance Pricing Business Case Study

Authors(s):

Cooper William Springs† (DSB); Ethan Mathew Lebon† (DSB); Matthew Wyatt Baratian† (DSB)

Abstract:

How can data analytics improve transparency in health insurance pricing? This project investigates that question by examining how demographic and lifestyle factors influence medical insurance charges. As healthcare expenses continue to rise, understanding the drivers behind cost variation can help individuals, insurers, and policymakers make more informed and equitable decisions.

Using the Medical Insurance Cost dataset from Kaggle, which includes 1,338 individual records, each representing a unique policyholder, this study applies key principles of data analytics to uncover meaningful patterns in pricing. The data are cleaned and standardized to ensure quality, then explored through summary statistics and visualization to identify preliminary trends. Early exploration suggests that personal and behavioral variables such as age, body mass index (BMI), smoking status, number of children, and region interact in complex ways to shape cost outcomes.

To validate these observations, a predictive modeling process is developed using a staged approach. Initial regression models establish a transparent foundation for interpretation, followed by techniques that improve stability through feature selection and cross-validation. This balance between interpretability and predictive strength enables both analytical rigor and accessibility for broader audiences.

Ultimately, this research highlights how accessible analytical tools can promote fairness and accountability in healthcare pricing. By linking individual characteristics to cost mechanisms in a transparent, interpretable manner, the project underscores the value of data-driven reasoning in supporting clearer communication, trust, and more equitable decision-making within the healthcare system.

Keywords:

Data Analytics; Health Insurance; Transparency; Predictive Modeling; Healthcare Decision-Making

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1109

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

Low Dropout Regulator for AFTx07 STEM

Authors(s):

Emma Lynn Stump† (Engineering); Mohamed Mostafa Hassan† (Engineering); Thomas Allen Greer‡ (Engineering); Chao Min Chung‡ (Engineering); Erik Kocinare‡ (Engineering)

Abstract:

Our team will provide a low dropout regulator on chip, commonly known as LDO, for integration with the AFTx07. We hope to provide both 3.3V and 1.8V power rails with low noise to enhance the SoCET microcontroller functionality. Our team is also working alongside projects focused on creating a high-speed Phase Locked Loop and ADC for further use on the AFTx07. Our LDO will be the supply for all of these components and will allow SoCET to keep components created in-house for use on this chip and future chips as the group continues to develop and design. Our biggest design specification that we targeted was ultra-low noise. There can be thermal noise, flicker, and other external noise we expect to handle and suppress. Every aspect of our design choices needs to help keep noise low as the LDO powers sensitive components, and even minor flutter could be propagated through the design in harmful ways, affecting future components. We also expect to consider power consumption and the size of the layout (5mm²) as significant constraints. We are planning on utilizing a telescopic Op-Amp topology for the LDO's error amplifier alongside an NMOS pass transistor for higher mobility. We are designing our voltage reference to sustain high noise immunity and provide a reliable, steady Vref. We are integrating a foldback current limiting circuit for safety purposes. Expected outcomes will be steady regulation below the current limit (200 mA) and a 40–50 dB total ripple attenuation at 200 MHz with appropriate filtering.

Keywords:

Low Dropout; Semiconductors; Noise; SoC

Mentor(s):

Seyedehmarzieh Rouhani (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1110

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

Forecasting Short-Term EV Charging Demand Spikes for Smarter Grid Management in the U.S.

Business Case Study

Authors(s):

Zachary David Sullivan† (DSB); Bernardo Bradley Chalaca Moreira† (DSB); Thomas Guy Engle† (DSB); Lucas Erwin Gerbscht† (DSB)

Abstract:

As electric vehicle (EV) adoption accelerates across the U.S., utilities and city planners face a growing challenge: predicting and managing sudden spikes in electricity demand from EV charging. This project develops a short-term forecasting model to anticipate these surges, helping ensure grid stability, guide infrastructure planning, and improve energy efficiency.

Using millions of charging records from the U.S. Department of Energy, we analyzed session-level data—including energy delivered, charger type, and time of use—aggregated by hour and day. Our exploratory analysis revealed clear temporal patterns: weekday charging demand nearly doubles weekend levels, and high-power DC fast chargers are the main contributors to intense, localized spikes.

To forecast these fluctuations, we'll build models in stages—starting with a simple baseline and progressing to more advanced techniques like gradient-boosted trees and neural networks. Model performance will be evaluated using K-fold cross-validation to ensure accuracy and reliability.

The resulting forecasts will support utility companies in balancing grid loads, implementing dynamic pricing, and optimizing the placement of public charging infrastructure. Ultimately, this work offers a data-driven framework for sustainable urban energy planning and supports the national transition to electrified transportation.

Keywords:

EV; Forecasting; Optimization; Infrastructure; Grid

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1111

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

Cybersecurity Risks of Freight Rail as Critical Infrastructure STEM

Authors(s):

Kira Qing Sun† (Engineering); Max Yu Zhen Chen‡ (Science); Nathan Yao‡ (Science)

Abstract:

Our project implements simulated train engineers to operate model train engines on a hybrid twin of a freight rail system. We can then use the model and simulate cyber-security attacks to demonstrate the risks and effects of the attacks. Using existing model train hardware and an Arduino running open-source software, DCC-EX and JMRI, we can control the train engines and various track components and sensors. We program each engine to make safe decisions about what speed and direction to take, using information provided by the various sensors and light signals around the track. When attacks occur, the engines can have incorrect information or make unsafe decisions, which can cause collisions or derailing.

Keywords:

[no keywords provided]

Mentor(s):

Courtney Allen Falk (Centers & Institutes)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1112

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

The Effects Of Peer Relationships On Student Performance

Humanities

Authors(s):

Dev Hiten Suraj† (HHS)

Abstract:

Healthy relationships are proven to have positive effects on student mental and academic performance and that peer support is instrumental for the proper development of adaptive academic and mental health outcomes (Worley 2023). This exploratory research project focuses on how Purdue students are navigating relationships, whether they are healthy or unhealthy, and how they affect academic and social performance. To investigate this further, I administered an 8-question survey to gather insight into how students treat their own relationships in the context of a college campus. These relationships include both platonic and romantic. From the dataset, I compare answers from Purdue students with national trends found through research and academic journals to determine how Purdue students utilize relationships differently or similarly. By focusing my research on student relationships, I hope to bring awareness to how much impact other people can have on a student.

Keywords:

[no keywords provided]

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1113

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

Project Scaffolding for Skill Development and Engagement in Engineering Education Social Science

Authors(s):

Angela Anqi Tan† (DSB|JMHC)

Abstract:

This purpose of this study was to understand how integrating project scaffolding into an undergraduate optimization course affects student perceptions of learning and engagement. Students completed complex projects in three major scaffolds: (1) Project Proposal (2) Project Update (3) Final Project Submission. A mixed-methods approach was used to analyze both quantitative and qualitative student feedback from an undergraduate level optimization course (n = 24) at an engineering program based out of Colombia, South America. Quantitative data were taken from a retrospective post-then-pre survey, a post-course survey, and a survey comparison with non-scaffolded courses. Qualitative data were gathered from open-ended reflections of students' learning experiences in the course. A thematic review of the reflections revealed four major themes: (1) Methods of Skill Development through consistent practice, independent discovery, and understanding foundational concepts; (2) Navigating Technical Challenges such as cleaning data, debugging code, and designing a graphical user interface; (3) Discovering Real-World Relevance of coding and data analysis in professional and societal contexts; and (4) Collaboration, where students reported benefits like skill development and idea exchange, but also interpersonal challenges. Overall, students reported that scaffolding strengthened their problem-solving skills, technical proficiency, and gave them a clearer sense of how coursework connects to real life applications. The findings suggest that instructors may use structured scaffolding in complex, collaborative projects to treat engineering education as a developmental process, where concepts and technical skills evolve into professional independence. Additional materials include the surveys given to students, the qualitative coding framework for written reflections, and anonymous quotes from student survey responses.

Keywords:

Scaffolding; Education; Surveys; Projects; Engagement

Mentor(s):

Lisa B Bosman (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1114

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

Purdue should incorporate a dental clinic open to students on campus Humanities

Authors(s):

Sudiksha Thirumalaivasan† (HHS)

Abstract:

Purdue University offers many student health services in the medical, nutritional, and mental health categories through the Purdue University Student Health Center (PUSH). It lacks an on-campus dental clinic, though, which is a significant lack in comprehensive student healthcare. This project investigates whether Purdue should offer a dental clinic for students to promote preventative oral health, improve academic success, and provide equal access to care.

Keywords:

Oral Health; College; Dental Care Access; Student Wellness; Purdue

Mentor(s):

Catherine Jean Shukle (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1115

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

Bispecific Antigenic Immuno-Therapy (BAiT) for Preclinical Evaluation in Hypoxic Melanoma STEM

Authors(s):

Eleanor Elizabeth Thompson† (Science); Ria Singh† (Science); Payton Scott Baker† (Science); pragnya athri* (Science|JMHC); Caisong Deng* (Science)

Abstract:

Nearly 100,000 new cases of melanoma are expected in the United States in 2025, and disease progression is strongly influenced by tumor hypoxia, which contributes to poor prognosis. Approximately 9% of melanomas exhibit high expression of Carbonic Anhydrase IX (CAIX), a hypoxia-induced enzyme linked to extracellular acidification, metastasis, and adverse outcomes. Current therapies do not directly address hypoxic niches, underscoring the need for innovative strategies. We adapted the Bispecific Antigenic Immuno-Therapy (BAiT) platform, originally developed for infectious disease, to target hypoxic melanoma. BAiT conjugates were designed to bind CAIX expressing tumor cells and recruit endogenous antibodies, activating immune effector functions (ADCC, CDC, ADCP). In vitro assays confirmed selective binding and robust effector activation in CAIX expressing CT-26 cells. In vivo, CAIX-BAiT treatment significantly prolonged survival in tumor-bearing mice compared to controls. Collectively, these data provide preclinical support for BAiT as a promising antibody-recruiting strategy in hypoxic melanoma and motivate further translational development.

Keywords:

[no keywords provided]

Mentor(s):

Imrul Shahriar (Science); Jeffery J H Nielsen (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1116

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

Deep Partnerships, Deeper Impact: From Recreation to Restoration in Ocean Conservation

Social Science

Authors(s):

Eleanor Elise Thumann† (Science)

Abstract:

The ocean is one of the most breathtaking and vital ecosystems on Earth, a fact I experienced firsthand while scuba diving through vibrant coral reefs teeming with life. Yet beneath this beauty lies a growing crisis of deterioration, overuse, and pollution. Through my research I will explore how recreational scuba divers can become key contributors to sustainable ocean management, particularly within Marine Protected Areas (MPAs). MPAs are government-monitored conservation zones that safeguard marine biodiversity and aid long-term reef restoration. However, their success depends on continuous data collection, responsible tourism, and effective monitoring.

This study will examine how divers, specifically recreational, could serve as citizen scientists through AI-assisted debris detection, species tracking, and ecological modeling. Drawing from peer-reviewed studies on marine debris removal, scientific diver training, and comparative MPA effectiveness, I will analyze current management methods and identify where recreational engagement could strengthen conservation outcomes. I plan to explore how this integration could enhance the data collection for underwater conservation without creating ecological disturbance.

Ultimately, this project aims to demonstrate that divers can shift from passive observers to active restoration partners, helping balance human recreation with marine protection. This paper will lay the initial conceptual foundation for merging human experience, advanced technology, and marine science in the pursuit of a healthier ocean.

Keywords:

Recreational Scuba Diving; Ocean Conservation; Marine Protected Areas; Underwater Technology; Debris Removal

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1117

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

Effects of Adding Processed and Unprocessed Lean Red Meat to a U.S.-Style Healthy Vegetarian Dietary Pattern on Fasting Plasma Trimethylamine N-oxide (TMAO) in Young Adults STEM

Authors(s):

Mara Valentina Ugaz Angeles† (HHS)

Abstract:

Cardiometabolic diseases, including cardiovascular disease, chronic kidney disease, and diabetes, are leading causes of death in the United States. Observational studies have linked higher red meat intake and elevated plasma TMAO (P-TMAO) levels (compound found in blood produced when certain nutrients are broken down by gut bacteria) with an increased risk of these conditions. The purpose of this study is to assess the effects of adding unprocessed (URM) and processed lean red meat (PRM) to a lacto-ovo vegetarian healthy dietary pattern (LOV-HDP) on plasma TMAO concentrations (P-TMAO). This was a randomized controlled trial involving 19 participants (42% female; age 26 ± 4 years; BMI 23 ± 3 kg/m², mean $\pm$ SD) without diagnosed disease. The study included three 3-week dietary interventions, separated by a 5-week washout period. During the interventions, participants consumed either the LOV-HDP (control), URM-HDP or PRM-HDP (experimental) diet. Our hypothesis was that the LOV-HDP group would show the lowest plasma TMAO concentrations, while the PRM-HDP group would have the highest. At the post-intervention time point, results did not reveal statistically significant differences in plasma TMAO between the LOV-HDP, URM-HDP, and PRM-HDP groups. The LOV-HDP group showed no change in TMAO levels, while both the unprocessed and processed meat groups exhibited higher values, with no significant difference between them. These findings suggest a trend that partially supports our hypothesis, although the differences were not statistically significant. These findings explore how dietary choices influence gut microbiota metabolism and cardiometabolic risk.

Keywords:

TMAO; Lacto-Ovo Vegetarian (LOV); Healthy Dietary Pattern (HDP); Unprocessed Lean Red Meat (URM); Processed lean red meat (PRM)

Mentor(s):

Wayne W Campbell (HHS)

Other Acknowledgement(s):

yu Wang (Engineering)

Poster Presentation Abstract Number: 1118

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

Validation and Temporal Analysis of Differentially Expressed MicroRNAs in Horse Serum Following Intravenous Lipopolysaccharide Administration STEM

Authors(s):

McKinley Kathryn Underhill† (Agriculture|JMHC)

Abstract:

Sepsis remains one of the leading causes of mortality in horses and presents significant diagnostic challenges, particularly in its early stages. MicroRNAs (miRNAs), small, non-coding RNA molecules that regulate gene expression, offer a promising avenue for early detection of sepsis before clinical signs become evident. However, limited research exists on the role of miRNAs in equine sepsis. Our preliminary analysis identified several miRNAs that were significantly upregulated or downregulated in response to the LPS challenge. Blood plasma samples were collected from horses before and after LPS administration, and digital PCR was used to quantify changes in specific miRNA expression. The aim is to identify miRNAs that are differentially expressed in horses during experimentally induced sepsis via lipopolysaccharide (LPS) infusion. These findings suggest that certain miRNAs may serve as potential biomarkers for the early detection of sepsis in horses. Further research is needed to validate these candidates in clinical cases. Ultimately, understanding miRNA dynamics in sepsis could contribute to faster and more accurate diagnostics, as well as improved outcomes, for equine patients.

Keywords:

[no keywords provided]

Mentor(s):

Andrea Pires dos Santos (Vet Med)

Other Acknowledgement(s):

Laura Machado Ribas (Vet Med); Kerstin Muner (Vet Med); Sandra D Taylor (Vet Med)

Poster Presentation Abstract Number: 1119

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

SmartLeash+: A Strategic Model for Disrupting the Pet Training Market

Business Case Study

Authors(s):

Marissa Shuluo Urbanek† (DSB); Kyle Steven Emgenbroich† (DSB); Vinicius da Paixao Fernandes† (DSB); Filippa Maria Rodriguez Pinzon† (DSB)

Abstract:

Dog training, grounded in behavioral learning theory, remains challenging for many owners lacking time or expertise, often leading to unsafe walks, poor reinforcement habits, and even pet abandonment. To address this, our team proposes the SmartLeash+, an assistive, technology-driven device designed to enhance both safety and behavioral conditioning during walks. The system integrates a self-training mechanism that automatically rewards desired behavior and a mobility-assist feature that maintains stability and control for owners of any strength level. Our team conducted extensive market and competitor analyses, customer identification, and financial planning, complemented by text-mining and machine learning on customer reviews and survey data to validate market needs and guide design priorities. Together, these insights shaped a solution that merges automation, humane training, and accessibility, offering a scalable, data-informed innovation that improves owner experience, canine welfare, and retention outcomes in the pet care market.

Keywords:

Market Analysis; Competitor Analysis; Financial Planning; Customer Identification; Machine Learning

Mentor(s):

Xing Wang (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1120

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

Fluid Network for Multifunctional HVAC Platform with Modular Thermal Storage STEM

Authors(s):

Allen Joseph Vidallont (Engineering)

Abstract:

Accurate calculations of mass flow rates and pressure drops in complex fluid pipe networks are crucial for optimizing the performance of HVAC thermal-fluid systems such as heat pumps. A cold-climate heat pump is modelled to have a secondary liquid fluid network consisting of centrifugal pumps, heat exchangers, and servo valves. It has 24 unique operating modes that can switch how components are connected to the vapor compression cycle. This work aims to develop an explicit function model to determine the flow rate and pressure drop relationship for all components as a system of implicit equations. A lookup table or a differentiable curve fit will be used to convert the implicit calculations into a much simpler explicit function. All 24 operating modes with their own unique fluid network are to be modelled by constructing the explicit function automatically. Key results from the model would be used to validate the network's response to varying input pump speeds. The model would be able to accurately capture the flow of fluid within the system and ensure proper heat pump operation. The development of this model will aid in real-time simulation and optimization of the primary cold-climate heat pump. Future work focuses on ensuring that the model is consistent with all 24 operating modes and will be validated with real experimental data.

Keywords:

Fluid Network Modelling; Automated Multi-Mode Operation; Q-dP
Component Modelling

Mentor(s):

Demetrius Gulewicz (Engineering); Neera Jain (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1121

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

Aligning Risk/Opportunity Preferences with Agent's Decision Making Behavior in the Financial Domain. STEM

Authors(s):

Valmik Anand Vyast† (Science); Shruti Sharma‡ (Science|JMHC)

Abstract:

This paper examines whether Large Language Models (LLMs) can reason about investor behaviors to uncover risk-aligned patterns that connect declared preferences with trading actions. We model this challenge as a classification problem, using the FAR-TRAN dataset (Sanz-Cruzado, Droukas & McCreddie, 2024), which links questionnaire-based risk profiles, transaction histories, detailed time-series data of traded stocks (close and min/max prices), and market data across European exchanges. To assess the difficulty of the problem, we conduct baseline experiments using a Random Forest classifier trained on aggregate transaction features per customer, such as trade type, amount, and market, achieving roughly 50% accuracy in predicting risk level, revealing the challenge of mapping behavioral signals to stated preferences. Motivated by this limitation, we propose an LLM-based approach that can reason about the relationship between sampled trading actions and declared preferences. Our approach will provide an automatically generated dataset aligning risk and actions. We will demonstrate the quality of the datasets by using it for training models in two related prediction tasks: (1) given a small window of past decisions and market context, infer the investor's risk preference; and (2) given a declared risk level and the same kind of context, decide whether a buy/sell action would be accepted by an investor with that preference. The resulting explanations form automatically generated but label-consistent data which can support both classifier training and evaluation, offering a pathway toward interpretable and risk-aware decision modeling.

Keywords:

Artificial Intelligence; Large Language Models; Machine Learning

Mentor(s):

Dan Goldwasser (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1122

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

Controller Design For Autonomous Racing Vehicle STEM

Authors(s):

Zhishan Wang† (Engineering); Kaijie Zhu† (Engineering); Jacob Forrest† (Engineering); Kieran Venkat Desireddi† (Engineering); Brian Sam Lee† (Engineering); Chi-Che Chen‡ (Engineering)

Abstract:

Our task is to design controllers for autonomous racing's racing cars. We hope that the racing cars can still drive quickly, stably and safely without the intervention of human instructions.

As the team most responsible for the controller design, we need to design a system that converts the best driving path desired by the racing car into actual operation instructions, so that the physical components of the racing car such as the engine, steering gear, and suspension can execute the path planning instructions.

In terms of methodology, we are implementing the PID (Proportional-Integral-Derivative) controller and ADRC (active disturbance rejection controller) in both lateral and longitudinal dimensions based on the physical model of a specific autonomous vehicle on MATLAB.

We then use plot to show the tracking, states, yaw, steering and longitudinal acceleration. With the adjustments of the parameters, we lead to better performance in simulation. We will use the Simscape Vehicle library to do the simulation in the future as the visual representation.

Our results show that our PID controller is functional in moderate initial errors. After the PI for speed and PID for lateral, overshoot is initially high but has a short settling time, while saturation constraints are respected. Operation outside of the specific offset range causes the closed-loop to become unstable and diverge from the reference. ADRC will aim to make the controller work within a larger range and still converge. The goal of this research is to make autonomous vehicles run with robustness and accuracy at high speeds. We will continue to conduct tests and develop control methods in the future, attempting to make this autonomously controlled racing car run efficiently and quickly.

Keywords:

PID; ADRC; Autonomous Racing; Optimization; Dynamic Model

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

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Reed Joseph Freer (Engineering); Samuel Labi (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1123

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

Protecting the Vulnerable: Ethical AI Monitoring of the Cognitively Impaired Humanities

Authors(s):

Austin William Watson† (HHS)

Abstract:

Artificial Intelligence (AI) is a controversial topic that presents the capability to improve medical care globally. According to Jiang et al. (2017), several new AI technologies are approaching feasibility, and a few are close to being integrated into healthcare systems. Although the intent of these technologies is to improve the lives of users, there are ethical considerations to consider with utilization of AI, particularly regarding individuals with cognitive disabilities. This exploratory research project aims to analyze the advantages and disadvantages of using AI monitoring on cognitively impaired individuals. Additionally, this research will distinguish what ethical considerations should be accounted for when monitoring individuals with cognitive impairments. I conducted a preliminary literature review of different academic and popular sources throughout this project. Throughout my research, I explored AI monitoring of individuals with cognitive impairments, up and coming technologies that are considered for implementation into the healthcare system, and some first-hand opinions of individuals, family members, and primary healthcare physicians who have used novel AI tools. This research aims to inform individuals of the need for stricter ethical regulations when monitoring those who cannot provide continuous informed consent with AI moving forward. Additionally, this research provides insight into some negative outcomes that may arise if stricter ethical regulations are not implemented when monitoring cognitively impaired individuals.

References:

Jiang, F., Jiang, Y., Zhi, H., Dong, Y., Li, H., Ma, S., Wang, Y., Dong, Q., Shen, H., & Wang, Y. (2017). Artificial intelligence in healthcare: Past, present and future. *Stroke and Vascular Neurology*, 2(4), 230–243. <https://doi.org/10.1136/svn-2017-000101>

Keywords:

[no keywords provided]

Mentor(s):

Jessica M Mercado (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1124

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

Temporary blanketing effect on cutaneous temperatures of horses with various coat colors.

STEM

Authors(s):

Gwen Elizabeth Weaver† (Agriculture); Karolina Maria Beveridge† (Agriculture); Samuel Isaiah Piper† (Agriculture|JMHC); Cicelia Suzanne Martin‡ (Agriculture); Elizabeth Ann Nobble‡ (Agriculture)

Abstract:

Department of Animal Sciences, Purdue University, West Lafayette, IN

Although horses have evolved to endure extreme climates, domesticated horses require increased caloric intake during cold weather, resulting in higher feed costs to owners. To conserve body heat and reduce feed costs, owners utilize horse blankets. However, effective management requires understanding how blanketing affects temperature regulation across breeds and possibly, various coat colors. This study investigates the impact of blanketing on cutaneous muscle temperature rates in horses of various colors. We hypothesized that darker colored (n=2; bay and chestnut) and medium colored (n=1; palomino) horses would exhibit higher post-blanket muscle temperatures due to greater absorption of light wavelengths, with the use of the blanket retaining heat, when compared to horses covered with predominantly white hair (n=2; paint). To explore this hypothesis, the cutaneous temperatures over the trapezius muscle was measured immediately before and after 15 minutes of coverage with a heavyweight blanket applied to each of five horses, consecutively. Thermography measurements were taken on the left-side of each animal using a FLIR ONE thermal imaging camera, held 7 inches away from the imaged muscle. Results included: bay = -2.2°C, chestnut = +1.6°C, palomino = +0.6°C, paint 1 = +1.3°C, and paint 2 = +2°C utilizing the trapezius muscle. These findings suggest that blanket coverage and coat color both influence localized heat retention. Further research incorporating varying blanket-weights, consistent environmental temperature, and longer intervals is needed to better understand the relationship between coat color, muscle temperature, and blanket use in equine thermoregulation.

Keywords:

Equine; Thermal Imaging; Blanketing

Mentor(s):

Casie S Bass (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1125

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

Utilizing Predictive Modeling for Retail Sales and Inventory Optimization

Business Case Study

Authors(s):

Colin Lucas Wellington† (DSB|JMHC); Jose Augusto Heighes Claux† (DSB); Marcus Victor Page† (DSB); Swati Raj Rajasekaran† (DSB)

Abstract:

Our project looks into trends, seasonality, and predictive patterns in e-commerce performance data across multiple product categories from January 2022 to June 2025. The analysis focuses on three key behavioral metrics: Add to Cart events, Page Views, and Order Quantity. We conducted a series of structured weekly analyses to analyze time series data to help predict future outcomes and explain anomalies in data that help with understanding future traffic and inventory.

Initial phases included data segmentation by week and month, followed by the creation of interactive visualizations to highlight patterns in the data. Additionally, we introduced year-over-year comparisons, correlation matrices, and regression models to identify significant relationships among variables. Using a training set and testing set, we created multiple forecasting models to predict future performance and incorporate new variables to improve predictive accuracy.

Ultimately, this research contributes to a deeper understanding of e-commerce dynamics and demonstrates how predictive analytics can drive data based decision making in retail operations, marketing strategy, and inventory management.

Keywords:

Retail Sales Forecasting; Predictive Modeling; Inventory Optimization; Data Analytics in R; Predictive Analytics

Mentor(s):

Xing Wang (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1126

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

Assessing Mental Health Safeguards in U.S. Physician-Assisted Suicide
Humanities

Authors(s):

Alivia Keler Whitney† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Physician-Assisted Suicide; Physician-Assisted Death; Safeguards; Laws; Mental Health

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1127

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

Biomimetic Robotic Fish

STEM

Authors(s):

Owen Lee Wise† (Engineering|JMHC)

Abstract:

Recent advances in biomimetic and soft robotics have opened new possibilities for non-invasive environmental monitoring, inspiring the design of robotic systems that imitate the motion of aquatic life. This project develops a biomimetic robotic fish capable of realistic swimming to collect environmental data without disturbing aquatic ecosystems. Current approaches to aquatic data collection rely on stationary sensors or periodic sampling, leaving gaps in spatial and temporal coverage. Our prototype reproduces fish locomotion using an electromagnetic actuator composed of a solenoid, an oscillating signal, and two opposing magnets. This actuation method minimizes noise and disruption compared to conventional motor-driven underwater vehicles. The robot is encased in a silicone body that replicates the form and motion of real fish. This will enable the fish to blend into its surroundings and generate lifelike fluid flow patterns. Future designs will explore sinusoidal tail-fin movements to transition from rigid-body ostraciiform motion toward more lifelike carangiform propulsion, incorporate a micro pump with an elastic “fish bladder” for buoyancy control, and implement a bisphenol-A (BPA) optoelectronic sensor for water-quality monitoring. An onboard microcontroller will manage the actuator’s sensor I/O, enabling remote control and real-time data streaming features. By blending naturally into aquatic environments, this technology could serve as a tool for long-term observation of pollution, temperature, and chemical contaminants in different bodies of water. This research aims to establish a foundation for low-cost, bio-inspired robots that support sustainable environmental monitoring. In the long term, environmental protection organizations could employ this technology to support data-driven and sustainable decision-making.

Keywords:

Biomimicry; Soft Robotics; Environmental Monitoring; Aquatic Ecosystems; Mechatronics

Mentor(s):

Ramses Martinez (Engineering); Jose Alfredo Ocegueda Barraza (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1128

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

AI Use in Disaster Response Image Classification

STEM

Authors(s):

Chi Che Colin Wu† (Science); Rishabh Mahesh† (Science); Ken Zhang† (Science); Joshua John Beigel‡ (DSB); Julia Kang‡ (Science); Logan Michael Fossum‡ (Engineering)

Abstract:

Rapid and reliable assessment is critical for effective emergency response and resource allocation in the circumstances of a large-scale disaster, yet traditional methods often lag behind in comparison to real-world events. This project develops automated methods to analyze disaster-related social media posts, leveraging the rapid, ground-level information that such platforms provide during crises. Using the CrisisMMD: Multimodal Crisis Dataset, a Twitter dataset consisting of several thousands of manually annotated tweets and images, we aim to classify disaster images based on the level of damage depicted. We convert raw social media images into fixed-length feature vectors through a reproducible preprocessing pipeline and produce compressed feature datasets to train image classification models. Using these features, we trained classic decision tree and random forest classifiers, assessing their performance with accompanying classification metrics and confusion matrices.

Our immediate goal is to reliably classify damage severity (little/no damage, mild, severe) from social media imagery. In the long term, our work would extend to multimodal classification with accompanying text and employing deep-learning models to improve generalization and robustness. Ultimately, this research aims to aid in reducing the lack of information on large and medium-scale natural disasters and provide specific actionable information from social media input and satellite imagery. This technology can provide an extensive understanding of the complications associated with disasters in minutes, complementing existing first responder deployment, and be a quick and efficient resource to tackle natural disaster complications before circumstances rapidly spiral out of control, possibly saving lives and reducing significant damage.

Keywords:

AI; ML; Image Processing; Disaster Response; Decision Tree

Mentor(s):

Soudabeh Taghian Dinani (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1129

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

A Hybrid Quantum–Classical Deep Learning Approach to Chest X-Ray Classification STEM

Authors(s):

Nadav Yaniv† (Science); Edgar Robles‡ (Science); Stephen Reeves† (Science); Sicheng He† (Science)

Abstract:

The use of machine learning in precision applications like medical imaging is a topic of interest for many researchers. The purpose of this project is to explore how quantum computing can be integrated with classical deep learning to analyze medical images more efficiently. The study focuses on developing a hybrid quantum–classical model that combines a convolutional neural network (CNN) with quantum machine learning techniques using the ChestMNIST dataset for training and testing. 21602 Chest X-Ray images with labeled diagnoses for 14 conditions were used to train the model. The model is able to “diagnose” a patient based on an input chest X-Ray image for a number of conditions, like pneumonia, growths/tumors, hernias, etc. The expected findings will compare the hybrid model’s classification accuracy and computational efficiency against a standard CNN.

Keywords:

Quantum Computing; Quantum Machine Learning; Medical Classification; Neural Networks; Biomedical Imaging

Mentor(s):

Andy Jung (Science); Noah Daniel Singer (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1130

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

From Passive Bandages to Active Healing: Characterizing Magneto-Responsive Elastomers for Disposable Biomedical Actuators STEM

Authors(s):

Ivanna Isabel Yllahuaman Bonifas† (Engineering); Daniel Kiyoshi Kuratomi‡ (Engineering|Graduate)

Abstract:

Wound care presents a significant global health challenge, marked by high costs and a substantial socio-economic burden. Current approaches, often relying on passive bandages or frequent nurse visits to prevent infection, provide limited therapeutic benefit and lack real-time information on the healing process. While active treatments utilizing magnetic fields and microstimulation have shown promise in accelerating wound healing, their widespread adoption is hindered by the requirement for specialized, expensive equipment, costly long-term treatments, and patient proximity to clinical settings. This necessitates the development of accessible, effective, and disposable solutions. In this talk, I will present the use of biocompatible magneto-responsive elastomeric materials to create disposable wearable biomedical actuators. This study investigates the characterization of these materials embedded with distinct magnetic alignments and compositions: iron particles, neodymium, and Fe₃O₄ nanorods. Our goal is to evaluate how these varied compositions influence magnetic attraction through controlled force measurements and their mechanical stiffness via stress-strain testing, thereby quantifying material stiffness and deformation behavior. Our findings aim to determine the precise interplay between magnetic and elastic properties unique to each material type. Ultimately, this research paves the way for non-invasive, cost-effective therapies and advanced regenerative medicine applications, transforming active wound care into a widely accessible solution.

Keywords:

Magneto-Elastomers; Wearable Actuators

Mentor(s):

Ramses Martinez (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1131

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

Evaluating the Genomic Safety of COVID-19 mRNA Vaccines STEM

Authors(s):

Camryn Anne Young† (Science)

Abstract:

In 2020, mRNA vaccines were highly recommended to reduce the COVID-19 outbreak. These vaccines became controversial in the public eye because many people worried about their safety. One of the major safety concerns was the potential for the mRNA vaccine to integrate into the recipient's genome. During the release of the COVID-19 vaccines, the public was reassured that the vaccine did not have the ability to modify a person's DNA because the mRNA contained in the vaccine is unable to enter the cell nucleus, where DNA is stored. Recent studies have found evidence of mRNA from COVID-19 vaccines integrating into the host genome via LINE-1 retrotransposons. mRNA genome integration shows that mRNA vaccines do have the potential to alter the DNA of a vaccine recipient. Although there is evidence of genomic changes, the majority consensus among medical professionals and researchers is that the vaccine is safe for administration. In this study, I will explain how COVID-19 vaccines can integrate mRNA into a host genome using LINE-1 transposons. I will then evaluate if the genomic changes caused by mRNA vaccines lead to any long-term consequences after vaccination. Finally, I will examine the reasoning behind why mRNA vaccines are deemed safe, even with the possibility of DNA alterations caused by the vaccine.

Keywords:

COVID-19; mRNA vaccine; Genome Integration; Vaccine Safety; DNA Alteration

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1132

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

Developing Collagen and Hyaluronic Acid Matrices to Model Nanoparticle Transport in Brain Extracellular Environments STEM

Authors(s):

Yuan Heidi Yue† (Science|JMHC)

Abstract:

Efficient intrathecal injection for delivering drugs to the brain depends on understanding how nanoparticles interact with and move through the extracellular matrix (ECM) surrounding neural tissue. This project focuses on developing in-vitro experimental models using collagen and hyaluronic acid (HA) hydrogels to investigate how proteins in cerebrospinal fluid (CSF) and other biological barriers influence nanoparticle transport. Collagen gels were prepared through self-polymerization and incorporated into a modified Transwell recovery assay, which allows observation of how nanoparticle-based therapeutics interact with the CSF and extracellular matrix of the pia mater. We replicate these components using a layer of nanoparticles suspended in artificial CSF (aCSF) above the tissue mimic. Albumin concentration in the aCSF was varied to evaluate how disease state impacts nanoparticle transport, as albumin levels—about 60% of total CSF protein in healthy individuals—can increase in neurological disorders. Nanoparticles with distinct surface chemistries, including unmodified, carboxylated, aminated, and PEGylated types, were characterized. The results show that nanoparticle diffusion depends on both surface chemistry and protein concentration, with PEGylated nanoparticles exhibiting reduced movement in albumin-rich environments. Unmodified, carboxylated, and aminated nanoparticles displayed increased transport with rising albumin concentration. In ongoing work, HA hydrogels are being synthesized through thiolation chemistry to create stable matrices suitable for similar nanoparticle studies. This work establishes methods for modeling extracellular transport and supports the optimization of nanoparticle design for intrathecal therapeutic applications.

Keywords:

Nanoparticles; Modeling; Transport; In Vitro; Tissue Mimic

Mentor(s):

Julie C Liu (Engineering); Marisa Ann Egan (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1133

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

What Makes a Song a Hit? Predicting Spotify Popularity through Music Analytics

Business Case Study

Authors(s):

Megan Zhu† (DSB); Alexandra Li Alderink† (DSB); Rachel Kalyn Speart (DSB); Angela Peng Gao† (DSB); Tiffany Sui‡ (DSB)

Abstract:

In today's streaming era, millions of songs compete for attention, but what truly makes a song popular? This project investigates how musical characteristics influence a song's success on Spotify, exploring whether data can reveal the secret behind viral hits. Using a dataset of over 18,000 songs from Spotify's public database, we aim to answer the central question: Can a song's popularity be predicted using its audio features? Our research bridges creativity and analytics, showing how numbers can help decode musical appeal and guide artists, producers, and streaming platforms in shaping the next chart-topping track.

Our dataset includes 18,835 unique songs, each described by 15 features such as danceability, energy, loudness, and tempo. Through exploratory data analysis, we found that song popularity follows a bell-shaped curve, meaning most tracks score between 40 and 70 on Spotify's 0-100 popularity scale. Notably, energy and loudness exhibit the strongest positive correlation ($r = 0.74$), while valence (musical positivity) shows moderate alignment with higher popularity levels. These insights suggest that upbeat, energetic songs tend to resonate more with listeners.

To predict song popularity, we developed a sequence of regression models. We began with a multiple linear regression model to establish a baseline understanding of linear relationships, followed by more advanced techniques like Random Forest Regression and K-Nearest Neighbors (KNN) to capture nonlinear patterns. Model performance was compared using mean squared error (MSE), root mean squared error (RMSE), and R-squared (R^2) metrics. To ensure reliability, K-fold cross-validation will be applied to estimate test errors and minimize overfitting.

We anticipate that our models will identify the most influential features driving Spotify popularity, particularly energy, loudness, and danceability. By leveraging predictive analytics, our findings can help artists tailor their sound, assist record labels in targeting marketing efforts, and enable

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

streaming platforms to enhance recommendation systems. Ultimately, this study emphasizes the growing role of data in creative industries and offers a replicable framework for using analytics to decode cultural trends and predict success in entertainment.

Keywords:

Song Popularity; Predictive Analytics; Linear Regression; Spotify; Data-Driven Decision Making

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1200

Presentation Time: Session 2: 10:30-11:30am

**Evaluation of the Heart Failure Rapid Uptitration Clinic at
Barts Health in London, England
STEM**

Authors(s):

Alton Jeffrey Adams† (Pharmacy)

Abstract:

[Abstract Redacted]

Keywords:

Heart Failure; Beta-Blocker; Clinic; Medication; Titration

Mentor(s):

Ellen M Schellhase (Pharmacy); Monica Miller (Pharmacy)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1201

Presentation Time: Session 2: 10:30-11:30am

Promoter Replacement of Mismatch Repair Genes Improves Meiotic Recombination and Hybrid Viability in Diverged Saccharomyces Species STEM

Authors(s):

Haven Marie Bader† (Science); Abigail Catherine Burris‡ (Science)

Abstract:

A central question in biology is how genetic differences give rise to phenotypic trait differences between species. This question is difficult to study because reproductive isolation prevents genetic analysis between species. In other words, crossing members of different species to directly study how different genes influence traits is currently unfeasible. *Saccharomyces* yeast offers a unique opportunity to overcome this challenge since species in this group that diverged millions of years ago can still form hybrids. However, these hybrids are typically unable to undergo meiosis successfully and are not viable. When the hybrids undergo meiosis, sequence divergences between the chromosomes lead to inappropriate activation of the mismatch repair system which then interferes with proper recombination. To address this problem, we are applying techniques to improve hybrid viability through genome engineering. We are silencing genes involved in the mismatch repair system of meiosis by replacing their promoters in two different *Saccharomyces* species, which are then hybridized to form interspecific hybrids. Through this, we aim to enable correct meiotic recombination and increase hybrid viability. To assess the effects of these modifications, we measured spore viability through tetrad dissection, examined independent assortment using phenotypic markers, and confirmed recombination through genome sequencing. Our results indicate that promoter replacements successfully increased spore viability and recombination in some hybrid cases but not others, suggesting that the effectiveness of mismatch repair suppression depends on evolutionary divergence between species. By enabling genetic mapping across diverged species, this work addresses how genetic differences give rise to phenotypic divergence.

Keywords:

[no keywords provided]

Mentor(s):

Brian Patrick Ha Metzger (Science); Aparna Desai (Science)

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

Other Acknowledgement(s):
David Matthew Moore (Science)

Poster Presentation Abstract Number: 1202

Presentation Time: Session 2: 10:30-11:30am

AI-Driven Repository Discovery: A Hybrid Feature Recommendation Engine for re3data.org STEM

Authors(s):

Ekam Bhullar† (Engineering); Gonzalo Capio-Rivero* (Engineering);
Dana Elizabeth Schirack* (Engineering)

Abstract:

Research data repository discovery in large registries like re3data.org is hampered by the limitations of static, keyword-based search, which often causes researchers to miss highly relevant resources. This project addresses this problem by developing a Hybrid Feature Recommendation System to enhance the search and discovery functionality of re3data.org. Metadata from 70 repositories were collected and split into a 60-repository training corpus and a 10-repository test set. Semantic features were generated using TF-IDF vectorization on repository descriptions and subjects, while operational features were derived from real-time HTTP status checks to indicate which repositories were active and accessible. The semantic and operational features were combined using Scipy's `hstack()` to form a unified feature matrix. Cosine similarity was then applied to this matrix to generate recommendations. Validation on the held-out test set demonstrates that the system successfully identifies repositories with similar topics that are also accessible online. Implemented entirely in Python using Scikit-learn, Pandas, and Flask, the system provides a lightweight, API-ready backend capable of real-time, reliability-aware recommendations. This project demonstrates a scalable and practical approach to integrating machine learning with data quality checks, significantly improving both the precision and trustworthiness of research data discovery on Re3data.org, which hosts over 3,400 repositories.

Keywords:

Machine Learning; Semantic Search; Data Reliability; Repository Recommendation; Python

Mentor(s):

Michael Witt (Libraries)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1203

Presentation Time: Session 2: 10:30-11:30am

Higgs Signal Classification with Machine Learning STEM

Authors(s):

William David Boulton† (Science); Kabir Jain† (Science); Carina Leigh Jacobson† (Science|JMHC); Nicolas Bustamante† (Engineering)

Abstract:

The efficient detection of Higgs Boson creation events in the LHC has continued to be a research problem since the particle's first observation in 2012. With 30 petabytes of data collected in the LHC every year, it is required of physicists and data scientists to create efficient and robust ways of detecting, filtering, and studying Higgs events. Although classical methods have been developed to solve this problem, we focus on the use of machine learning tools to correctly identify these Higgs events. In this work, we present a deep neural network (DNN) that is capable of detecting events in which the Higgs Boson is created with high accuracy. We present our methods of training, tuning, and testing this model along with the resulting accuracy and efficiency.

Keywords:

Higgs; LHC; Deep Neural Network

Mentor(s):

Andreas Jung (Science); Heather Nicole Martin (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1204

Presentation Time: Session 2: 10:30-11:30am

**Optimization of Peptides Active Against *Balamuthia*
mandrillaris
STEM**

Authors(s):

Manuela Maria Buitrago Cardenas†

Abstract:

[Abstract Redacted]

Keywords:

Peptides; *Balamuthia mandrillaris*; Solid Phase Peptide Synthesis

Mentor(s):

Laura Gabriela Coy Rodriguez (Pharmacy); Elizabeth I Parkinson (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1205

Presentation Time: Session 2: 10:30-11:30am

Gene Regulatory Modifications in the Mismatch Repair Pathway Promote Hybrid Viability in Diverse Saccharomyces Species STEM

Authors(s):

Abigail Catherine Burris† (Science); Haven Marie Bader‡ (Science)

Abstract:

Understanding how new molecular functions arise is challenging for biology. Genetic barriers between species cause reproductive isolation, inhibiting genetic crossing-over, and preventing the use of genetic crosses for identifying the genes responsible for new functions. Using genetic alterations in distantly related species counteracts reproductive barriers through gene regulation changes. The use of *Saccharomyces* yeast allows for sterility to be bypassed as they can still hybridize with previously diverged groups. We specifically focused on *Saccharomyces jurei* and its inability to cross with distant yeast relatives by using CRISPR-cas9 genome editing to alter expression of genes involved in mismatch repair. Building on previous work with other *Saccharomyces* species, we used microdissection experiments to separate meiotic progeny and scored the segregation of several markers to look for evidence of independent assortment of chromosomes between species. In the future, we plan to sequence surviving offspring from hybrid crosses to look for evidence of recombination between species. This work will identify the genetic basis of trait differences between species and thus help to understand how new functions have evolved.

Keywords:

Genetics; Evolution; *Saccharomyces* Yeast; Meiosis; Reproduction

Mentor(s):

Brian Patrick Ha Metzger (Science)

Other Acknowledgement(s):

Aparna Desai (Science); David Matthew Moore (Science)

Poster Presentation Abstract Number: 1206

Presentation Time: Session 2: 10:30-11:30am

Identifying Doxorubicin-Induced Cardiotoxicity Using 4D Echocardiography STEM

Authors(s):

Bea Olivia Cabot† (Science); Anna Julie Astrid Webb‡ (Science); Aasish Chowdary Karuturi‡ (Science|JMHC); Wilhelm S Smith‡ (Engineering)

Abstract:

Doxorubicin is an effective, commonly used chemotherapeutic drug. However, this drug is accompanied with disadvantages. Specifically, doxorubicin is associated with cardiotoxicity, characterized by left ventricle dysfunction. We hypothesize that 4D ultrasound imaging can reveal cardiac changes associated with doxorubicin-induced cardiotoxicity earlier in disease progression than 2D ultrasound imaging. To test this hypothesis, C57BL/6J mice were separated into treatment or control groups. Intraperitoneal injections were administered weekly for 4 weeks, each dosage equivalent to 4 mg/kg of either doxorubicin (treated) or saline (control). A Vevo3100 high frequency ultrasound system (FUJIFILM VisualSonics) was used to collect 2D and 4D ultrasound images of cardiac structures. Weekly imaging was carried out for 8 weeks following baseline imaging. 2D images were analyzed using Vevo Lab (VisualSonics) software. Parameters reflecting diastolic and systolic function including ejection fraction were collected, as well as left ventricle dimensions. Ejection fraction, or the percent of blood volume expelled from the left ventricle, is a commonly-used marker of cardiotoxicity. The 4D ultrasound images, analyzed using a custom-built MATLAB Graphical User Interface, uniquely quantified cardiac strain using the full volume of the heart. Cardiac strain is a measure of cardiac wall displacement. In mice treated with doxorubicin, decreases in both ejection fraction and strain are anticipated. Ongoing image analysis will quantify any changes in cardiac strain that may occur prior to changes in the metrics found using 2D analysis. The ability to identify dysfunction using cardiac strain before traditional analysis has potential to improve early diagnosis and treatment of cardiotoxicity.

Keywords:

[no keywords provided]

Mentor(s):

Cortland Hannah Johns (Engineering); Benjamin Zeidler (Engineering); Craig Goergen (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1207

Presentation Time: Session 2: 10:30-11:30am

Modelling the impact of weak stratigraphy on the development of accretionary prisms STEM

Authors(s):

Barbara Soares Cabral† (Science|JMHC)

Abstract:

The Cascadia region west of Washington state is an active convergent plate margin. This margin has produced significant seismic hazards in the geologic past, but the origin of the structures comprising it remain poorly understood. The Cascadia accretionary prism is observed to be dominated by landward vergent thrusts, which do not align with the mechanical theory of thrust wedge formation. It has been hypothesized that these thrusts formed in response to weaker stratigraphy and elevated pore fluid pressure, which allow for highly localized deformation. Our goal is to determine which elements are key to the development of backthrusting and why these thrusts do not commonly occur elsewhere. We use scaled analog models to simulate this region. Past experiments were unable to model landward dominated wedges without a viscous basal layer to simulate weak stratigraphy. We tested the role of significant mechanical stratigraphy above a weak decollement to investigate its ability to produce landward vergence in a frictional rheology. We simulated a weak upper decollement with a layer of low friction glass beads. The experimental wedge had a tapered backstop and basal dip to account for angle of plate subduction. We found that frictional stratigraphy could not produce a wedge dominated by landward vergence, suggesting that ductile deformation is integral to its development. While the localization of deformation was substantially impacted by our weak upper layer, we found that it was still dominated by seaward verging structures, but that those structures were active at different times than in mechanically isotropic wedges.

Keywords:

Analog Modeling; Thrusting; Mechanical Stratigraphy; Cascadia; Image Analysis

Mentor(s):

Saad S B Haq (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1208

Presentation Time: Session 2: 10:30-11:30am

Autonomous Car Racing: A Weather Resistant Simultaneous Localization and Mapping Implementation STEM

Authors(s):

Siddarth Balaji Calidast† (Engineering); Aadya Rangole† (Science); Aya Wael Mohammed Tawfik Elghayaty† (Engineering); Andrew Dominick Angelt† (Engineering); Pin-Hsuan Tu‡ (Polytechnic); Marko Daniel Peric‡ (Engineering)

Abstract:

Autonomous Race Engineering Systems (ARES) is a team under Purdue College of Engineering's Vertically Integrated Projects (VIP) program. ARES focuses on providing students with the opportunity to explore open research areas in autonomous vehicle racing. Our team is exploring the problem of inclement weather conditions affecting sensor data, specifically for the Indy Autonomous Challenge (IAC). This was a problem experienced by IAC teams during the 2022-2023 season, when rain and fog affected the performance of many IAC team's vehicles because their algorithms were not designed to handle sensor data compromised by bad weather conditions. Our team is focusing on implementing a Simultaneous Localization and Mapping (SLAM) stack designed specifically to perform well in rain, fog, dust or other inclement weather. Our SLAM stack will utilize IMU, LiDAR, camera and Radar sensors and will implement multiple modifications to existing implementations. First, a robust denoising stage will improve the quality of the sensor data by implementing specialized filters designed to remove noise caused by current weather conditions. IMU odometry will provide high frequency localization estimates, while a sensor fusion algorithm that combines odometry and mapping from other sensor sources will correct this estimate at a lower frequency, and update the environment map. This sensor fusion algorithm will change the weights of each source based on its estimated reliability given the current conditions. The final deliverable for this project will be a demonstrated implementation of this stack in a ROS2 environment, either on artificially corrupted sensor data or in a simulation.

Keywords:

SLAM; LiDAR; Odometry; Sensor Fusion; Kalman Filter

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Reed Joseph Freer (Engineering); Richard Osita Ajagu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1209

Presentation Time: Session 2: 10:30-11:30am

Adult Intelligibility Ratings of Child Speech

STEM

Authors(s):

Jordan Ceront† (HHS); Jillian Grace Robbins‡ (HHS)

Abstract:

Intelligibility is the degree to which a speaker is understood. Children with speech sound disorders (SSD) produce more speech errors and are less intelligible than other children of the same age. Several factors influence intelligibility ratings, including the room acoustics, the talker's speech, and the listener. The aim of our study is to investigate the impact of bilingualism of the listener on the intelligibility of children with and without SSD. We developed a speech intelligibility task consisting of single words and short utterances produced by a child with typical speech, and by a child with an SSD. Adults who are monolinguals or bilinguals listen to words and utterances produced by one of the child speakers and write down what they hear. Sixteen adults have completed the study to date, and preliminary results regarding differences in interlistener variability in intelligibility will be presented. We will also briefly discuss implications for the assessment of children suspected of presenting with SSD.

Keywords:

Intelligibility; Speech Sound Disorders; Child Speech

Mentor(s):

Francoise Brosseau-Lapre (HHS)

Other Acknowledgement(s):

Zoe Zhang (HHS)

Poster Presentation Abstract Number: 1210

Presentation Time: Session 2: 10:30-11:30am

Accounting for Censored Data in Charitable Giving: A Tobit Model Replication of Karlan & List

Social Science

Authors(s):

Aashna Chandnani† (DSB)

Abstract:

Nonprofits often rely on matching gift campaigns to increase charitable donations, but standard evaluation methods may underestimate their true impact. In Karlan and List's (2007) field experiment, over 50,000 individuals received fundraising letters offering donation matches at varying ratios (1:1, 2:1, 3:1). While their analysis showed that offering a match increases the likelihood of donating, it failed to account for one critical issue: 98% of potential donors gave \$0, creating a highly censored dataset.

This study revisits the original findings using a Tobit model to more accurately reflect the effects of matching gifts when donation amounts are left-censored. We replicate the original Probit and OLS regression results before applying the Tobit model across multiple subsamples. While being offered a matching donation significantly increases donations when tested in isolation, this effect becomes statistically insignificant when controlling for other factors, such as the match ratio, the suggested ask amount, and the donation threshold. These results align with the original study, but with an improved model fit and clearer interpretation.

This research is important because it provides a more accurate way to analyze donation behavior in campaigns where the majority of individuals choose not to give. For fundraising professionals, the Tobit model provides stronger predictions of donor behavior, allowing organizations to design more effective donation strategies. For researchers, it highlights how ignoring censored data can conceal important behavioral insights and emphasizes the need to use econometric models that align with the structure of the data.

Keywords:

Charitable Giving; Tobit Modeling; Censored Data; Behavioral Economics; Regression Analysis

Mentor(s):

Adrian Hoffert Wolanski (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1211

Presentation Time: Session 2: 10:30-11:30am

Large Format Additive Manufacturing - Anisotropic Shrinkage and Crystallization Kinetics in Semi-Crystalline Polymer Composite STEM

Authors(s):

En-Hua Chang† (Engineering)

Abstract:

Large Format Additive Manufacturing (LFAM) has enabled printing structures on a scale of multiple meters in length. Reinforcing polymers with fibers has been a key enabler to scale this technology from the desktop 3D printing scale to the multi-meter scale. Semi-crystalline polymers offer higher thermal stability and chemical resistance than amorphous polymers used in 3D printing. However, semi-crystalline polymers undergo a phase change, crystallization, as the material cools down from the processing temperature to the ambient temperature. During crystallization, polymer chains are ordered in a crystalline structure, resulting in the shrinkage of the polymer, inducing residual stress within the part, causing warping, splitting, and undesired tolerance. In addition, the coefficient of thermal expansion changes as the polymer cools down below the crystallization temperature and crosses the glass transition temperature, thus detailed characterization is necessary to ensure quality prints from LFAM. Hence, this project focuses on characterizing the shrinkage developed as Polyethylene Terephthalate (PET) reinforced with 50% by weight of glass fiber cools down from the processing temperature to the ambient temperature. A constant Coefficient of Thermal Expansion (CTE) was characterized for temperatures between ambient and the glass transition temperature (T_g), a temperature-dependent CTE was characterized by temperature between T_g and the melting temperature. Similarly, the crystallization shrinkage was characterized. An overview of the experimental procedure used to characterize shrinkage in different material directions and supplementary Differential Scanning Calorimetry techniques used to relate temperature history to crystallization history will be presented.

Keywords:

Additive Manufacturing; Material Characterization; Composite Material; Semi-Crystalline Polymer; Thermal Expansion

Mentor(s):

Eduardo Barocio Vaca (Engineering); Jordan James Wess Kalman (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1212

Presentation Time: Session 2: 10:30-11:30am

Smart Sensor Applications in Material and Equipment Maintenance STEM

Authors(s):

Ethan Keid Chen† (Engineering); Micah A Macias‡ (DSB)

Abstract:

Our group would like to examine the application of IoT technology such as vibration, pressure, and temperature sensors in the field of predictive maintenance. Predictive maintenance is a maintenance strategy which uses data communicated by sensors to monitor the condition of a specific material or piece of equipment, looking at things such as stress, fractures, and corrosion in real-time. This is different from the practice of preventive maintenance, where routine checks are performed on a material or piece of equipment, which can be inefficient and time-consuming, especially on a large, industrial scale. By implementing and embedding sensors into machinery or materials, the information communicated by these sensors can help detect any issues within equipment, allowing workers to fix the issue before it arises, but without forcing workers to complete unnecessary routine checks when there is no evidence of any problems. Coupling these sensors with systems such as Computerized Maintenance Management Systems (CMMS), the programs are able to create recognized patterns and find anomalies that might correspond to an issue with the equipment or material. As more and more data is collected, the patterns become stronger and anomalies are easier for the system to detect, improving efficiency even further. This idea of integrating sensors into materials and machines can also be expanded by growing fields such as artificial intelligence, which can help write algorithms that accurately predict when a maintenance worker should make a repair.

Keywords:

Sensors; Predictive Maintenance; Efficiency; Data Analysis; Materials

Mentor(s):

Steven R Dunlop (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1213

Presentation Time: Session 2: 10:30-11:30am

Measuring the Effectiveness of Follow-up Observations by the Las Cumbres Observatory in Constraining Explosion Physics of Transients STEM

Authors(s):

Erika Chiommino† (Science|JMHC); Anya Kanagala† (Polytechnic);
Nicola Jirina Ferrante† (Science); Ananya Molugu† (Engineering);
Ishaan Avinash Limaye‡ (Science|JMHC)

Abstract:

The upcoming Vera C. Rubin Observatory is set to detect more transients in its first year than ever before in the history of astronomy. However, the cadence of observations between filters (>20 days) will not robustly constrain models, leading to considerable uncertainty in estimates of physical parameters including explosion energy and mass. The Las Cumbres Observatory (LCO) is a network of telescopes that complements all-sky survey observations by providing follow up data. However, LCO observations are not systematically planned, leading to potential redundancy in coverage. In this study, we fit light curve models to Type Ia supernovae data from both the Zwicky Transient Facility (ZTF) and LCO, and compare the inferred parameters to fits only using ZTF data. By examining the difference in uncertainty, we will measure whether the additional LCO data provides meaningful constraints for understanding the physics of transients—an essential step toward developing efficient follow-up strategies to maximize the scientific yield of the Rubin Observatory.

Keywords:

Astronomy; Supernovae

Mentor(s):

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1214

Presentation Time: Session 2: 10:30-11:30am

Consumer Behavior Case Study on Fisher Funeral Home
Business Case Study

Authors(s):

Jeremy Francis Ciaramella† (DSB); Andrew Dean Fredette† (DSB);
Austin James Knipp† (DSB); Matthew David Pelletier† (DSB); Joshua
Andrew Zyrek‡ (DSB); Masahiro Suzuki‡ (DSB)

Abstract:

[Abstract Redacted]

Keywords:

Marketing; Consumer Behavior; Consumer Choice; Funeral Home

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1215

Presentation Time: Session 2: 10:30-11:30am

Factors Influencing Mental and Cognitive Health in Old Age: Integrative Approaches to Active Aging Social Science

Authors(s):

Vanessa Claire Cook† (HHS)

Abstract:

As life expectancy across global populations increases, maintaining mental and cognitive health in later life has become a growing priority. Cognitive decline (dementia) and mental health challenges can significantly impact quality of life among older adults, yet research shows that many of these outcomes are influenced by lifelong social, educational, and behavioral factors. Within this study, I explore the multifaceted factors that influence mental and cognitive health in older adulthood and examine strategies to preserve and support these functions across the lifespan. Utilizing meta-analysis of pre-existing sociological, public health, and medical literature, I will highlight the roles of education and health literacy in shaping lifelong cognitive health and capacity. Psychosocial factors such as autonomy, social usefulness, and active engagement in one's community and activities are also shown to contribute to psychological resilience and well-being in old age. Furthermore, intervention-based research emphasizes the benefits of health promotion practices, mindfulness activities like yoga, and person-centered approaches in sustaining mental and cognitive vitality. These findings suggest that sustaining active aging and maintaining cognitive health in older populations requires an integrative approach that combines educational, psychosocial, and behavior support through the life course.

Keywords:

Cognitive Health; Health Literacy; Mental Health; Well-Being; Active Aging

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1216

Presentation Time: Session 2: 10:30-11:30am

Exploring the Histaminylation Proteome in Colorectal Cancer Cells STEM

Authors(s):

Kaiwaan Porus Dalal† (Engineering)

Abstract:

Histaminylation is a recently identified post-translational modification in which the enzyme transglutaminase 2 (TGM2) covalently attaches histamine to glutamine residues on target proteins. While this PTM has been studied on histone H3 at glutamine 5 (H3Q5) in neurons of the posterior hypothalamic tuberomammillary nucleus, its function in cancer remains under-studied. This project aims to explore TGM2-mediated histaminylation in the HCT 116 human colorectal cancer cell line to understand its potential influence on cancer phenotype.

A synthetic histamine probe with an alkyne handle was designed for bio-orthogonal tagging and detection of histaminylated proteins in HCT 116 cells. Labeled proteins are being analyzed using global and site-specific proteomics to identify histaminylation targets and precise modification sites.

By mapping these modification sites and their associated pathways, this study may help clarify whether TGM2-mediated histaminylation plays a functional role in cancer biology and lay groundwork for identifying potential molecular targets in future therapeutic research.

Keywords:

Histaminylation; Proteomics; Colorectal Cancer; Transglutaminase-2; Bioorthogonal Chemistry

Mentor(s):

Qingfei Zheng (Pharmacy)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1217

Presentation Time: Session 2: 10:30-11:30am

Clock Domains for SoCET Design Flow STEM

Authors(s):

Raunak Dani† (Engineering); Moe Wai Yan Myint‡ (Engineering); Niels van Ritbergen‡ (Engineering); Blake Alexander Andrews‡ (Engineering); Tei Okamoto‡ (Engineering)

Abstract:

In modern VLSI design, connecting multiple domains operating at different clock frequencies is critical to achieving optimal power and performance for a System-on-Chip (SoC). This requires partitioning designs into different clock domains and connecting them using Clock Domain Crossing (CDC) techniques. SoCET's current SoC design uses a single ungated clock, resulting in unnecessary dynamic power consumption. We propose a multi-domain clocking architecture with systemic clock gating and verified CDCs to decouple high-speed core logic from lower-speed I/O. Our approach will utilize asynchronous FIFOs with gray code pointers for safe data transactions across domains. As a proof of concept, we developed a send-and-receive prototype to demonstrate compatibility with our design and verification tooling. For SoCET's next SoC iteration, core and I/O clocks will be separated, with idle subsystems gated to save power. The project's second phase will extend clock domain separation to SoCET's new dual-core design and the on chip SRAM. Success will be measured by reduced dynamic power, measurable differences between core to I/O clock frequencies, and functional data transfers in silicon. This work will also establish a reusable and verified physical design flow template for future SoCET projects using clock domain crossings.

Keywords:

Clock Domain Crossings; VLSI; System-on-Chip; SoCET

Mentor(s):

Timothy Francis Hein (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1218

Presentation Time: Session 2: 10:30-11:30am

A Topological Approach to Parameterizing Deep Hedging Networks STEM

Authors(s):

Alok Das† (DSB)

Abstract:

Deep hedging uses recurrent neural networks to hedge financial products that cannot be fully hedged in incomplete markets. Previous work in this area focuses on minimizing some measure of quadratic hedging error by calculating pathwise gradients, but doing so requires large batch sizes and can make training effective models in a reasonable amount of time challenging. We show that by adding certain topological features, we can reduce batch sizes substantially and make training these models more practically feasible without greatly compromising hedging performance.

Keywords:

Hedging; Topology; Optimization

Mentor(s):

Kiseop Lee (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1219

Presentation Time: Session 2: 10:30-11:30am

Evaluation of the Biocontrol Potential of *Trichoderma harzianum* Against Anthracnose Disease in Sorghum STEM

Authors(s):

Adeline Bernice Dering† (Agriculture|JMHC)

Abstract:

Anthracnose disease (*Colletotrichum sublineola*) is a major concern for sorghum (*Sorghum bicolor*) growers worldwide, causing significant yield and revenue losses. Limited access to, and rising costs of, conventional control methods such as fungicides highlight the need for sustainable alternatives. This study investigates the role of *Trichoderma harzianum*, a beneficial fungus commonly used in biological control, in conferring quantitative resistance to anthracnose, measured by the severity of disease infection. Multiple susceptible *S. bicolor* genotypes were grown and inoculated with different strains of *C. sublineola* to evaluate resistance patterns. Quantitative PCR analysis will be used to quantify *C. sublineola* presence in each plant. The findings may guide future research and promote the use of *T. harzianum* as a sustainable alternative to fungicides in managing sorghum anthracnose disease.

Keywords:

Plant Pathology; Agronomy; Fungal Ecology

Mentor(s):

Tesfaye D Mengiste (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1220

Presentation Time: Session 2: 10:30-11:30am

Autonomous Data Exploration Agent STEM

Authors(s):

Ishana Didwania† (Science); Samuel Jordan Skulsky‡ (Science)

Abstract:

Large language models (LLMs) excel at interpreting textual information but struggle with large-scale dataset analysis. Understanding human social dynamics remains one of the most challenging domains for computational models. Power relations, coordination, and influence are subtle and context-dependent; frequently, LLMs will fail to interpret them despite having robust linguistic capabilities. Exposing and formalizing these factors not only deepens our understanding of human interaction but also provides the foundation for building models that more reason more effectively about social behavior and communication structure.

This project develops an autonomous data exploration agent that identifies and reasons about emergent concepts across conversational data without relying on LLMs for computationally intensive tasks. We apply this framework to understand social dynamics in human conversations, specifically examining factors that influence conversational power dynamics.

Our approach adapts methodologies from InstructLF (Xie et al., NAACL 2025) and GoalEx (Wu et al., NAACL 2025) to discover latent factors that explain asymmetric power relationships. InstructLF integrates LLM-generated properties with gradient-based clustering to uncover higher-level conversational concepts, while GoalEx uses unsupervised, goal-conditioned clustering that provides interpretable explanations for social behavior. Rather than clustering by topic, we pursue explanatory clustering that reveals why certain participants hold more power.

This hybrid system will combine LLMs' contextual reasoning with efficient computational methods to autonomously detect how social constructs manifest across large-scale conversational data. We evaluate the system through classification and explanatory prediction tasks, assessing whether the discovered social dimensions improve power and influence recognition while reducing human effort and preserving interpretive depth.

Keywords:

[no keywords provided]

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

Mentor(s):

Dan Goldwasser (Science); Eylon Caplan (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1221

Presentation Time: Session 2: 10:30-11:30am

**VR Machine Shop Training Simulator: Improving Safety and
Learning Outcomes
STEM**

Authors(s):

Marcus Macapodi Douge† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Virtual Reality; Safety Education; CAD

Mentor(s):

Steven R Dunlop (DSB); Saanvi Singh (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1222

Presentation Time: Session 2: 10:30-11:30am

Automated maize kernel counting using computer vision: A benchmarking study STEM

Authors(s):

Juan Camilo Douglas Bolano† (Agriculture)

Abstract:

Accurate maize (*Zea mays* L.) kernel counting is crucial for yield estimation, breeding research, phenotyping programs, and crop scouting applications. Traditional kernel counting is performed using either specialized counting machinery or manual methods. Automated counters require expensive equipment that may not be accessible to all research programs, while manual counting is labor-intensive, time-consuming, and subject to human error. Computer vision approaches offer a potential alternative, with recent studies demonstrating high counting accuracy and significant time savings compared to traditional methods. The objective of this study is to evaluate smartphone compatible computer vision models for automated maize kernel counting and compare their performance with conventional approaches. Maize ears from publicly available hybrid combinations were sampled from field trials and photographed using smartphones from two opposing views to achieve 360° coverage. Three computer vision models (Segment Anything, YOLO, and RT-DETR) were applied to these images and their counting accuracy benchmarked against manual and machine-based methods. Results comparing model accuracy, processing time, and practical implementation considerations will be presented. This research addresses accessibility and efficiency limitations in maize phenotyping by evaluating portable, cost-effective solutions for high-throughput kernel quantification.

Keywords:

Kernel Counting; Computer Vision; Smartphone-Based Detection; Maize Phenotyping

Mentor(s):

Pedro Henrique Magalhaes Cisdeli (Agriculture); Ignacio Antonio Ciampitti (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1223

Presentation Time: Session 2: 10:30-11:30am

Leveraging Sequential Pattern Mining for Predictive Military Aircraft Maintenance STEM

Authors(s):

Jack Drabenstott† (United States Military Academy West Point)

Abstract:

Army aircraft are frequently grounded for scheduled and unscheduled maintenance lasting up to 60 days. During scheduled maintenance, soldiers submit DA Form 2407-E digitally to document the components requiring repair. Each form includes multiple Work Unit Codes (WUCs) corresponding to specific aircraft components. Because there are thousands of possible codes, maintainers often select general WUCs such as "00" or "02," which inaccurately indicate that the entire aircraft is inoperable. As a result, the submitted maintenance data are difficult to clean, interpret, and apply effectively.

This inefficiency contributes to higher maintenance costs and increased unscheduled maintenance, as the current system cannot reliably predict component failures. Long lead times for ordering replacement parts further exacerbate aircraft downtime and reduce operational readiness.

To address these challenges, we developed a Sequential Pattern Mining (SPM) model to identify temporal patterns in component failures and predict which parts are most likely to fail and when. The outputs of this SPM analysis were then integrated into a mixed-integer optimization model that generates an annual maintenance schedule, aligning predicted part failures with resource and personnel availability. Together, these models enable proactive part ordering and replacement, reduce maintenance costs and repair times, and ultimately enhance aircraft availability and mission readiness.

Keywords:

Maintenance; Predictive Modeling

Mentor(s):

Andrew Banko (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1224

Presentation Time: Session 2: 10:30-11:30am

Grappling with Graphical Abstracts: A Case Study on Student Graphical Abstract Construction in a Cancer Biology Course STEM

Authors(s):

Matthew Ryan Dunlap† (Science)

Abstract:

The way scientific information is communicated is a contributor to how people understand it. Therefore, students' gaps in knowledge from their learning may not be a direct relationship to the subject or difficulty of the material presented to them, but rather the way that it is communicated. Thus, our goal is to assess how students take up and utilize information in primary literature for scientific communication. For this research, we used primary literature assignments from a semester of a graduate-level cancer biology course open to upper-division undergraduate students at a large midwestern public research university. We examined how students communicate their understandings of published research papers through their ability to distill and redisplay that information by creating visual summaries known as graphical abstracts (GAs). Through qualitative coding of 40 student GAs, we analyzed the amount of information in the GAs and compared it to the amount of information available in the primary literature. Informed by the noticing framework, we determined what parts of the paper students noticed most and grouped them accordingly, highlighting key areas of interest. Additionally, we compared those groups to each other and to a part of the assignment where each student had acknowledged which figure best answered the gap in knowledge being addressed in the primary literature. This preliminary study will aid in setting the foundation for future studies surrounding students' reasoning for scientific communication.

Keywords:

[no keywords provided]

Mentor(s):

Stephanie M Gardner (Science); Traven Levar Cargill (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1225

Presentation Time: Session 2: 10:30-11:30am

Creating a Box-Office Hit: Determining Key Financial Indicators for Films Through Predictive Modeling

Business Case Study

Authors(s):

Sara Claire D'Urso† (DSB|JMHC); Ashley Mei Hung† (DSB); Anishka Pateriya† (DSB); Akhand Bindra† (DSB)

Abstract:

How do producers, investors, and studios know that a movie will be financially successful? This project aims to predict movies' total revenues using measurable predictors such as budget, genre, cast, producers, and other production-related variables. Understanding these relationships can help stakeholders make data-informed decisions about future film projects.

Our exploratory data analysis revealed an average box office revenue of \$40.10 million across our sample. We found that individual predictor variables show low linear correlations with revenue (less than 0.2), suggesting the need to explore variable combinations to build a stronger predictive model. The combination of Adventure and Fantasy genres yielded the highest average gross revenue, providing a strong starting point for prediction.

To predict total revenue, our strategy involves constructing and comparing two models. First, we will build a linear regression model utilizing backward stepwise selection to identify the most relevant predictors. Second, we will create a more complex, flexible model (e.g., using lasso regression, ridge regression, random forest, or polynomial regression). We will account for meaningful interaction effects, such as between budget and genre (e.g., action films benefiting more from larger budgets) and release timing and holiday proximity. Model effectiveness will be determined by comparing test error and adjusted R² through cross-validation.

Ultimately, this study contributes to the field of predictive analytics by quantifying how various production factors translate into financial success, offering valuable insights that could revolutionize entertainment production and guide studios toward creating the highest-grossing films.

Keywords:

Revenue Prediction; Box Office Revenue; Film Industry; Linear Regression; Python

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1226

Presentation Time: Session 2: 10:30-11:30am

A Simple Thermoelectric Device for Batch Distillation STEM

Authors(s):

Matthew Ellsworth† (United States Military Academy West Point); Broc Gilland‡ (United States Military Academy West Point)

Abstract:

Phase-change operations are enormously important in many industrial processes, such as chemical processing, fuel refining, and water purification. Energy integration strategies are common in distillation, where energy removed in the condenser is recovered and sent to the boiler, reducing the energy demand in the boiler. With the goal of ultimately increasing energy recovery in distillation processes, a novel thermoelectric distillation apparatus was developed in this work. We hope ultimately to exploit the inherent efficiency of thermoelectric devices to enhance or possibly replace traditional methods of heat management within the distillation process. The apparatus allows for the measurement of performance coefficients of thermoelectric devices for potential use as heat-pumping devices in condensers and reboilers. Coefficients of performance (COP) were determined for methanol and water to characterize the effectiveness and efficiency of the design. COPs were found to be near unity for both substances, regardless of volume and power levels, indicating an average energy loss of about 10%.

Keywords:

Distillation; Energy; Separations

Mentor(s):

Andrew Banko (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1227

Presentation Time: Session 2: 10:30-11:30am

RUDOLF Project **STEM**

Authors(s):

Weston James Ertelt† (Engineering)

Abstract:

To create the most efficient and suitable classroom for both education and accessibility can be a demanding task, with hundreds of thousands of possible layouts for a variety of furniture items and entry points. The RUDOLF project aims to simplify and automate such checking of floorplan accessibility. The primary goal is to analyze the geometric spatial layout of a classroom/lab and then process the required furniture items. Using a generative algorithm to produce the highest capacitance for students, while ensuring that every room fixture is accessible. Currently, the RUDOLF project is working to use its generative algorithm to create the most optimal floor plan for KNOY B028, a classroom in the Polytechnic Institute at Purdue. Architectural and programming software, such as Revit, Python, and Dynamo, were used to create the generative algorithm, and to allow users to view the output in real time. In this presentation, the focus is on resolving boundary issues related to furniture placement. In addition, attempts were made to create a possible resolution for overlapping and depth issues within the algorithm, in Dynamo file processing and generative designs. The overall goal is to create a fully functioning system to generate optimized floor plans for classrooms/labs in STEM education.

Keywords:

[no keywords provided]

Mentor(s):

Jiansong Zhang (Polytechnic); Jingyi Lai (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1228

Presentation Time: Session 2: 10:30-11:30am

**Investigating Basic Needs Resource Access and Student
Academic Success at Purdue University**
Humanities

Authors(s):

Anna Grace Ewing† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1229

Presentation Time: Session 2: 10:30-11:30am

Integration and process compatibility of electrochemical and semiconductor sensors for wearable systems STEM

Authors(s):

Zixuan Fei† (Engineering|JMHC)

Abstract:

With the rapid growth of wearable devices, the use of advanced packaging technology to further scale down and miniaturize sensor systems is becoming more of interest. This project aims to test commonly used sensors in wearable and testing them to explore their compatibility with advanced packaging processes. The methods involve fabrication and characterization of two sensing elements: a pH-sensitive electrode and a semiconductor temperature sensor. The pH-sensitive electrode is fabricated using a polyaniline thin film as the working electrode, coupled with a silver/ silver chloride reference electrode to enable stable electrochemical measurement. The temperature sensor is constructed using a microfabrication-compatible process flow of semiconductor devices. Both components will undergo a series of reliability and process-compatibility tests, including exposure to thermal cycles and chemical solvents, to evaluate changes in sensitivity, stability, and operational lifetime. The expected results include identifying fabrication conditions that allow both electrodes to maintain stable response and sensitivity after exposure to microfabrication processes. The project ultimately aims to establish an integrated system with co-packaged semiconductor and electrochemical sensors, demonstrating process compatibility and reliability as a foundation for future wearable system. The results of this study could advance the design of next-generation wearable devices. Integrating electrochemical sensing with semiconductor technology may lead to compact, flexible, and low-power systems for real-time health applications.

Keywords:

Wearable Sensor System; PANI; Semiconductor Integration; Advanced Packaging; Electrochemical Sensor

Mentor(s):

Dhiya eddine Belkadi (Engineering); Muhammad Mustafa Hussain (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1230

Presentation Time: Session 2: 10:30-11:30am

**Evaluation of Bit Error Rate Performance in Optical Transceivers within the Subcritical Pile
STEM**

Authors(s):

Andrew Owen Fewell† (Engineering)

Abstract:

This project evaluates the reliability of high-speed optical transceivers exposed to radiation levels comparable to those found in space environments (such as low-earth orbit). The objective is to quantify how radiation exposure influences bit error rate (BER) and link stability over time. A three-week experimental study was conducted in which optical transceivers transmitted standardized digital patterns through continuously monitored optical links. Error detection and correction logs were recorded to measure variations in BER under controlled radiation exposure. The results provide new insights into the resilience and degradation mechanisms of optical communication components in radiation-intensive conditions. These findings will support the design of more fault-tolerant optical systems and help establish baseline parameters for integrating optical data links into space missions and other high-radiation applications.

Keywords:

Optics; Transceiver; BER; Radiation; Space

Mentor(s):

Peter Bermel (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1231

Presentation Time: Session 2: 10:30-11:30am

**Lipid-Lowering Effects of Inclisiran in Different Demographic
Subgroups
STEM**

Authors(s):

Emery Elizabeth Frey† (Pharmacy)

Abstract:

[Abstract Redacted]

Keywords:

Inclisiran; Cholesterol; Lipids; Demographics; Dyslipidemia

Mentor(s):

Monica Miller (Pharmacy); Ellen M Schellhase (Pharmacy)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1232

Presentation Time: Session 2: 10:30-11:30am

Exploring Chaotic Scrambling Solutions

STEM

Authors(s):

Ananya Ganesh† (United States Military Academy West Point); Babe Kwasniak† (United States Military Academy West Point)

Abstract:

This project is an exploration and continuation of the work presented in the white paper “Chaotic Scrambling for Wireless Analog Video” (Corron et al.). The goal of this project is to use chaos theory to build a hardware scrambler that can encrypt wireless analog images/video and securely transmit the information to the user, as well as design a matching descrambler for the receiver. We explore how the Kirchoff's equations associated with our design of a hardware circuit form a chaotic dynamic system and how we can implement machine learning through neural networks to help create a descrambler. This talk will be given jointly by Ananya Ganesh and BK Kwasniak.

Keywords:

Chaos; Chua Circuit; Machine Learning; Scrambling; Analog

Mentor(s):

Andrew Banko (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1233

Presentation Time: Session 2: 10:30-11:30am

Privacy-Preserving Machine Learning (Adversarial Neuron Pruning Purifies Backdoored Deep Models) STEM

Authors(s):

Sidharth Garigipati† (Engineering)

Abstract:

The study examines Adversarial Neuron Pruning (ANP), a defense strategy proposed to mitigate backdoor attacks in deep neural networks (DNNs). Backdoor attacks insert hidden triggers into models during training, causing targeted misclassification while maintaining high accuracy on clean data. The purpose of this study is to reproduce and evaluate ANP's effectiveness in purifying backdoored models and to explore the trade-off between backdoor removal and clean accuracy retention.

The method involves three stages. They include training a backdoored ResNet-18 model on CIFAR-10, optimizing neuron masks through adversarial perturbations to identify backdoor-associated neurons, and then iteratively pruning these neurons. Performance metrics include clean accuracy (Clean ACC), poison accuracy (Poison ACC), and poison loss.

The results of reproducing the results of the study show that the initial backdoored model achieved a Poison ACC of 1.0, confirming a successful attack. During the mask optimization, poison loss decreased to 0.04 while maintaining clean ACC at 0.85. However, Pruning at a mask threshold of 0.9 completely eliminated the backdoor (Poison ACC = 0.0) but reduced Clean ACC to 0.153. This indicate that optimal pruning between 0.2 and 0.4 retained approximately 0.75 Clean ACC while keeping Poison ACC near zero.

Overall, these findings demonstrate that ANP can effectively remove backdoors using minimal clean data, offering a practical, data-efficient defense strategy. However, the results also highlight a critical trade-off between security and model performance, suggesting the need for adaptive pruning or neuron regularization techniques.

Keywords:

[no keywords provided]

Mentor(s):

Zahra Ghodsi (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1234

Presentation Time: Session 2: 10:30-11:30am

A Simple Thermoelectric Device for Batch Distillation STEM

Authors(s):

Broc Gilland† (United States Military Academy West Point); Matthew Ellsworth‡ (United States Military Academy West Point)

Abstract:

Phase-change operations are enormously important in many industrial processes, such as chemical processing, fuel refining, and water purification. Energy integration strategies are common in distillation, where energy removed in the condenser is recovered and sent to the boiler, reducing the energy demand in the boiler. With the goal of ultimately increasing energy recovery in distillation processes, a novel thermoelectric distillation apparatus was developed in this work. We hope ultimately to exploit the inherent efficiency of thermoelectric devices to enhance or possibly replace traditional methods of heat management within the distillation process. The apparatus allows for the measurement of performance coefficients of thermoelectric devices for potential use as heat-pumping devices in condensers and reboilers. Coefficients of performance (COP) were determined for methanol and water to characterize the effectiveness and efficiency of the design. COPs were found to be near unity for both substances, regardless of volume and power levels, indicating an average energy loss of about 10%.

Keywords:

Distillation; Energy; Separations; Thermoelectric Devices; Coefficients of Performance

Mentor(s):

Andrew Banko (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1235

Presentation Time: Session 2: 10:30-11:30am

Investigating Indianapolis

Social Science

Authors(s):

Anjali Devi Gupta† (Science|JMHC); Luke Anthony Braun* (HHS)

Abstract:

The purpose of this study was to explore how the Indianapolis Public School district's "Rebuilding Stronger" plan overcomes or exacerbates barriers to educational access. This study used descriptive analysis collected from publicly available data. Each school type across all four zones was tallied, and the data was examined to reveal patterns of inequity or equity between each zone. Untangling the current IPS school choice market web revealed nine distinct school types, often distinguished by curricular model (IB, STEM, Exploratory, Montessori, Dual Language, Visual/Performing Arts, High Ability, Reggio-Inspired, and Charter). Overall, Montessori, dual-language, visual/performing arts, high-ability, and reggio-inspired schools were evenly accessible, at least in theory, across all zones. Despite at least one school of each model being offered to families in each zone, questions of equitable geographic access to the school choice market persist. Collectively, the findings highlight inequities in geographic access to IB, STEM, and Charter schools. The findings also suggest that zones 1 and 4 may be geographically disadvantaged due to the larger number of historically underperforming schools located within them, as well as more limited access to IB schools. Based on preliminary census data collected, which will be incorporated into further study, we can hypothesize that these findings are related to the overall economically oppressed nature of these geographic zones. These findings continue to demonstrate the impact of the expansion of school choice policy on educational access within IPS's district, raising important questions about equity in access to school choice.

Keywords:

School Choice; Equity; Education; Indianapolis

Mentor(s):

Bryan J. Duarte (Education)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1236

Presentation Time: Session 2: 10:30-11:30am

VIP Digital Twin

STEM

Authors(s):

Paul Michael Hamas† (Engineering); Akram Reda Mahmoud‡ (Engineering); Owen Chen† (Science)

Abstract:

This project focuses on building a flexible and realistic simulation model of a go-kart to explore autonomous control strategies. In the first phase, we'll take detailed measurements of the current go-kart and study its Ackerman steering setup, which uses a custom steering rack. These measurements will help make sure our virtual model closely matches the real thing. Next, we'll bring the model into MATLAB Simulink to simulate key dynamics—like steering, acceleration, braking, and suspension—and test how the system responds under different driving conditions using Simulink's signal generators.

In the third phase, we'll focus on creating a dynamic core framework that allows the model to be easily transferred between simulation environments. This flexibility will make it easier to experiment and integrate with other simulators down the line. Finally, we'll work on generating a URDF file to define the cart's geometry and kinematics, along with 3D mesh files for more advanced simulations.

By the end, we aim to develop a scalable simulation platform that can serve as the foundation for future AI-driven control systems and robotics projects. This work sets the stage for continued research and innovation in autonomous vehicle modeling and dynamic system design.

Keywords:

Simulation Modeling; Autonomous Control Systems; Dynamic Modeling; Ackerman Steering; MATLAB Simulink

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Reed Joseph Freer (Engineering); Richard Osita Ajagu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1237

Presentation Time: Session 2: 10:30-11:30am

Developing Computer Vision and Artificial Intelligence Systems for the Robots in RoboMaster Club STEM

Authors(s):

Hussein Sayed Hanafy† (Engineering); Ahmed Atef Mahmoud
Elsheshtawy Elbehiry‡ (Engineering)

Abstract:

The purpose of this project was to develop a computer vision algorithm for detecting armor plates in robotic combat, specifically for the RoboMaster competition. This project implemented a real-time detection system using OpenCV and ROS2 frameworks over one semester, Fall 2025, to enable automated targeting capabilities for combat robots through processing live camera feeds to identify light bars and armor plates. The engineering design process consisted of five phases: requirement definition based on competition specifications, conceptual design with feasibility testing, design development implementing ROS2 nodes and detection algorithms including `is_light_bar()`, `is_armor()`, and `search()` functions, testing and validation using the robot's camera feed under various lighting conditions, and iterative analysis to enhance robustness and computational efficiency. The project successfully delivered a functional ROS2 node for armor plate detection with camera topic subscription and frame processing capabilities, integrating color segmentation, contour detection, and light bar analysis within the robotic system's framework optimized for embedded hardware constraints. Developers might consider applying this automated targeting system to enhance accuracy and efficiency in robot combat competitions, demonstrating the feasibility of implementing complex computer vision algorithms on resource-constrained embedded systems for real-time robotic applications with potential for future expansions including multi-target detection and enhanced environmental robustness.

Keywords:

[no keywords provided]

Mentor(s):

Zijian He (Engineering); Abolfazl Hashemi (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1238

Presentation Time: Session 2: 10:30-11:30am

The Value of a Voice Tools Application in Speech Therapy

Social Science

Authors(s):

Juliana Harges† (Purdue University Fort Wayne)

Abstract:

Many speech-language pathologists use voice analysis tools, but there is a need for an application that is both inexpensive and easily accessible. An application that meets these criteria could not only benefit SLPs, but clients with at home practice. The aim of this study is to compare the app Voice Tools to the golden standard of analysis, Praat, in the pitch values they record. The data pool consists of participants who volunteered to participate after hearing about the study, who are adults in the age range of 18-65. Data is collected using a digital recording device and iPad containing Voice Tools application. Each participant reads the Rainbow Passage, sustains the vowel /a/, and describe what they see in the picture Cookie Theft. While still actively collecting data, an analysis of the data will include comparing the differences between the pitch values collected. Based on preliminary data collection, it suggests that Voice Tools could be considered as an acceptable application for voice analysis.

Keywords:

Voice; Therapy; PRAAT; Technology

Mentor(s):

Jolene Teresa Lawton (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1239

Presentation Time: Session 2: 10:30-11:30am

Optimizing MRE Packing Process: From Dimensional Analysis to Container Loading Problem STEM

Authors(s):

Kennedy Heckert† (United States Military Academy West Point)

Abstract:

The United States Army recently upgraded their Meal-Ready-to-Eat (MRE) packaging, decreasing the package size and weight. However, MREs are supplied from three different producers, each with slightly different package measurements. This has caused packing procedures to vary from supplier to supplier, many underutilizing the packaging box. Additionally, the boxing for MREs failed to upgrade with the packages, causing boxes to be overfilled and underfilled. This project addresses inefficiencies in the current packing configuration of U.S. military Meals Ready-to-Eat (MREs), with a focus on maximizing container utilization while adhering to real-world logistical and operational constraints. The objective is to formulate and validate a container loading optimization model that can improve packing density, accommodate dimensional variability among manufacturers, and satisfy military-specific requirements such as weight, stability, and meal diversity. Using a heuristic algorithm, our container loading solution provides a packing procedure to optimize the space available. These packing procedures allow for increased reliability of the MRE boxes and increased transportability.

Keywords:

Optimization; Container Loading Problem; Supply Chains; Military; Heuristic Algorithms

Mentor(s):

Andrew Banko (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1240

Presentation Time: Session 2: 10:30-11:30am

Cutaneous Temperature Differences in Mares vs Geldings STEM

Authors(s):

Delani J Henderson† (Agriculture); Alexis Rae Benson† (Agriculture); Allison Meckenzie Downey‡ (Agriculture); Lydia Ilene Price‡ (Agriculture|JMHC); Alivia J Meeks‡ (Agriculture); Megan Nicole Broecker* (Agriculture|JMHC); Taylor Caroline Anderson* (Agriculture)

Abstract:

Muscle physiology is important for understanding athletic performance, injury prevention, and nutritional needs. More specifically, cutaneous temperature provides us with further insight into the muscular workload and thermoregulation, as well as viewing hormones as a role in the temperature of the body between males and females. Knowing a baseline for our horses as owners can let us know if there is an injury or inflammation correlated to the muscles. Furthermore, racing makes up the largest portion of the United States equine industry, meaning muscle physiology provides us with crucial information regarding rehabilitation and recovery. In our experiment, the gluteus, trapezoidal, and pectoral muscles are highlighted in five mares and five geldings utilizing a thermography camera. We hypothesize that there will not be a significant difference between mare and gelding cutaneous temperatures. The cutaneous temperatures for both mares and geldings were recorded at similar times of day, and outside temperatures were recorded to limit variability. The temperature data was then analyzed to determine if there was a significant difference or not. Recorded temperatures for mare pectorals are 32.748°C, trapezoidal are 31.978°C, and gluteus are 30.664°C, whereas gelding temperatures are pectoral 32.074°C, trapezoidal 31.278°C, and gluteus 30.384°C. Further analysis regarding internal temperatures will be needed to better understand cutaneous temperature variation between mares and geldings.

Keywords:

Horses; Temperature; Gender

Mentor(s):

Casie S Bass (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1241

Presentation Time: Session 2: 10:30-11:30am

Indiana Water Resource Analysis and Website STEM

Authors(s):

Jaimison Evelyn Henton† (Engineering)

Abstract:

This project presents a public-facing, storytelling website that synthesizes observations of Indiana's surface and groundwater resources for the 2025 Water Year, which spans the period from October 1st, 2024, to September 30th, 2025. The recently completed water year is put into perspective by comparing it with similar measurements over the previous three decades. The dataset includes 182 surface-water gauges, 108 groundwater wells, 9 lake/reservoir records and 52 U.S. Drought Monitor entries. Methods standardize records to the water year, ranking the 2025 values within multi-decade history of each site, and applying robust, distribution free statistical tests to estimate long-term trends. Drought conditions were notable but not extreme but worsening towards the end of the year with 53% of the state experiencing D1 (Moderate Drought) conditions or worse, and 92% of the state being at least D0 (Abnormally Dry). During the course of the year, 26 of 52 weeks showed no areas classified as D0 or worse, meaning just over half of the weeks were free from dryness or drought designation. The State of Indiana Waters website provides interactive maps to enable comparison of 2025 conditions with prior decades and descriptive text to help the general public interpret the results. All processes are reproducible from raw sources, making annual updates possible as well as transparent year-to-year comparisons. These outputs make an extensible and reproducible baseline for water assessment for Indiana and public communication.

Keywords:

Ground Water; Surface Water; Water Trends

Mentor(s):

Keith A Cherkauer (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1242

Presentation Time: Session 2: 10:30-11:30am

AI Hardware Scratchpad STEM

Authors(s):

Julio Hernandez† (Engineering); Rafael Monteiro Martins Pinheiro† (Engineering); Haejune Kwon‡ (Engineering); Nicha Muninnimit* (Engineering); Duc Pham Minh* (Engineering)

Abstract:

AI accelerators are specialized processing units designed to accelerate matrix operations, which are fundamental to deep learning and ML workloads. Modern Tensor Cores can deliver massive compute throughput, but their performance is increasingly limited by memory bandwidth and data movement. In workloads such as convolutions and GEMMs, throughput depends on how efficiently tiles of activations and weights are streamed to the compute units, making memory efficiency critical to performance.

Our design aims to reduce the area cost of crossbars by implementing the area-optimized Benes Network algorithm. Additionally, the scratchpad will be software-controlled to reduce the overhead of tag arrays. Combining this with the multi-banked SRAM makes the scratchpad asynchronous, allowing for the prefetching of future tiles to take place while also servicing hits. The scratchpad is specialized to feed the Systolic Array's activations and weights. Multiple SRAM banks and a pipelined crossbar allow the backend to pull data from DRAM while the frontend services the Vector Core and Systolic Array simultaneously. The load/store path is fully pipelined with fixed latency, enabling software to issue a steady stream of memory requests and guarantee throughput without stalls.

While this approach improves utilization and reduces redundant transfers, it introduces crossbar design complexity, as the crossbar needs to be able to handle row and column reading, and is limited by DRAM bandwidth.

This work demonstrates a scalable, software-managed memory system that closes the throughput gap between memory and compute. Our next steps will be to focus on RTL synthesis and verification.

Keywords:

[no keywords provided]

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

Mentor(s):

Mark Johnson (Engineering); Sooraj Chetput Venkataraghavan (Engineering); Akshath Raghav Ravikiran (Engineering); Vinay Jagan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1243

Presentation Time: Session 2: 10:30-11:30am

The Extensive and Largely Detrimental Effects of AI Use in the Classroom

Business Case Study

Authors(s):

Abigail Vega Hershberger† (Education)

Abstract:

Artificial intelligence (AI) has taken the world by storm. Generative AI, especially in the form of large language models, is becoming increasingly popular. This popularity has extended to classrooms worldwide, and is especially prevalent in American schools. Educators are generally considered responsible for students' education and, to an extent, their wellbeing. For this reason, it's crucial for educators to understand the impacts of AI on their students, thereby allowing them to maximize the potential benefit of AI use for students and minimize its potential detriment. AI use has been shown to have effects on the world at large that may indirectly impact students, such as environmental damage and widespread short-term financial loss, although it's been speculated that AI could result in widespread long-term financial gain. AI has also been proven to be capable of harming users directly in a variety of ways. These include emotional and social harm resulting from emotional dependence on AI; self-inflicted harm by users in response to encouragement from AI; emotional, social, physical, and potentially other types of harm from intentional attempts to torment users; and academic and intellectual harm from users unknowingly treating false statements provided by AI as truth or from AI use hindering deep cognitive processing and retention. Despite the many potential detriments of AI on its users, it's also been proposed as a helpful tool for gifted students as well as disabled students. These are some of the varied effects of AI that educators should understand for the benefit of their students.

Keywords:

Artificial Intelligence; Generative AI; Large Language Models; AI in Education

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1244

Presentation Time: Session 2: 10:30-11:30am

The Price is Right (Skewed): Using Features to Predict Wine Prices

Business Case Study

Authors(s):

Nathaniel John Hiatt† (DSB); Ethan Dewen Louie‡ (DSB)

Abstract:

When buying or selling a bottle of fine wine, how can we be sure the asking price is fair and accurate? This project aims to predict the continuous cost of wine by leveraging key characteristics, including winery, country of origin, grape variety, and professional review score. Accurate price estimates offer significant value to the entire industry: they help producers and retailers set competitive prices, maximize margins, and avoid over- or under-rating their products. Furthermore, these predictions aid consumers and collectors in making fair valuations and more informed purchase decisions.

To tackle this question, we're using an extensive collection of over 130,000 professional wine reviews, with each observation representing a unique bottle and its characteristics. Before we can build a predictive model, the data needs some cleanup. We first noticed that the price itself was heavily skewed, meaning a small number of costly wines pulled the average way up. To make the data more manageable for prediction and to ensure our models don't focus solely on the expensive outliers, we applied a mathematical transformation to the price. We also had to find clever ways to handle categorical data (e.g., the names of hundreds of wineries) and extract useful information from wine descriptions, effectively turning tasting notes into quantifiable features. Initial analysis of data revealed a moderate positive correlation (0.41) between the wine's review score (points) and its price, confirming that while quality is a key factor, it is not the sole determinant of value. Other varying factors, such as brand, also play a role.

To validate these insights and build an accurate prediction tool, we will develop a predictive modeling process using a staged approach. We start with a baseline CART model, followed by more complex methods such as random forest and gradient boosting models to capture intricate relationships within the data. The goal is to compare these models comprehensively. The final model selection will be based on the value of the selected accuracy metric, such as the Root Mean Squared Error (RMSE) or R-Squared (R²), estimated on the held-out test set after K-

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

fold cross-validation. This ensures our model's accuracy is reliable and generalizable to new, unseen wines.

The main contributions of this project include achieving a highly usable accuracy rate for end-users and providing explicit identification and explanation of the top features that truly drive wine p

Keywords:

Classification Trees; Regularization; Text Analysis; Wine Valuation; Ensemble Learning

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1245

Presentation Time: Session 2: 10:30-11:30am

Evaluating the Viability of Biomethane as a Renewable Energy Source in the Global Energy Transition

Humanities

Authors(s):

Eric Hou† (Engineering)

Abstract:

In light of the current global energy crisis, new sources of renewable energy have been a pressing area of interest. Europe has already taken action through initiatives like the REPowerEU plan, outlining the necessary steps forward to improve economic efficiency and diversify energy sources. One of these energy sources garnering promise is biomethane, a renewable energy source created from organic waste through purification processes (Tiago et. al 1). This low-carbon alternative has plenty of advantages that fossil fuel lobbyists are excited about, but it also comes with a fair share of drawbacks from its slow "anaerobic digestion (AD)" to methane emissions from leakage (Harvey; Tiago et. al 1; Bakkaloglu et al. 1). In this exploratory research project, I assess the effectiveness of using biomethane as a renewable energy source, looking at the benefits and drawbacks to determine if it's worth the transition. Furthermore, this investigation aims to better understand what contexts biomethane is suitable for. To examine biomethane's potential, I carried out a preliminary research review of popular and peer-reviewed sources focusing on biomethane production, its efficiency, and environmental impact. I analyze perspectives on its carbon footprint from methane leakage, scalability in various locations, and economic viability. This research contributes insights into whether or not biomethane serves as a realistic and sustainable option as we transition away from fossil fuels, helping make informed decisions on future energy policies.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1246

Presentation Time: Session 2: 10:30-11:30am

Fraud Prediction on Synthetic Pop-up Retail Data: a Transaction-Level Risk Assessment

Business Case Study

Authors(s):

Adam Benjamin Houser† (DSB|JMHC); Sasank Nunna† (DSB); Kumar Shreyansht (DSB); Shreyaa Karant (DSB)

Abstract:

Can we stop fraud before it occurs? Fraud is a problem faced by all businesses that causes lost revenue, data leaks, and tarnished brand reputation. We produced a model trained on transaction-level details that can predict the likelihood of a fraudulent transaction. The final model detects a high-risk transaction before it is processed.

Our dataset consists of 2,133 synthetically produced transaction records for global luxury retail pop-up events. Each transaction has 16 features designed to capture customer, geographic, transactional, and temporal data as well as a binary fraud flag. Exploratory analysis shows that fraud is relatively rare. A positive correlation is observed between age and footfall. Transaction device and product categories have high variance in fraud ratios. Customer loyalty tier and transaction amount are negatively correlated with fraud. These initial insights suggest that our data has predictive power.

Our model takes the 16 original variables and outputs the probability of fraud. We began with a baseline logistic regression model. We then explored GAMs and random forests, including BART, while integrating boosting and bagging. Cross-validation was employed for final model selection.

While infrequent, transaction fraud has a significant impact on a business's operations and reputation. Small companies, such as the pop-up events we studied, are particularly at risk of fraud due to limited infrastructure. Our framework offers a scalable protection solution for businesses through transaction-level risk assessment, stopping fraud before it can be processed.

Keywords:

Fraud; Machine Learning; Predictive Analytics; Transactional Data; Retail

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1247

Presentation Time: Session 2: 10:30-11:30am

High Throughput Synthesis of Super-ordered MAX and MXene for Magnetic Properties STEM

Authors(s):

Dylan Mark Huamani† (Engineering)

Abstract:

MXenes are two-dimensional transition metal carbides/nitrides with unique properties such as electrical conductivity ($<24,000$ S/cm), solution processability (~ -40 mV zeta potential in water), 2D flexibility, and tunable surfaces. These unique properties allow for scalable synthesis and versatile processing, in addition to property tuning. MXenes are characterized by the chemical equation $M_n+1X_nT_x$ and have impressive compositional tunability that allows them to have different applications in a wide variety of fields, such as biomedicine, electronics, energy storage, and magnetism. Through the incorporation of rare-earth metals in the MXene structure, tuning of the magnetic state and transition of the MXene is possible. To achieve this, we must design a precursor MAX where incorporation of rare-earth metals occurs in the M site, and its MXene is synthesized via selective etching of the MAX to remove the A layer. However, the compositional space is very large with more than 12 possible M elements and 14 rare earth elements. Our synthesis targeted a super-ordered structure with in-plane ordering on the outer M-site (M' and RE) and out-of-plane ordering between the inner (M'') and outer M sites. High throughput synthesis allows testing of many variations of a super-ordered rare-earth containing MAX phase with various rare earth elements. First, MAX synthesis is explored with various rare earth elements [dysprosium (Dy), terbium (Tb), and yttrium (Y)] to explore different sintering temperatures. Then MXene synthesis is studied to optimize etching of the MXene phase using hydrofluoric acid to remove the aluminum while varying temperature and time of the reaction. This synthesized MXene will be taken for magnetic characterization to determine how rare-earth changes the magnetic state of the material.

Keywords:

MXene; Magnetism; Rare Earth; Two-Dimensional

Mentor(s):

Annabelle Leigh Bedford (Engineering); Babak Anasori (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1248

Presentation Time: Session 2: 10:30-11:30am

Physical Activity and Academic Success in College Students
Humanities

Authors(s):

Cole Thomas Hunt† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1249

Presentation Time: Session 2: 10:30-11:30am

Magnetic Tuning Induced by Doping Mn into Double Transition Metal MXenes STEM

Authors(s):

Spencer William Isbell† (Engineering)

Abstract:

MXenes are a family of two-dimensional carbides, nitrides, and carbonitrides traditionally derived via top-down synthesis from their bulk MAX precursor, where M represents early transition metals, A are typically group 13-16 elements, often Al, while X denotes carbon or nitrogen. MXene synthesis uses selective etching of the metallic M-A bonds within the three-dimensional MAX which is synthesized through high temperature sintering of elemental powders. The compositional tunability of MAX and MXenes is a powerful tool to design for future material needs in electronics, energy storage, and magnetism. Within the family of MXenes, the out-of-plane ordered MXene subgroup is formed when two transition metals occupy distinct, alternating layers within the structure. In this work, the out-of-plane ordered MAX, $\text{Mo}_2\text{Nb}_2\text{AlC}_3$, was modified by partially replacing Nb with Mn to induce a magnetic transition. Incorporating this Group 7 element is expected to alter the magnetic transition of the resultant MXene with Mn in the structure. Magnetic testing of this phase reveals the effects of this compositional and structural change on the magnetic state and transition of the MXene.

Keywords:

MXene; Ferromagnetism; 2D Materials

Mentor(s):

Annabelle Leigh Bedford (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1250

Presentation Time: Session 2: 10:30-11:30am

Modeling PV Microgrids with Integrated Battery Storage for Energy Resilience in Puerto Rico STEM

Authors(s):

Roxsonna Nika Janiszewski† (Engineering)

Abstract:

Many vulnerable communities worldwide deal with unreliable electricity due to aging grids and natural disasters. Puerto Rico, where outages remain frequent after recent hurricanes, illustrates this challenge. This project investigates the design of a solar microgrid with battery storage for a rural community in Ciales, Puerto Rico for the purpose of improving resilience during instances of grid instability. The research develops realistic community load profiles for simulations in the National Renewable Energy Laboratory's System Advisor Model (SAM), where parameters such as the PV and battery system designs, shading and loss components, and battery dispatch algorithms are refined to evaluate the system's ability to reliably meet critical community load needs during short (hours), medium (days), and long-term (weeks to months) blackout scenarios. This research seeks to outline design approaches that balance reliability, cost, and critical load needs with potential applications for strengthening energy resilience in Puerto Rico and beyond.

Keywords:

Photovoltaics; Battery Energy Storage; Energy Resilience; Simulation Modeling; Microgrids

Mentor(s):

Peter Bermel (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1251

Presentation Time: Session 2: 10:30-11:30am

Creating a Xenografted Human Vascularized Chimeric Brain Model STEM

Authors(s):

Oliver Thomas Johnson† (Science|JMHC)

Abstract:

Cerebral blood vessels are essential for transporting nutrients throughout the brain and regulating the entry of materials into the brain through the Blood-Brain Barrier (BBB). Dysfunction of the brain's vascular system is linked to conditions such as stroke, vascular dementia, and Alzheimer's disease. Growing evidence shows significant differences between human and mouse vascular cells. For example, human vascular cells express higher levels of Alzheimer's-associated genes. Therefore, it is urgent to develop human vascular models to better understand how the vascular system affects brain health and disease. An in vivo vascular model, in which human blood vessels are perfused and functionally integrated into the host's brain, has not yet been developed. To create these models, we will inject human Pluripotent Stem Cell (hPSC)-derived vascular progenitor cells into mice and allow the cells to grow and differentiate within the mouse brains. We will examine human vasculature maturation in host brains by harvesting, sectioning, and immunohistochemically staining the brains at different times post-cell injection. The staining will target markers for the main cell types needed for functional blood vessels and the Blood-Brain Barrier: endothelial cells, smooth muscle cells, pericytes, and astrocytes. Developing this chimeric vascularized brain model will provide a more physiologically relevant system for studying neurovascular contributions in healthy and diseased conditions, such as Alzheimer's disease and Vascular Dementia.

Keywords:

Neuroscience; Stem Cells; Blood Vessels; Alzheimer

Mentor(s):

Ranjie Xu (Vet Med); Xingjian Gu (Vet Med)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1252

Presentation Time: Session 2: 10:30-11:30am

**Side effects of weight loss products, on the cardiovascular
system**

Humanities

Authors(s):

Vishnu Ramaraju Kalidindi† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1253

Presentation Time: Session 2: 10:30-11:30am

Long term effects of Creatine on Adolescents

Humanities

Authors(s):

Vigneshvaran Karthikeyan† (Engineering)

Abstract:

In recent years, the usage of creatine has surged across the domains of team sports, bodybuilding, and general daily fitness routines. While the medical community mostly supports controlled creatine supplementation for adults due to scientifically based benefits, its impacts on adolescents remain far less understood. Youth athletes are affected by rapid physiological changes, but research surrounding creatine's safety and long-term effects in this age group is relatively inconclusive. Existing studies show short-term improvements in performance and muscle development but raise concerns about sample size, participant diversity, and insufficient follow-up periods. Furthermore, potential long-term consequences such as reinforcement of dehydration-based training, muscle cramps, and digestive issues are largely unexamined in adolescent users. Beyond physical risks, early creatine use may also encourage unhealthy training habits, including dehydration-based routines or overexertion. Given these uncertainties and possible health implications, creatine supplementation among adolescents should not be based on balanced nutrition, proper hydration, and safe strength-building methods that align with natural adolescent development. This exploratory literature review focuses on adolescent creatine use, evaluates methodological limitations in existing studies, and argues that precautionary restrictions are necessary until long-term safety can be confidently established.

Keywords:

Creatine; Adolescents; Long Term Effects

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1254

Presentation Time: Session 2: 10:30-11:30am

Blocking DDR4 DRAM Controller STEM

Authors(s):

Dhruv Roopchand Khatri† (Engineering); Tri Than† (Engineering); Adrian Daniel Buczkowski* (Engineering); Aryan M Kadakia* (Engineering|Graduate); Jason Dumaul Lyst* (Engineering)

Abstract:

On-chip memory is fast, but limited chip area means it cannot be large (typically in megabyte range). Thus, it is inadequate for applications such as AI which rely on vast amounts of data. In contrast, Dynamic Random Access Memory (DRAM) offers significantly higher capacity (x1000), but it is off-chip and needs a dedicated controller for access. Therefore, this project focuses on the design and implementation of a DRAM controller based on the JEDEC DDR4 protocol, a widely used standard for memory systems. It will allow the AI accelerator being developed by SoCET to access the large off-chip memory while adhering to the specific command sequencing and timing constraints of the protocol. The functionality of the controller will be validated by interfacing it with a Micron DDR4 simulation model for memory access operations. However, the controller design handles blocking memory requests; it does not allow overlapping memory requests. The controller waits for a request to be completed before issuing the next one, resulting in lower throughput and high latency. This project will lay the groundwork for accessing off-chip memory useful for applications such as AI, and improvements are being made to the design to handle requests in a non-blocking or overlapping manner.

Keywords:

Memory Controller; DRAM; DDR4; AI Hardware

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1255

Presentation Time: Session 2: 10:30-11:30am

Quacky vision: Pekin ducks display preference for red LED compared to blue LED lighting systems STEM

Authors(s):

Alice Soyeon Kim† (Agriculture)

Abstract:

While studies have been conducted to assess the impact of different lighting systems on behavior and welfare in poultry, none have attempted to determine how they affect birds' abilities to perceive their environment. To address this gap, our lab developed mathematical models of how Pekin ducks perceive their visual environment based upon retinal physiology, light characteristics, and spectral quality of objects in their environment. We found that Pekin ducks have red-shifted vision and may be unable to see blue lights. We then evaluated the preference of different lighting that Pekin ducks may display. Adult Pekin ducks (n = 36 ducks/sex) were randomly selected from their home pen and placed alone in a room with different lighting on opposite sides: red and blue LED lights (peaks 638 nm and 457 nm, respectively) normalized to 0.128 $\mu\text{mol photons/m}^2/\text{sec}$. Each trial lasted 10 minutes; their light preferences were recorded based on their location in the room after 10 minutes. To further validate that their choices were based on wavelength preference, we repeated the procedure with a familiar object, a feeder. Data was analyzed using a Kruskal-Wallis H test using SAS JMP. The majority of ducks moved to the red lighting (64% drakes and 75% hens) compared to the blue lighting (3% drakes and 8% hens; $p < 0.0001$). The presence of a feeder did not affect these results. This provides further support that blue lights are not appropriate for duck housing as it may adversely affect their ability to perceive their environment.

Keywords:

Color Perception; Eyesight; Waterfowl Ethology; Color Bias

Mentor(s):

Greg Fraley (Agriculture); Jenna M Schober (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1256

Presentation Time: Session 2: 10:30-11:30am

The Dog Run Case Study

Business Case Study

Authors(s):

Tammy Kong† (DSB); Sally Chowon Bae† (DSB); Eddy Zhang† (DSB);
Elisa Chung† (DSB); Wan Tian‡ (DSB); Yehor Khaidakin‡ (DSB)

Abstract:

This project explores the market viability and strategic positioning of Dog Run, a proposed mobile dog gym service designed to provide dogs with convenient, safe, and efficient exercise. The business concept centers on a mobile van equipped with a wood-slat treadmill, allowing customers to schedule 30-minute exercise sessions for their dogs right at their doorstep. The service aims to address challenges faced by dog owners who lack time, encounter weather constraints, or have reactive dogs that make regular outdoor activity difficult.

A key question driving this research is whether the business model is viable in a smaller market like West Lafayette. The study focuses on three main objectives: identifying the target customer segments most likely to use the service, assessing appropriate pricing strategies, and refining Dog Run's value proposition to differentiate it from existing pet care options.

Using a combination of market research and competitor analysis, the study will evaluate consumer demand, pricing perceptions, and potential barriers to adoption. The findings will determine whether Dog Run can be successfully launched in West Lafayette or if strategic adjustments are necessary to increase appeal and affordability. Ultimately, this project aims to provide data-driven recommendations to guide Dog Run's launch strategy, ensuring the concept is both sustainable and competitive within the local pet services market.

Keywords:

Marketing

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1257

Presentation Time: Session 2: 10:30-11:30am

Design and Optimization of Bidirectional Air–Ground Communication Architecture for Long-Range Data Transmission STEM

Authors(s):

Joseph Timothy Kritenbrink† (Engineering); Anderson Anousit Varnert‡ (Engineering)

Abstract:

The Purdue Aerial Robotics Competition Team has been tasked with developing an unmanned aircraft to compete in SUAS and CUASC, with the Avionics Subteam responsible for all air-ground communications, including both uplink (G2A) and downlink (A2G) systems. To meet competition requirements, a constant A2G connection must be sustained at distances greater than 1 km, which is critical for downlinking 4K resolution images at a rate of 2 images per second. Similarly, this connection is crucial for relaying important navigation information such as position and velocity, while also enabling the use of more robust computational power on the ground station in comparison to the Jetson Nano onboard. To support these capabilities, a grounded antenna tracker constructed of three high gain directional patch antennas has been proposed to allow for focused, long range communication. Additionally, a configuration of three low gain omnidirectional antennas mounted on the aircraft – two linked to the rocket and one to the data radio – is outlined, with multiple viable plane transmission methods considered for minimal path loss. Key system tradeoffs in gain, bandwidth, and antenna design are evaluated to optimize A2G communication performance within the physical constraints of the aircraft.

Keywords:

Antenna; Communications; Directional Antenna; Aircraft; A2G

Mentor(s):

John William Rolfe (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1258

Presentation Time: Session 2: 10:30-11:30am

Predicting Term Deposit Subscription: Insights from Bank Marketing Campaign Data Business Case Study

Authors(s):

Gavin Craig Kulak† (DSB); Sulav Shrestha† (Polytechnic); Viswanath Jay Nair† (DSB); Henry Patrick Merchant† (DSB)

Abstract:

Why do some bank customers decide to open a term deposit while others turn it down? Our project explores this question by using data from a Portuguese bank's marketing campaigns to predict which clients are most likely to subscribe. Understanding these behaviors can help banks focus on customers who are genuinely interested, making campaigns more efficient and cost-effective.

The dataset, from the UCI Machine Learning Repository, contains over 45,000 client records with information such as age, job type, account balance, call duration, and outcomes of previous campaigns. After cleaning and encoding the data, we explored it to find early patterns. We noticed that longer call durations and prior successful contacts were associated with a higher likelihood of subscription, while brief or first-time calls were more likely to be rejected.

To test and validate these findings, we are building predictive models in stages. We begin with Logistic Regression as a simple and interpretable baseline, then move to Random Forest and CatBoost to capture more complex relationships. The Area Under the ROC Curve (AUC) is our main performance measure because it shows how well the model separates likely subscribers from non-subscribers and helps avoid bias from class imbalance. The final model will be selected based on the AUC value estimated on the test set after K-fold cross-validation to ensure consistent and generalizable results.

Ultimately, our analysis aims to help banks design more personalized campaigns, focus on real prospects, and improve overall marketing performance.

Keywords:

Predictive Modeling; Bank Marketing; Customer Behavior; ROC-AUC Evaluation; Machine Learning

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1259

Presentation Time: Session 2: 10:30-11:30am

User Experience with Brightspace at Purdue

Humanities

Authors(s):

Joseph Richard Kunkel† (Exploratory Studies|Other)

Abstract:

In this era of technology, almost every school across the country has adopted the use of an online learning management system (LMS). This change has been made to support educators in helping their students and to provide students with better resources for managing their schoolwork. Purdue switched to using Brightspace instead of Blackboard almost 6 years ago. In this exploratory research project, I investigate how users at Purdue perceive the LMS Brightspace now that it has been in use for a sufficient period to be thoroughly implemented. To gain a better understanding of this issue, I administered a survey to current students and conducted an interview with one professor. In my initial research on this topic, I did not find any data on actual user feedback. Although this research is exploratory, it begins to fill a crucial gap in this topic, which is essential to improving learning.

Keywords:

Brightspace; Learning Management System; Purdue

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1260

Presentation Time: Session 2: 10:30-11:30am

Exploring the Physics of Type Ic Supernovae through Statistical Light Curve Modeling STEM

Authors(s):

Kaira Wing Kwong† (Engineering); Alexandra Madison Chrostowski‡ (Engineering); Brian Jeffrey Young† (Science); Srinidhi Sivakumar† (Science)

Abstract:

Type Ic supernovae (SNe) are one of the many subclasses of powerful stellar explosions resulting from the core-collapse of massive stars. Type Ic SNe are classified by their lack of hydrogen and helium emission lines in their spectra, which is believed to be caused by the loss of the progenitor star's hydrogen and helium envelopes before collapse. The mechanism(s) of mass loss and final structure of the star before supernova explosion are poorly understood. Here we estimate key physical parameters of a large sample size of type Ic SNe through statistical modeling in order to explore trends in the characteristics of these explosions. We obtained data from the Zwicky Transient Facility (ZTF) for spectroscopically classified Type Ic SNe and fit the supernovae light curves using semianalytic type Ic SNe models to estimate explosion properties such as ejecta mass, kinetic energy, and opacity. The resulting distribution of parameters across all of the SN Ic events were then analyzed to identify patterns and correlations. Our analysis aims to define characteristic ranges of explosion features that describe SNe Ic and to identify any potential outliers or trends within the population. This creates a basis for a systematic study of Type Ic supernova properties to better understand the diversity within this subclass of core-collapse supernovae.

Keywords:

Supernova; Astrophysics

Mentor(s):

Danny Milisavljevic (Science); Noah William Zimmer (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1261

Presentation Time: Session 2: 10:30-11:30am

Opportunities in Street Food to Promote Tourism and Culture STEM

Authors(s):

Anna Thi Le† (Agriculture)

Abstract:

Street food, commonly found in Asian countries, is a popular and affordable meal option. Low investments to start their business allow communities to access entrepreneurship, and wider options of dishes in the local area become available. From a tourist perspective, the local dishes served street style are conceptualized as an authentic component in culinary tourism. The representation of a country through its street food culture builds economic growth and local lifestyle, which tourists can gain a holistic experience of the region. However, the consideration of street food shifts regarding the standards of hygienic practice and current regulations impacting the safety of consumption. To further investigate, I will review literature findings on tourists' behavior in local food consumption and marketing strategies identified in street food. The research examines the role of street food as a method of popularizing a destination and promoting tourism, as well as perspectives on representing local culture. Additionally, I will examine several regulations utilized to maintain safe food vending operations and offer a future suggestion in building trust between the government, vendors, and consumers. This study will highlight the significance of street food in enhancing local economies and provide other implications in destination marketing for tourists.

Keywords:

Street Food; Culture; Tourism; Globalization

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1262

Presentation Time: Session 2: 10:30-11:30am

Pushing Quantum Limits: How Error Mitigation Makes Simulations More Reliable STEM

Authors(s):

Derek Yishio Lee† (Engineering); Sarina Manchirala† (Engineering);
Anubhav Majumdar† (Science); Nikhil Sai Kolli† (Engineering)

Abstract:

Quantum computing has many advantages, one being its ability to simulate quantum mechanical systems, which is vital when studying interactions at the molecular level. A significant roadblock in today's quantum computers is noise. Qubits are very fragile and thus yield unreliable results when not carefully contained. Minimizing the effects of error is imperative to the usefulness of quantum algorithms. Here we will use PennyLane's Variational Quantum Eigensolver (VQE) to simulate and calculate the ground state energy of the H₂ molecule. To simulate noise in our otherwise noiseless simulation, we will apply a depolarizing filter to each wire to introduce noise to the circuit. The strength of the noise is controllable, but its exact impacts are entirely random. With the data produced from the simulation, we can then apply error mitigation techniques. Zero Noise Extrapolation (ZNE) is a technique where when presented with the simulated ground state energies at certain noise levels will approximate the simulated ground state energy for when no noise is present. This technique will be evaluated.

Keywords:

Quantum Computing; Error Mitigation; Simulation; PennyLane

Mentor(s):

Andreas Jung (Science); Noah Charles Singer (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1263

Presentation Time: Session 2: 10:30-11:30am

Low-Power Passive 3D Depth Camera: Reimplementation of Focal Split STEM

Authors(s):

Nana Lee† (Engineering); Tanvi Dhawade‡ (Engineering); Roy Liut (Engineering)

Abstract:

This project reimplements Focal Split, a low-power, passive 3D depth camera that estimates scene depth from differential defocus (DfDD). Traditional DfDD systems require sequential image capture, external power, or heavy computation, limiting their portability. Focal Split overcomes these issues through a setup that captures two differentially defocused images in a single snapshot using a beamsplitter. This enables real-time depth estimation on a fully untethered, low-power platform such as a Raspberry Pi.

During the first phase, the project focuses on reproducing the theoretical and computational framework presented in Focal Split: Untethered Snapshot Depth from Differential Defocus (CVPR 2025). This includes validating the mathematical relationship between defocus blur, Laplacian derivatives, and scene depth through simulation and algorithm reimplementation. The goal is to confirm how optical and computational parameters influence depth accuracy and stability.

In the second phase, the work transitions to hardware integration. The team will assemble the camera prototype and evaluate its performance under real-world conditions. The project contributes to advancing energy-efficient, portable 3D imaging systems that bridge optics, embedded computation, and signal processing for applications in robotics, wearable devices, and autonomous sensing.

Keywords:

3D Imaging; Computational Imaging; Differential Defocus (DfDD); Embedded Systems; Depth Estimation

Mentor(s):

Junjie Luo (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1264

Presentation Time: Session 2: 10:30-11:30am

A systematic review of GABA(A)receptor expression modified by histone deacetylase regulation STEM

Authors(s):

Seo Young Lee† (HHS); Sein Kim† (Science); Taehong Min† (HHS);
Jungmin Im‡ (HHS)

Abstract:

The GABA system drives inhibitory mechanisms in neurons associated with depression and anxiety. Recent studies reveal that ethanol not only regulates the expression and function of GABAA receptors, but also induces long-term epigenetic modifications. This systematic review reveals the correlation between ethanol and the GABA system and introduces how ethanol modifies GABAA receptor expression in the context of histone deacetylase (HDAC) regulation. According to the research, in murine models, acute ethanol consumption has a positive relationship with receptor expression and chronic ethanol consumption has a negative relationship. Interestingly, some research examined consumption during withdrawal, and it inhibited the neuron firing rate even if the GABA(A) receptor's subunits were highly expressed. The mechanism behind this is that chronic ethanol exposure enhances HDAC activation and induces histone deacetylation near the promoter of the GABAA receptor gene locus. As a result, transcription was repressed and GABAA receptor protein expression was reduced at the synapse. The main consensus in this area supports the idea that ethanol-mediated pathways enhance GABA(A) receptor expression at an acute dosage of ethanol. Conversely, the reduction of GABAA receptor expression by HDAC-mediated histone deacetylation in chronic dosage. This provides molecular evidence explaining alcohol-associated neuropsychiatric disorders.

Keywords:

Histone Deacetylase (HDAC); Epigenetic Regulation; Ethanol; GABA(A) Receptor; Neuropsychiatric Disorders

Mentor(s):

Hongmi Lee (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1265

Presentation Time: Session 2: 10:30-11:30am

**Effective Collaboration in Virtual Reality
STEM**

Authors(s):

Brayden S Lee† (DSB); Mahit Mehta† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Virtual Reality; Collaboration

Mentor(s):

Steven R Dunlop (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1266

Presentation Time: Session 2: 10:30-11:30am

Would Purdue Students Benefit From Sleep Improvement Resources?

Social Science

Authors(s):

Marisol Andrea Lefort-Liceaga† (HHS)

Abstract:

The purpose of this research project is to determine whether Purdue students would benefit from resources by the university advocating for improved sleep. Research will be conducted by reviewing literature topics including benefits of sufficient sleep, levels of sleep in college students, and how other colleges and universities have provided resources for improved sleep for their students. Primary research will be conducted by a survey of Purdue students as well. The findings from the research will be utilized to determine how beneficial resources for improved sleep provided by Purdue are, and proposals will be offered on how and what kind of resources to implement on Purdue's campus.

Keywords:

[no keywords provided]

Mentor(s):

Catherine Jean Shukle (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1267

Presentation Time: Session 2: 10:30-11:30am

AutoHoops: A Human-in-the-Loop System for Accelerated Spatio-Temporal Annotation of Athletic Motion STEM

Authors(s):

Junhee Lim† (Science)

Abstract:

Large-scale analysis of athletic biomechanics severely constrained by the high cost of manual video annotation. We address this bottleneck with AutoHoops, a machine learning-assisted, human-in-the-loop system that accelerates the annotation of free-throw shots in broadcast basketball footage. Our system integrates a three-stage pipeline into a web-based annotation interface, transforming from manual labeling to rapid human verification.

Our methodology begins by extracting 2D keypoint trajectories for all individuals in a video using YOLOv11s-Pose. Then, our prediction model first uses logistic regression on kinematic features to predict the shooter. An Long Short-Term Memory (LSTM) network analyzes the shooter's motion sequence to predict the temporal boundaries of the shot. Finally a LightGBM model classifies the camera viewpoint using geometric features from the motion's peak. These predictions—shooter ID, timing, and camera angle—are pre-populated in our interface, where an annotator can accept, reject, or modify them.

On a corpus of 6,000 NBA videos, our system reduced annotation time-per-video by over 50% with a 70% first-pass acceptance rate. This efficiency gain enabled the creation of our 1,000-video ground-truth dataset in a fraction of the time required by traditional methods. Verified annotations are collected to facilitate a continuous retraining loop for model improvement. AutoHoops provides two primary contributions: (1) a scalable system that makes creating large, high-quality sports analytics datasets feasible, and (2) a blueprint for ML-assisted annotation that directly addresses the operational challenges in video-based human motion research.

Keywords:

Computer Vision; Sports Analytics

Mentor(s):

Timothy G Reese (Science)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1268

Presentation Time: Session 2: 10:30-11:30am

**Optimizing Open-Vocabulary Segmentation via CNN
Backbone Replacement and Knowledge Distillation
STEM**

Authors(s):

Xuanrui Lin† (Science); Pranav Boyapati‡ (Engineering); Arvind Shyam† (Science); Luisa Cruz Miotto† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Knowledge Distillation; Semantic Segmentation; Low-Power Computer Vision; CNN Backbone

Mentor(s):

Yung-Hsiang Lu (Engineering); Zihao Ye (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1269

Presentation Time: Session 2: 10:30-11:30am

NSWC Autonomous Boating Challenge

STEM

Authors(s):

Jacob Charles Long† (DSB); Chengming Wu† (DSB); William David Bridgnell† (Engineering); Andrew Joseph Shelley‡ (Polytechnic); Alexander T Valdes‡ (Engineering); Margulan Mukhametkarim‡ (Engineering); Steven James Van Hulle‡ (Science)

Abstract:

This research develops an autonomous navigation system for maritime environments, addressing the dynamic challenges of aquatic navigation. Unlike land-based autonomous systems that navigate relatively static environments, our approach must account for shifting wave patterns, unpredictable currents, and transient obstacles. Navigation is conducted using relatively few landmarks present on otherwise flat water. Using an integrated multi-sensor localization method, we aim to achieve real-time obstacle detection, localization, and adaptive pathfinding in complex water conditions. Our model incorporates data from four RGB depth cameras for identification of markers, inertial measurement units, and LiDAR for longer-distance sensing. Sensor inputs are processed through a pipeline designed to filter out noise from water movement and sensor error, ensure compatibility between sensor systems that output data at different rates, and prioritize critical real-time data to path-find its destination. Though results are pending, this technology has significant applications across global trade, disaster response, defense, and environmental monitoring. By advancing autonomous navigation at sea, this project aims to reduce human risk and improve operational efficiency.

Keywords:

Autonomy; Artificial Intelligence; US Navy; Boating

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Reed Joseph Freer (Engineering); Richard Osita Ajagu (Engineering); Samuel Labi (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1270

Presentation Time: Session 2: 10:30-11:30am

Segmentation model and path planning STEM

Authors(s):

Jennifer Yunning Lu† (Science)

Abstract:

The purpose of this project was to improve on the autonomous go-kart developed by Autonomous Motorsports Purdue (AMP) by improving its perception capabilities. Our team focused on two main areas, semantic segmentation and object detection. The existing segmentation model was based on the BDD100k dataset, which provides general driving scenes but lacks specificity for the AMP go-kart. To address this, we fine-tuned the model using a custom dataset collected by the club, consisting of approximately 1,000 images. We then expanded this dataset through a variety of data augmentation techniques such as flipping, cropping, and padding so as to improve model robustness and generalization. Additionally, we introduced an object detection pipeline to enable the kart to recognize and localize key elements on the track, such as cones and other go-karts. Given the dataset already given by AMP, we synthetically generated training examples by spawning cones and go-karts within existing images so as to implement object detection. This approach allowed us to use data specific to the go kart without requiring extensive new data collection. The synthetic data was then annotated and used to train object detection models capable of identifying track boundaries, obstacles, and other vehicles in real time. These advancements enhance the go-kart's overall autonomy, enabling more accurate environmental understanding and paving the way for future races with other autonomous go karts.

Keywords:

Data Augmentation; Fine Tuning; Segmentation; Computer Vision; Synthetic Data Generation

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1271

Presentation Time: Session 2: 10:30-11:30am

What Predicts College GPA? A Data-Driven Look at Study Habits and Test Scores

Business Case Study

Authors(s):

Eliza Jane Lutgen† (DSB|JMHC); Gonzalo Antonio Silva† (DSB);
Uddipta Sarkar† (DSB|JMHC); Kyle Anthony Fernandez† (DSB); Angel
Wang† (DSB)

Abstract:

What determines a student's final GPA? This project explores that question by building a model to predict academic performance based on factors such as study habits, IQ, and standardized test results. Students are curious about what truly drives success in college, and understanding these patterns can help improve academic outcomes. Our goal is to provide insights that help students make informed decisions about how they study and prepare for exams.

Our dataset includes over 100 student observations, each representing an individual's GPA, study hours, IQ, and SAT scores. After cleaning the data and standardizing variables to make them comparable, we explored the data visually and statistically to find patterns. The results showed positive connections between GPA and both study hours ($r = 0.78$) and SAT scores ($r = 0.64$), while GPA and IQ had a weaker relationship ($r = 0.32$). This suggests that consistent effort and preparation may matter more for academic performance than innate ability.

To test these patterns, we built several prediction models and compared their accuracy. We started with a simple linear regression model, then tested polynomial, Ridge, and Lasso regression to capture more complex relationships. The best model was selected based on evaluation metrics such as RMSE, MSE, and MAE using K-fold cross-validation.

Our project highlights the main factors that influence GPA and shows how data can be turned into something useful for students. The model could eventually become an interactive tool where students enter their own information and receive an estimated GPA to guide study habits and academic planning.

Keywords:

GPA; Studying; Habits; Prediction; Performance

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1272

Presentation Time: Session 2: 10:30-11:30am

Forward Electricity Price Forecasting

Business Case Study

Authors(s):

Aryaa Madan† (DSB); Ethan Thomas Garcia† (DSB); Rou Chi Huang† (DSB); Aidan Daniel Manickam† (DSB); Rishit Basundhara‡ (DSB)

Abstract:

This project evaluates the accuracy of forward electricity price forecasts by comparing predicted and actual market prices using time series analysis. The dataset spans multiple years and requires extensive cleaning to standardize hourly values. Visualizations revealed seasonal trends. Error analysis showed consistent overestimation during peak months like July and August, highlighting weaknesses in the existing forecasting model.

To streamline the process, we began developing a Python workflow to automate data preparation, visualization, and error calculation. Future work includes historical aggregation and exploring advanced predictive methods to improve forecast reliability.

Keywords:

[no keywords provided]

Mentor(s):

Xing Wang (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1273

Presentation Time: Session 2: 10:30-11:30am

Data-Driven Prediction of Residual Stress in Laser-Based Additive Manufacturing Using XGBoost STEM

Authors(s):

Harshini Madhusudhanan† (DSB); Clara Cecilia de Groot† (DSB);
Fanyang Meng† (Polytechnic); Connor David Watson† (DSB|JMHC)

Abstract:

The purpose of this study is to develop a predictive data-driven framework to analyze and minimize residual stress in laser-based additive manufacturing (AM). Residual stresses formed during fabrication significantly affect part quality and dimensional accuracy, reducing the reliability of AM processes. This work employs 150 simulated thermal datasets generated through physics-based thermal modeling, each representing variations in key process parameters such as laser power, scan speed, and hatch spacing. Using XGBoost, a gradient boosting algorithm, the model learns nonlinear relationships between thermal distributions and residual stress outcomes. Regression analysis and feature importance evaluation are used to identify dominant parameters influencing stress formation. Preliminary results show that temperature gradients and scan speed have the greatest impact on residual stress prediction, with the model achieving high accuracy and low error metrics across cross-validation tests. These findings confirm the effectiveness of combining simulation data with machine learning to capture process–structure–property relationships. The developed framework will be integrated into a Streamlit-based dashboard that allows interactive visualization of predicted results and parameter optimization. Overall, this study demonstrates how data-driven modeling can enhance process control, improve reproducibility, and support intelligent decision-making for more sustainable and reliable additive manufacturing.

Keywords:

XGBoost; Regression Analysis; Cross-Validation Tests; Additive Manufacturing

Mentor(s):

Hazim Atef El Mounayri (Purdue University)

Other Acknowledgement(s):

Farshad Samadpour Samarin (Engineering)

Poster Presentation Abstract Number: 1274

Presentation Time: Session 2: 10:30-11:30am

Systemic Barriers and Dental Fear: Understanding the Disparities in Oral Care

Humanities

Authors(s):

Jennifer Ngocan Mai† (HHS)

Abstract:

Although the root of dental disparities for adults are often attributed or pointed to financial limitations, dental fear is more deeply rooted in systemic barriers such as restrictive Medicaid policies, limited private practices accepting coverage, and mistrust of health care providers that cause unequal access and fear (Sun et al. 8). In order to create a change, professionals in the field should focus on expanded Medicaid coverage and specialized patient care to rebuild trust and reduce anxiety for vulnerable individuals. In this preliminary research, the purpose of investigating dental fear is to see how this concern is rooted in an individual's past experiences and how it affects internal health, self confidence, and social interactions later in their adult life. In order to investigate this issue, I plan on using literature reviews and primary sources to show patients experience with dental practitioners or practices. Through these various sources, I will use data and personalized experiences to show how experiences with dentists have affected a patient's outlook on receiving dental care. This research project aims to raise awareness of how dental practitioners should prioritize building trust and provide strong communication with their patients. By prioritizing patient education and active listening, these systemic barriers will be prevented and further reduce a patient's fear for practitioners in the dental field.

Keywords:

[no keywords provided]

Mentor(s):

Jessica M Mercado (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1275

Presentation Time: Session 2: 10:30-11:30am

Nursing clinical crisis? Assessing the relationship between clinical site commute distance and sleep habits on the cognitive performance of nursing students

Social Science

Authors(s):

Kelly Marie Makovic† (HHS|JMHC); Dave A Ceniza† (HHS|JMHC); Sai Dhanush Pulligilla† (HHS|JMHC); Logan Villena Obrique† (HHS|JMHC)

Abstract:

Student researchers enrolled in the Foundations of Nursing Research and Evidence Based Practice class at Purdue University have created a project proposal to assess whether any relationships are present between clinical site travel time, student sleep patterns, and cognitive performance at site. The sleep habits of university students are often analyzed to determine effects on academic performance. One subset of university students, Bachelor of Science in Nursing (BSN) students, are subjected to a unique sleep habit factor: clinical site rotations. At many universities, including Purdue, clinical experiences are at off-campus locations beginning in the early morning hours. These locations vary in their distance from student residences. With the entire Nursing 21801 cohort of 175 students spread across seven possible clinical sites, travel time requirements range from less than 10 minutes to greater than 40 minutes. Data will be collected through a mixed-methods survey, the NUR 218 Clinical Site Stressors Survey. It would be administered at clinical site, before official duties had begun. The cross-sectional and observational portion will collect focused data related to student clinical site commute, sleep habits, and other compounding variables (such as caffeine consumption and transportation role). To test cognitive performance at site, the survey will incorporate the administration of a Digit Span Task (DST) and a Psychomotor Vigilance Task (PVT), which have been utilized in working memory studies and sleep studies, respectively.

Keywords:

Nursing; Sleep; Commute; Students; Performance

Mentor(s):

Mopelola T Adeola (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1276

Presentation Time: Session 2: 10:30-11:30am

**Virtual Twin of Semiconductor Fabrication Process
STEM**

Authors(s):

Tanuj Santosh Mangalam† (Engineering|JMHC); Shriya Gupta† (Engineering); Samridh Prabhakar† (Engineering); Ekagra Agarwal† (Engineering); Sicheng He‡ (Science); Abdulaziz Hamad Alanazi‡ (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Digital Twin; CATIA 3D Experience; Semiconductor Fabrication; PVD

Mentor(s):

Zhihong Chen (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1277

Presentation Time: Session 2: 10:30-11:30am

**Liquid-Phase Synthesis of Sequence-Defined Peptide
Dendrimers via an Iterative Convergent/Divergent Coupling
Strategy
STEM**

Authors(s):

Isabella Anne Markert† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Peptides; Organic Synthesis; Dendrimer; Peptide Synthesis

Mentor(s):

Severin Thomas Schneebeli (Pharmacy); Anthony Gabriel Mena (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1278

Presentation Time: Session 2: 10:30-11:30am

Simulating Adverse Weather Effects on Perception and Localization in Autonomous Racing STEM

Authors(s):

Suhani Mathur† (Engineering); Kareem AbdelHameed Hassan† (Engineering); Farah Moussa† (Engineering); Shaunabh Bose† (Engineering); Srihith Gangireddygar† (Science)

Abstract:

Adverse weather conditions such as rain and fog pose significant challenges for autonomous racing vehicles, often degrading camera, LiDAR, and radar sensor data. This issue was observed during the 2022-2023 Indy Autonomous Challenge (IAC) season, when several teams' vehicles struggled to maintain localization accuracy under rainy conditions. The Autonomous Race Engineering Systems (ARES) team, part of the Vertically Integrated Projects (VIP) program, addresses this challenge through the joint work of two integrated subteams. The Simultaneous Localization and Mapping (SLAM) subteam is developing a perception stack that maintains reliable localization and mapping performance under adverse weather conditions. Our Simulation subteam complements this effort by providing controlled and repeatable virtual environments necessary to evaluate and refine the SLAM system safely before deployment on real vehicles.

We use the CARLA simulator, configured to emulate the Indianapolis Motor Speedway, one of the tracks used in IAC competitions. CARLA was selected for its high-fidelity sensor models that match the vehicle's LiDAR, radar, camera, and IMU suite, as well as its native integration with ROS 2 through a Python API. Our methodology follows two paths. First, we corrupt existing IAC datasets with realistic weather noise, such as fog attenuation, LiDAR dropouts, radar interference, and image streaks. Second, we generate synthetic racing scenarios using CARLA's Scenario Runner to model multi-agent interactions under various weather conditions. This approach provides a low-risk, repeatable, and scalable testing framework for studying the effects of weather on perception and localization, accelerating the development of safer and more resilient autonomous racing systems.

Keywords:

Autonomous Racing; Simulation; Perception; Sensor Fusion

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Richard Osita Ajagu (Engineering); Samuel Labi (Engineering); Reed Joseph Freer (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1279

Presentation Time: Session 2: 10:30-11:30am

Integrating SIMT and Scalar Cores to Manage Control Flow Divergence STEM

Authors(s):

Shresth Mathur† (Engineering); Akshath Raghav Ravikiran‡ (Engineering); Muhammad Zohaib Ali† (Engineering)

Abstract:

The main benefit of GPUs, designed with SIMT (single-instruction multiple-thread) cores, over CPUs is their high performance per watt. However, this advantage degrades as fewer threads run in lockstep for MIMD (multiple-instruction, multiple-data) workloads due to control flow divergence and serialized threads. We aim to mitigate this effect by running divergent threads on less power-consuming scalar cores. Our proposed architecture utilizes hardware mechanisms to dynamically detect and transfer threads from the SIMT core during runtime. In this way, the hardware can use intelligent bookkeeping to make decisions about whether threads will diverge. This causes fewer lanes to remain idle, thereby increasing GPU power utilization.

Our lightweight Python simulations showed that the upper limit of our solution had an improvement of up to 60% in SIMD efficiency compared to a baseline GPU implementation taken from GPGPU-sim. The main limitation of our architecture is its usefulness in running real-world GPU workloads since they are meant to be "embarrassingly parallelizable"; control flow divergence decreases the amount of parallelization that can be done by the GPU and is avoided whenever possible, but our architecture's only real use is for accelerating workloads with medium to high degrees of divergence. Therefore, our current goals are to collect more data on the degree of divergence present in real-world GPU workloads to gauge the usefulness of our architecture, and also to gain better estimates of our architecture's true SIMD efficiency by using the GPGPU-sim cycle-accurate simulator to test our proposed architecture and collect much more accurate execution traces.

Keywords:

GPU; SIMT; Control Flow Divergence; Power; Accelerator Architecture

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering); Hassan Al-alawi (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1280

Presentation Time: Session 2: 10:30-11:30am

**Design & Development of a Portable, User-Friendly Quadrat
for Efficient Field Sampling
STEM**

Authors(s):

Zoe Kathryn Mercert† (Engineering); Felicity Hayahn Park-Smith‡
(Engineering|JMHC)

Abstract:

This project focuses on designing an improved quadrat for ecological and environmental fieldwork that enhances portability, ease of assembly, and user functionality while maintaining the standard 1 m x 1 m dimensions. Traditional quadrats can be bulky, difficult to transport, and time-consuming to assemble in the field limiting their practicality in different terrains and long field work days. The proposed design aims to address these challenges through lightweight, durable materials, and a collapsible or modular structure that can easily be assembled or disassembled without any tools or strong force. By prioritizing ergonomics and efficiency, this project aims to create a quadrat that simplifies the fieldwork logistics, reduces any researcher fatigue, and improves the accuracy and consistency of vegetation data collection.

Keywords:

[no keywords provided]

Mentor(s):

Kristen Marie Bellisario (JMHC)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1281

Presentation Time: Session 2: 10:30-11:30am

Improving Campus Recycling Systems at Purdue University: Education, Design, and Collaboration STEM

Authors(s):

Brookly Elizabeth Minert† (Engineering); Jennifer Adriana Velazquez Cortez‡ (Liberal Arts); Lauren Elizabeth Choppt (Liberal Arts)

Abstract:

Our project addresses the growing issue of underfunded and ineffective recycling systems on Purdue University's campus, including both campus housing and academic buildings. Purdue is a complex system to tackle so we have refined our scope to one dormitory, Shreve Hall, with the goal of extending our findings to all of campus. The project develops sustainable, cost-effective strategies for education, signage, and sorting improvements to enhance recycling efforts in campus housing. Using the Cradle to Cradle framework, we analyze the environmental and social impacts of current materials and waste management, identifying opportunities for low-cost reuse and student education. The project involves collaboration with the Purdue Sustainability team, Purdue Housing Department, Facilities staff, and local waste management companies to create practical solutions. Choosing a dorm building occupied mainly by freshmen and sophomores presents the opportunity for Resident Assistants to support the program and encourages sustainable habits from the start of a Boilermaker's journey at Purdue. We hypothesize that a design-based approach integrating improved signage, education, and sorting systems will increase the effectiveness of recycling on Purdue's campus. The outcome of this initiative is to propose actionable design tactics that reduce waste, conserve resources, and strengthen Purdue's sustainability performance in systems such as LEED, STAR, and WELL. An improved recycling system will not only benefit the community of Purdue but also foster a culture of environmental responsibility and learning amongst students and staff.

Keywords:

Sustainability; Recycling; Design-Based; Campus Involvement; Waste Reduction

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1282

Presentation Time: Session 2: 10:30-11:30am

Forecasting Credit Card Losses for Capital One Using Multi-Bank Data

Business Case Study

Authors(s):

Grant A Moreland† (DSB); Kiefer Alexander Bell† (DSB); Colin Patrick Budreau† (DSB); Justin Thomas Brady† (DSB)

Abstract:

Can better predictions of future credit card losses help Capital One strengthen portfolio management and improve capital planning decisions? This project aims to answer that question by forecasting Capital One's quarterly credit card net charge-off rates for the next four quarters. The net charge-off rate—essentially the percentage of outstanding loans written off as uncollectible—is a key indicator of credit risk and portfolio quality. By forecasting this rate, Capital One can more accurately anticipate future losses and adjust its loan loss allowances, stress-testing processes, and overall capital strategies.

The study draws on historical Call Report data from Capital One and the ten next-largest credit card lending banks, covering 2004 Q4 through 2025 Q2. After cleaning and standardizing the dataset, new financial ratios were engineered, such as total credit card loans to non-performing credit card loans. Early exploratory data analysis shows a strong correlation between card NPLs and card charge-offs, which is expected. Another feature that seems valuable is the tier 1 capital ratio. More importantly, the means of our card charge-off ratios (card charge off to total card loans) do vary, such as Synchrony Bank at 0.01638 and AmEx at 0.009. This means that potentially some banks might make the model worse for predicting capital one or vice versa.

To validate these findings, the project applies to a staged predictive modeling approach. It begins with a simple baseline regression model to establish foundational relationships between key balance sheet ratios and charge-off rates. The process then advances to more sophisticated machine learning techniques (e.g. Ridge, Lasso, and Gradient Boosting) that capture nonlinear relationships and interactions between risk variables. Model performance is evaluated using root mean squared error (RMSE), mean absolute error (MAE), and R^2 to select the most accurate and interpretable forecasting method.

Ultimately, this project supports Capital One's broader risk management and financial planning objectives. Accurate charge-off forecasts can inform the setting of credit loss allowances, enhance capital adequacy assessments, and strengthen regulatory reporting and scenario analysis. By leveraging predictive insights from peer bank data, Capital One can benchmark its portfolio performance against industry trends, improve the timing and scale of reserves, and maintain a disciplined approach to credit risk mitigation.

Keywords:

Credit Risk Forecasting; Predictive Modeling; Banking Analytics; Financial Forecasting; Regulatory Data

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1283

Presentation Time: Session 2: 10:30-11:30am

Powering AI Data Centers: Examining Small Modular Reactors as a Possible Energy Solution STEM

Authors(s):

Alexander Jake Myers† (Science|JMHC)

Abstract:

Nuclear energy is quickly growing in popularity due to climate concerns and increasing energy demand in the U.S. The rise in energy demand is partly due to large tech corporations like Microsoft, Amazon, and Meta building AI data centers. These corporations are considering building the first small modular reactors in the U.S. to power their AI data centers. Small modular reactors (SMRs) are a new type of nuclear fission reactor that promise to be cheaper, more efficient, and safer than regular nuclear fission reactors. However, SMRs are relatively untested compared to other forms of energy. Currently, only two SMRs are operational globally. In this exploratory research project, I investigate if SMRs are capable of safely, cheaply, and efficiently powering AI data centers. To better understand this issue, I will analyze the cost projections of building SMRs in the short term versus long term. Additionally, I will examine current SMR's power output and footprint on their communities. Then, I will compare these findings to other forms of energy and determine if SMRs can meet AI data center's energy demands. This research provides insights into powering AI data centers and contributes to a larger discussion about energy needs globally.

Keywords:

Small Modular Reactors; Artificial Intelligence; Energy; Safety; Cost

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1284

Presentation Time: Session 2: 10:30-11:30am

AFTx06: A RISC-V SoC with Integrated Peripherals on the Skywater 130 nm Node STEM

Authors(s):

Aditya Manoj Nair† (Engineering)

Abstract:

This project presents the design and development of AFTx06, a compact RISC-V System-on-Chip (SoC) created for open-source fabrication using the Skywater 130 nm CMOS process. The main goal of this work is to design a fully functional SoC that integrates a 32-bit RISC-V processor core (RV32IMF) with on-chip memory, peripheral interfaces, and interrupt control within a single chip. The processor communicates with memory through an AHB-Lite bus, which connects to both SRAM and ROM for program and data storage. An AHB-to-APB bridge is used to link a range of peripherals, including UART, SPI, I²C, Timer, PWM, and GPIO modules, enabling flexible communication and control functions.

Interrupt management is handled by a Core Local Interrupt Controller (CLINT) for timer and software interrupts, and a Platform-Level Interrupt Controller (PLIC) for handling external interrupt sources. The design also integrates JTAG and UART interfaces to support hardware programming and debugging. Power regulation and clock generation circuits are included to ensure stable system operation.

The schematic design was developed using KiCad following a hierarchical structure, dividing the SoC into functional modules for clarity and scalability. Functional simulations verified correct communication between the processor, memory, and peripherals. The final design was integrated into the Caravel open-source harness for fabrication readiness. Overall, AFTx06 demonstrates the practicality of building an open-source, educational RISC-V SoC suitable for research, prototyping, and embedded systems learning.

Keywords:

RISC-V; System-on-Chip

Mentor(s):

Weijing Sebastian Chen (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1285

Presentation Time: Session 2: 10:30-11:30am

Increasing Audience Engagement for Purdue Theatre & Dance through Strategic Marketing Innovation

Business Case Study

Authors(s):

Rishi Venkatesh Natarajan† (DSB); Gavin Challmant† (DSB); Tanner Reid Oracheff† (DSB); Kevin Marint† (DSB); Hantao Zhang† (DSB); Sarah Ahmed Alharthi† (DSB)

Abstract:

The Purdue Department of Theatre & Dance seeks to expand and diversify its audience base. In recent years, attendance at live theatre events has declined, and many potential audience members are either unaware of the department's performances or do not perceive them as accessible or relevant. This project aims to develop a strategic marketing plan to increase visibility, engagement, and ticket sales among key groups, including Purdue students, alumni, and local families.

Our team will begin by evaluating the department's current outreach efforts, ticketing trends, and competing entertainment options to understand how audiences discover Purdue Theatre and what influences their decisions to attend. Through this analysis, we will segment target audiences and identify the motivations and barriers unique to each group. We will also explore how Purdue Theatre can better communicate its distinct value and cultural relevance compared to other campus and community entertainment choices.

Based on these insights, we will propose a comprehensive marketing strategy encompassing promotional channels, partnership opportunities, pricing, and audience experience enhancements. Recommended tactics may include creative social media campaigns, collaborations with student organizations, family-focused events, and alumni engagement programs.

The final deliverables will include a market research summary, actionable marketing recommendations, and examples of proposed materials such as ad mockups or social media content. Overall, this project aims to provide Purdue Theatre & Dance with a sustainable and practical framework to build stronger connections with the community and grow its audience for future seasons.

Keywords:

Marketing; Purdue Theatre; Case Study

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1286

Presentation Time: Session 2: 10:30-11:30am

Indigenous Northern Thai Hill Tribe Women's Health and Access to Healthcare Services amidst Structural Barriers, Cultural Influences, and Intersecting Identities

Social Science

Authors(s):

Natcha Ngaosuphanvongs† (Agriculture)

Abstract:

Indigenous Hill Tribe Women located in the Northern region of Thailand experience a multitude of intersecting cultural and socio-economic influences that impact their rights, lifestyle, and health. To highlight the health disparity and negative stigmatization these women experience in healthcare, this study discusses the ways in which these factors impact their health. Bringing awareness to the discrimination and lack of healthcare outreach for these women is crucial in mending the ever-present health inequity, along with displaying the underlying political economic strife that is brought to light when observing the root causes of these health issues. Data includes the plethora of ethnographic research, systematic qualitative literature reviews, along with an interview with an anthropologist field expert. Through the compilation of data across various sources, a compounded product of the core reasons behind this health disparity may be uncovered. Through extensive research, the main findings span across three factors in which are the core principles of the study: Culture and stigma, Socio-economic Status, and Statelessness. Through addressing these core rationales, this study addresses changes necessary for improved healthcare. Furthermore, the truths brought to light may also reveal the cracks beneath their underlying systemic issues of their political economic state, which may be applied to the hill tribe's overall life and well-being in Thai society.

Keywords:

Medical Anthropology; Healthcare; Indigenous; Culture; Social Science

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1287

Presentation Time: Session 2: 10:30-11:30am

Racing Against the Odds: Understanding the Gender Gap in Motorsports Engineering Social Science

Authors(s):

Dominique Nieto Corona† (Engineering)

Abstract:

Despite significant progress toward gender diversity in STEM, women remain underrepresented in motorsports engineering. This research explores the social, cultural, and structural factors that contribute to the low participation of women in this field. The study examines existing literature on gendered socialization, early exposure to engineering, and representation within the motorsports industry to identify key barriers to entry. Using a mixed-method approach that combines interviews with female engineers and content analysis of motorsports media, this project seeks to understand how early education, workplace culture, and media visibility shape women's interest and persistence in motorsports engineering. Preliminary findings suggest that limited early encouragement in technical fields, lack of visible female role models, and male-dominated work environments significantly influence women's engagement and retention. This research aims to highlight not only the obstacles women face but also emerging initiatives that promote inclusion, such as mentorship programs and outreach efforts led by Formula 1 and the FIA. Ultimately, the project contributes to broader discussions about gender diversity in engineering by identifying strategies that can make motorsports a more accessible and equitable space for future female engineers.

Keywords:

STEM; Inclusion; Gender Gap; Motorsports; Engineering

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1288

Presentation Time: Session 2: 10:30-11:30am

VIP AI4DR: Disaster Tweet Classification Using Machine Learning for Real-Time Relief Efforts STEM

Authors(s):

Yubeen Oht† (Engineering); Tanishq Praveen Pauskart† (Science); Max Ben-Azai Kirschnert† (DSB); Sarah Mohapatra‡ (Science); Dylan D Patel‡ (Engineering); Sai Maanasa Gogula‡ (Engineering)

Abstract:

When natural disasters strike and lives are in danger, every moment counts. With current technology, it remains difficult for rescue teams and first responders to accurately and efficiently provide relief. Every second lost is time that could have been used towards saving lives and preventing further damage. We propose that efficiency and accuracy in the relief efforts of first responders can be greatly increased through the use of artificial intelligence (AI) and social media. This research project focuses on the classification of crisis-related posts from X (formerly known as Twitter) using the CrisisMMD dataset, with feature extraction techniques such as term frequency-inverse document frequency (TF-IDF) to train machine learning models for use in these situations. The outcome of this project is a model that predicts the type of assistance needed during disasters based on real-time information from X. To accomplish this, we utilized term frequency-inverse document frequency (TF-IDF) weighting to generate tokenized input features. We employ a double-layer structure that combines logistic regression and SoftMax regression to build a model that identifies whether a tweet contains informative content and categorizes it based on the specific type of disaster related information it conveys. If put to use in disaster relief situations, the model will be able to evaluate new posts on X based on their informativeness and then decide which category the informative posts belong in to provide critical information that will aid disaster relief efforts in real time.

Keywords:

Text Classification; Machine Learning; CrisisMMD Dataset; PyTorch; Supervised Learning

Mentor(s):

Soudabeh Taghian Dinani (Engineering); Siddeshwar Raghavan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1289

Presentation Time: Session 2: 10:30-11:30am

Perception-Driven Autonomous Navigation for Low Altitude Aircraft STEM

Authors(s):

Ali Ayman Moha Omar† (Engineering); Abdulrahman Mohamed Abougendia† (Engineering); Salaheldin Elsayed Ibrahim AbdelMoaty† (Engineering); Zeyad Mohamed Al Elshafey† (Engineering)

Abstract:

The purpose of this project is to design and develop an autonomous low-altitude aerial system capable of independent navigation and real-time obstacle avoidance in complex environments. The system will be built on PART's existing quadcopter platform, which we will develop to establish a new division within PART focused on the development and deployment of low-altitude autonomous aircraft. The project employs a phase-based approach emphasizing simulation-based validation prior to physical testing. Algorithms for obstacle detection and path finding will be implemented within the Robot Operating System (ROS) framework. The ROS framework is set to enable accurate mapping, localization, and motion planning, while the ArduPilot control stack will manage low-level stabilization and flight execution. Testing will be conducted in the Gazebo simulation environment to test the system's functionality under realistic conditions. Expected results include the successful simulation of autonomous point-to-point navigation, accurate real-time mapping of the surrounding environment, and reliable obstacle detection and avoidance at low altitudes. The project anticipates demonstrating stable control loops, acceptable computational latency on the computing platform, and consistent performance across simulated environments. The simulated outcomes will serve as verification of system feasibility before hardware integration, establishing confidence in the control and perception algorithms developed. The implications of this work extend beyond the scope of simulation validation. The project will provide a technical foundation for future research and development in low-altitude autonomous aerial systems at PART, supporting applications such as on-campus drone delivery, autonomous security patrols, and participation in aerial robotics competitions. By developing this platform, PART will strengthen its position in the field of autonomous aerial robotics, create opportunities for interdisciplinary collaboration, and contribute to advancing the practical deployment of intelligent, low-altitude unmanned systems.

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

Keywords:

Low-Altitude; PART; Drone; Autonomous; Navigation

Mentor(s):

John William Rolfe (Engineering); Shreyas Sundaram (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1290

Presentation Time: Session 2: 10:30-11:30am

Lockup-free Cache Verification based on UVM Platform STEM

Authors(s):

Dev M Patel† (Engineering|JMHC); Sirui Yang† (Engineering); Joseph Allen Sowers† (Engineering|JMHC)

Abstract:

As part of the SoCET GPU-UVM team, this sub-team's purpose is to verify the lockup-free cache component of the GPU designed by GPU team for tapeout. The team proposes a verification environment built using SystemVerilog and UVM (Universal Verification Methodology), consisting of a four-agent testbench: an active and passive agent simulating the CPU, and an active and passive agent simulating the RAM. Separate transactions were implemented for both CPU and RAM operations.

The verification plan decomposes the lockup-free cache into typical cache behavior, lockup-free specific mechanisms, and edge cases. Corresponding covergroups are to be developed to provide stratified coverage across these categories. The main technical challenge lies in the predictor module, which effectively simulates the entire cache behavior. Ensuring the predictor's accuracy requires a deep understanding of the specification. Furthermore, out-of-order transactions introduce additional complexity in aligning and comparing expected and actual results. Additionally, randomized stimulus is generated to execute all planned scenarios, ensuring comprehensive verification across both standard and corner cases.

This work will establish a complete UVM-based testbench architecture that accurately models cache functionality and verifies lockup-free cache operation. The resulting verification framework provides a reusable foundation for future GPU cache validation projects within the SoCET program.

Keywords:

GPU-UVM; Lockup-Free Cache; System Verilog

Mentor(s):

Mark Johnson (Engineering); Ayush Singh (Engineering); Anas Zyad Abughali (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1291

Presentation Time: Session 2: 10:30-11:30am

**Ultra-Low Thermal Conductivity PVDF-rGO Membranes for
High Efficiency Thermal Desalination
STEM**

Authors(s):

Arnab Paul† (Engineering); Hassan Mustafa Tagar‡ (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Membrane Distillation; Membrane; Desalination; Thermal Conductivity

Mentor(s):

Waqas Alam (Engineering); David Warsinger (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1292

Presentation Time: Session 2: 10:30-11:30am

Advancing Semiconductor Workforce Training with Real-Time VR Digital Twins STEM

Authors(s):

Tung Gia Pham† (Engineering)

Abstract:

The critical shortage of skilled workforce and increasing process complexity in global semiconductor industry requires the development of effective and scalable training solutions. This poster presents an interactive digital twin of semiconductor manufacturing processes within virtual reality (VR) environment using Unreal Engine 5.6 coupled with real-time data from Purdue's nanohub simulation infrastructure. By integrating real-time simulation data, the digital twins will accurately represent dynamic scenarios, specifically targeting processes such as photolithography, wet etching, and ion implantation. Unlike existing VR training tools that rely on static models, this work establishes a live, data-driven connection between physics-based process simulations and 3D digital representations, allowing for higher levels of digital twin fidelity. This digital twin system features a virtual mask aligner, enabling users to simulate the photolithography process with precise control over light exposure and alignment accuracy. The wet bench module provides an interactive platform for students to learn photoresist development techniques, including immersion, agitation, and rinse cycles. The digital twin further incorporates a physical vapor deposition (PVD) chamber and a chemical vapor deposition (CVD) module. Here, users witness the formation of atomically-thin oxide films essential for dielectric isolation and gate formation in microchip manufacturing. Each module offers detailed visualization of process variables such as temperature profiles, chamber pressures, and layer thickness measurements. Together, this system creates realistic digital twins of key semiconductor manufacturing steps and real-time operational behaviors. The resulting VR platform serves as an educational tool, offering effective and immersive training solutions.

Keywords:

VR; Digital Twin; Unreal Engine; Manufacturing; Semiconductor

Mentor(s):

Ramses Martinez (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1293

Presentation Time: Session 2: 10:30-11:30am

Datacenter Network Accelerator : NIC - Physical Layer Parsing and Generating STEM

Authors(s):

Brady Owen Philhowert† (Engineering); Nolan Porter Jones† (Engineering|JMHC); Weichih Hsieh† (Engineering)

Abstract:

Modern data centers need to move and process enormous amounts of data at very high speeds. Traditionally, when computers communicate over a network, their central processors (CPUs) handle every step of sending, receiving, and managing data. This process creates bottlenecks and wastes computing power.

Remote Direct Memory Access (RDMA) helps solve this by allowing one computer to read or write directly to another computer's memory without going through the CPU. This approach greatly reduces latency and CPU workload, but RDMA is limited—it can only perform simple read and write operations. More complex data manipulations still require CPU involvement or multiple RDMA commands, both of which slow down performance and consume extra bandwidth.

Our project, Smart Remote Memory, enhances RDMA by embedding small programmable computing units, called kernels, directly inside the network interface card (NIC). This allows certain operations to be performed “in flight,” as data moves through the network, instead of waiting for the CPU. By processing data within the NIC, we can reduce latency, save bandwidth, and improve overall system efficiency—making data centers faster and more cost-effective.

Our subteam focuses on developing the data parsing module, which reads incoming Ethernet packets and extracts key information such as source and destination addresses, operation types, and packet size. This metadata is then passed to other modules for further processing. Our performance is measured by how quickly our parser can process and forward data, and how efficiently it sends packets back into the network.

Keywords:

Network Accelerator; Network Architecture; Hardware Design; RTL Design; Smart Remote Memory

Mentor(s):

Rishikesh Reddy Bathina (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1294

Presentation Time: Session 2: 10:30-11:30am

From Sound to Streams: Predicting Music Success Through Analytics

Business Case Study

Authors(s):

Brendan William Polese† (DSB); Rachel Elizabeth Carlson† (DSB);
Abigail Claire Smith† (DSB); Mert Ryan Kiroglu† (DSB)

Abstract:

How can streaming popularity prediction guide artists and labels in optimizing production and marketing decisions? In this project, we predict Spotify streaming popularity from audio characteristics and metadata. With accurate and interpretable forecasted predictions, this will help artists and labels make decisions that highly impact the music industry economy. As a result, the predictions will provide insight into production choices and improve playlist/recommendation positioning.

Our data preparation process consisted of exploring and understanding the data and then cleaning it. The main features in our dataset include different audio features percentage in a song, such as danceability, energy, liveness, instrumentality, etc. Some other key features are how many playlists a song appears in on Spotify, Apple Music, and Deezer. Our target column is the count of total Spotify streams. To begin cleaning, we imputed missing values, dropped columns we wouldn't be using, merged the date columns, and changed certain variables to the correct data types.

From here, we will begin by building a linear regression model as our base that we can use to compare future advanced models to. Next, we will apply regularization techniques such as ridge and lasso regression to improve model performance. To capture any potential non-linear relationships, we plan to utilize Random Forest Regression. We will use feature importance metrics and SHAP (Shapley Additive Explanations) values to identify the most influential predictors and interpret how different features affect the popularity of a song. Finally, we will evaluate our models using k-fold cross-validation to see the reliability of our results.

The preliminary findings indicate that our early EDA suggests playlist exposure outperforms charts in explaining stream scale, though it exhibits diminishing returns at higher counts. Danceability, BPM, and valence show near-zero correlation with total streams. To validate these

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

insights, a predictive modeling process will be developed using a staged approach. Beginning with a simple baseline model, followed by more complex models. The final model will be selected based on the lowest test error determined through K-fold cross-validation. The resulting analysis will inform exposure strategies and feature tradeoffs for artists and labels.

This project demonstrates how predictive analytics can uncover the key drivers of consumer engagement within the music industry. By identifying w

Keywords:

Predictive Analytics; Streaming Popularity; Feature Importance; Consumer Behavior; Cross Validation

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1295

Presentation Time: Session 2: 10:30-11:30am

The Design of Auxiliary Blocks in Support of a Undergraduate-Led Die-to-Die Chiplet Interconnect STEM

Authors(s):

Arthur Prudius† (Engineering)

Abstract:

With the ever-increasing demand for high performance computing, integrated circuits that serve this purpose also become much more complex and grow dramatically in die area size. As a result, this makes the traditional monolithic System-on-Chip (SoC) become much more difficult to manufacture due to higher chances of defect given larger die area. As a solution to this problem, Semiconductor industry has gradually adopted chiplet-based design as this provides better modularity, shorten product development cycle with intellectual properties (IP) reuses and improve yield. There have been many efforts around the industry to collaborate and standardize Die-to-Die (D2D) communication protocol like BoW (bunch of wires) or UCIe (Universal Chiplet Interconnect Express). Even though there have existed strong demands from industry, there has not been a serious undergraduate-led initiative in academia to prepare engineering students for this shift in integrated circuit design paradigm. This work outlines the design of auxiliary blocks such as a low dropout regulator (LDO), bandgap reference, and current-steering DAC in support of a university designed D2D protocol, implemented in a 180nm bulk CMOS technology.

Keywords:

Chiplet; SerDes; LDO; DAC

Mentor(s):

Seyedehmarzieh Rouhani (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1296

Presentation Time: Session 2: 10:30-11:30am

Mechanical Behavior Of Subcutaneous Injections and Implications on Injection Site Reactions STEM

Authors(s):

Shreya Shrikrushna Pulujkar† (Engineering); Sounish Ghosh† (Engineering); Andrew Jonathan Savysky† (Engineering); Ying-jen Chen† (Pharmacy)

Abstract:

Our project aimed to investigate how the mechanical behavior of subcutaneous injections affects tissue stress and potential pain responses. Understanding this relationship can help improve patient comfort and drug delivery performance.

High-speed imaging was used to capture the injection plume. Image sequences of plume growth from three different types of autoinjectors were analyzed using Python-based image processing to measure flow rate, changes in plume volume, symmetry, and deformation. These parameters were used to estimate local pressure and the resulting tissue stress. The connection between flow rate, pressure, and local stress distribution was used to establish a quantifiable relationship between injection dynamics and potential injection site reactions such as pain or swelling. Higher flow rates were found to produce greater localized stress within the tissue and increased discomfort after injection. The results demonstrated that higher flow rates generated higher localized stress in the surrounding tissue. The increased deformation and asymmetry in plume growth were also associated with uneven stress distribution, which can lead to swelling, pain, or discomfort after injection. These findings suggest that mechanical injection dynamics directly affect tissue response. By connecting flow rate, pressure, and local stress distribution, this research provides a quantitative understanding of how injection mechanics relate to tissue pain and performance. These insights can support the design of next-generation autoinjectors and injection protocols aimed at minimizing discomfort while maintaining efficient drug delivery.

Keywords:

[no keywords provided]

Mentor(s):

Reza Babakhani Galangashi (Engineering); Sourav Das (Engineering);
Brett A Meyers (Centers & Institutes)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1297

Presentation Time: Session 2: 10:30-11:30am

Optimizing Photolithography and Metal Lift-Off for High-Fidelity MIM Capacitor Fabrication STEM

Authors(s):

Vaishnavi Purram† (Engineering|JMHC); Bobby Gu‡ (Engineering|JMHC); Annabelle Nakamura Defosse‡ (Engineering|JMHC); Samuel K Law‡ (Engineering)

Abstract:

This research investigates the optimization of lithography and lift-off processes to enhance pattern fidelity and yield in Metal-Insulator-Metal (MIM) capacitor fabrication. Building upon prior efforts of the VIP@Birck MIM Capacitors team, our objective was to improve the quality of lithography and lift-off through comparative analysis of three treatment methods: SurPass 4000 adhesion promoter, chlorobenzene soak, and Lift-Off Resist (LOR 3B). Each method was evaluated across exposure dosages ranging from 120–170 mJ/cm² using the MJB3 mask aligner. Process performance was assessed through both qualitative and quantitative metrics, including visual residue, defect density, and area percent error (APE) between designed and fabricated geometries. Scanning Electron Microscopy (SEM) and optical microscopy provided insights into resist adhesion, undercut profiles, and resist deformation. Results revealed that SurPass 4000 achieved excellent adhesion but lacked consistent undercut formation, while chlorobenzene produced controllable overhangs at the cost of higher edge defects. LOR 3B demonstrated theoretical promise for clean lift-off yet introduced imaging, residue, and compatibility challenges. Analysis identified contamination, inconsistent timing, and improper development as primary sources of variation across wafers. Overall, this study highlights the trade-offs inherent in each resist system and proposes future work involving tri-layer resist structures, refined process timing, and developer agitation to achieve optimal lift-off performance. The findings contribute to more reliable lithography workflows for microelectronic device fabrication and provide a framework for process standardization and reproducibility in MIM capacitor production.

Keywords:

Semiconductors; Lithography; Engineering; Microelectronics; Nanotechnology

Mentor(s):

David B Janes (Engineering); Jozue Kim (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1298

Presentation Time: Session 2: 10:30-11:30am

Multi-Agent Simulation of Autonomous Drone Behavior in MATLAB Simulink STEM

Authors(s):

Akul Ramasubban† (Engineering); Andrew Clark Cowen Cerrato† (Engineering); Alexander Haitian Zhang† (Engineering); Andrew Ryan Davidson† (Science|JMHC); Avantika Shah* (Science); John Michael Wyman* (Engineering); Mohamed Mahmoud Zaitoun* (Engineering); Anubhuti Mittal* (Science)

Abstract:

This project aims to develop a multi-agent simulation framework within MATLAB Simulink to model autonomous drone behavior and their interactions in competitive racing scenarios. Our team will go over the design of the simulation environment, which will include designing the plant (drone) system, and implementing different control algorithms to simulate the motion of a real drone. The simulation environment will employ multiple agents, each representing a unique drone identity with separate physical characteristics and one of two decision-making models. These models are Nonlinear Model Predictive Control (NMPC) and Nonlinear Receding Horizon Differential Game (NRHDG). We capture the varying nature of different drones by including variations in mass, inertia, motor dynamics, aggression limits, and more. Our environment will use physics-based models and take into account external forces to simulate realistic flight dynamics within a shared 3-D simulation environment. We believe this is an important problem to solve as an accurate and robust simulation is what provides the groundwork for understanding drone behavior as precisely as possible before real world testing.

Keywords:

Autonomous Drone; Simulation; MATLAB Simulink; Drone Racing; Multi-Agent

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Richard Osita Ajagu (Engineering); Reed Joseph Freer (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1299

Presentation Time: Session 2: 10:30-11:30am

Simulation-Based Rotor Profile Design Process for Twin-Screw Compressors in High-Temperature Heat Pump Systems STEM

Authors(s):

Aveena Kuntal Rawal† (Engineering|JMHC)

Abstract:

High-temperature heat pumps (HTHPs) are an energy-efficient alternative to conventional fossil-fuel furnaces as they are used in most heat intensive industrial processes, e.g. in food processing, chemical industry, pulp, and paper industry. However, the operating temperature of HTHPs that are currently available on the market is limited to 170 °C due to component, fluid, and cycle architecture restrictions. The focus of this project is to further advance the operating range by developing a HTHP that can provide a heat sink temperature of 200 °C at a coefficient of performance (COP) of 3. To efficiently achieve this temperature, a new internally cooled screw compressor type is designed applying additive manufacturing. As part of the design process, the rotor profiles of the screw compressor were improved, using a screw profile optimization tool. The newly created profiles were then investigated in a parametric study where the compressor and system performance were calculated through a multi-chamber compressor model with the software SCORG. Based on the results of the compressor model, the best fitting rotor profile could be selected, and overall system efficiency could be improved. Furthermore, a deeper understanding of the effect of different compressor geometries on the screw compressor performance was gained.

Keywords:

[no keywords provided]

Mentor(s):

Davide Ziviani (Engineering); Andreas Josef Hoess (Engineering)

Other Acknowledgement(s):

Eckhard A Groll (Engineering)

Poster Presentation Abstract Number: 1300

Presentation Time: Session 2: 10:30-11:30am

Predicting Retail Sales Trends Using a Synthetic Dataset Business Case Study

Authors(s):

Neha Mary Regi† (DSB); Zijing Zhang† (DSB); Shih-En Wang† (DSB);
Christopher Cruz† (DSB)

Abstract:

How can retail businesses accurately forecast future sales to optimize inventory, spending, and customer satisfaction? This project addresses that question by analyzing a synthetic retail dataset containing historical sales, product information, supplier data, seasonal trends, and promotional activity.

Our exploratory data analysis (EDA) reveals key patterns—such as spikes during holiday seasons, stronger performance in specific product categories, and correlations between discount depth and short-term sales boosts. These findings help us understand the underlying drivers of retail performance in a practical, business-oriented way.

To validate these insights, we will develop predictive models in a staged process: beginning with simple benchmarks (moving average and ARIMA) and progressing to advanced machine learning models (Random Forest Regressor). Model accuracy will be assessed using RMSE, MAPE, and R^2 , with K-fold cross-validation guiding final model selection.

The resulting forecasts will help retail decision-makers allocate budgets efficiently, reduce overstock and stockouts, and enhance promotional timing. By leveraging data-driven intelligence, this project demonstrates how predictive analytics can transform retail operations, helping businesses shift from reactive responses to proactive, insight-driven strategies for sustainable growth.

Keywords:

Predictive Analytics; Retail Sales Forecasting; Machine Learning Models; Exploratory Data Analysis; Business Decision-Making

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1301

Presentation Time: Session 2: 10:30-11:30am

Hash-based Pseudorandom Number Generator on ASIC STEM

Authors(s):

Elian Inigo Turcal Rieza† (Engineering); Aayuman Ghangurde† (Engineering); Sai Kaushal Sri Viswa Gautham Palaparathi† (Engineering); Rohan Shah† (Engineering|JMHC)

Abstract:

Large cryptographic hashing algorithms and their subsets have been constructed and can be used to determine the uniqueness of any set of data that has been ran through the algorithm and long gone is the time that technology has capped the complexity, hash bit length, lookup tables and buckets that are required to calculate a hash.

This Intro II project has decided to take a step back from high-complexity algorithms and strip back hashing algorithms to its rudimentary functions within the 1000-gate, Tiny Tapeout-fitting constraint of the project.

Extensive usage of the non-cryptographic Pearson hashing algorithm, a simple, computationally fast hash function designed for 8-bit register processors, was prioritized and permits for the FPGA to act as the input module with a separate seven-segment display to output the encrypted text based on a permutation table.

Our choice in the project to create a non-cryptographic hash calculator was realized due to our shared experiences in the need for quick random generation of a number. In such cases, implementing a lightweight hash-based checksum provided a practical method for creating such a generator. A FPGA hash calculator is a hardware-friendly approach ideal for ensuring a fast and accessible way to get a random value given where an output would have enough variation to be declared random using frequency testing and a chi-squared test.

Keywords:

FPGA; ASIC; Cryptography; Entropy; TinyTapeout

Mentor(s):

Malcolm Lloyd Seib McClymont (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1302

Presentation Time: Session 2: 10:30-11:30am

FEA Modeling of Radius Bones

STEM

Authors(s):

Kathryn Anne Roscetti† (Engineering)

Abstract:

Care for osteoporosis patients includes pharmaceutical treatment shown through clinical trials to increase bone resilience and reduce fracture risk. Experimental research demonstrates that treatment of bone samples with osteoporosis medication alters bone quality, which is correlated to increased bone strength and fracture resistance. However, exact measurements of strength are difficult to quantify due to irregular geometry and inhomogeneity of bone samples. This study employs finite element methods to quantify the strength of radial bone samples, to allow for more accurate measures of strength improvement through clinical treatment by accounting for geometric properties specific to each sample. Finite element models of twelve radius bone samples were constructed using high resolution CT imaging. These models were then subjected to three-point bending tests with various prescribed displacements. The computational stress values found by finite element modeling software were then used to compute a geometric modulus, to account for irregularity along the length of a sample. Computed modulus values at various displacements were found to be similar among individual samples, indicating consistency of the geometry effects at various loads. However, further testing will establish methods to apply geometry specific model loading properties to enhance strength measurements in experimental data.

Keywords:

[no keywords provided]

Mentor(s):

Thomas H Siegmund (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1303

Presentation Time: Session 2: 10:30-11:30am

Investigating Microbial Motility as a Potential Agnostic Biosignature: Cell Shrinking and Expanding STEM

Authors(s):

Arunima Saha† (Science); Gretchen K Minich‡ (Science|JMHC)

Abstract:

One major challenge in detecting microbial life beyond Earth is the uncertainty of its composition. Movement is one of the most basic indications of life that can occur independently of composition, but it can also happen in systems that aren't alive through basic physical forces like flow, friction, and random motion. Scientists are interested in finding out if particular forms of movement can be used as agnostic biosignatures, which are potential indications of life that don't rely on any particular biochemistry existing on Earth. In this project, we aim to compare biotic movement due to osmotic pressures with abiotic movements of solvent droplets within monitored lab conditions. We use *Escherichia coli* (*E. coli*) as a model organism in our experiments to see how its movement changes when salt is added or removed, resulting in environments which can cause the *E. coli* to adjust their cell concentrations resulting in expansion or contraction. This changing balance of water inside and outside of the cells may also impact how the bacteria move and behave. We use microscopy to take short videos and pictures of *E. coli* under different salt conditions and compare them to abiotic movements from evaporating and moving droplets (water, methanol). We want to figure out what makes biological motion different from purely physical motion by looking at how fast, in what direction, and how organized the movement is. This comparison provide insight for the development of a motility biosignature detection algorithm by our collaborators at Johns Hopkins APL.

Keywords:

Biosignature; Movement; Astrobiology; Microbial Life; Osmotic Pressure

Mentor(s):

Ben K D Pearce (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1304

Presentation Time: Session 2: 10:30-11:30am

Magnetic Active-MPT for Yield Stress Quantification in PEG-Based Hydrogels STEM

Authors(s):

Aneesh Sathay† (Engineering)

Abstract:

We present a magnetic microrheology platform designed to quantify the yield stress of poly(ethylene-glycol) (PEG) covalent adaptable hydrogels (CANs). Hydrogel CANs exhibit key properties of soft tissue such as viscoelastic mechanics, high water content, and porosity. Therefore, CANs are used in a variety of research areas including the elucidation of mechanistic cell-environment interactions and the development of tissue-regeneration and drug-delivery technologies. In our work, active multiple particle tracking microrheology (MPT) is used to find the yield stress. Yield stress refers to the point of stress under which the hydrogel transitions from solid-like elastic deformation to liquid-like viscous flow. Active MPT involves observation of particle motion through a sample due to an external force, in this case the magnetic field force, using video microscopy. This enables characterization of non-linear viscoelastic responses such as yielding behavior.

We develop a sample chamber for rapid imaging of active MPT using two capillary tubes and a Neodymium fridge magnet. One capillary tube contains non-magnetic probes providing focus calibration. The second parallel capillary tube contains magnetic probes enabling immediate sample injection and data capture. This set-up allows for rapid data acquisition; however, it exhibits low repeatability due to rapid equilibration of the magnetic response and high sensitivity to loading errors. Even minor delays or contact during sample injection disrupts focus or exhausts magnetically driven motion before imaging begins. Future work will implement a tunable electromagnet and micromanipulated positioning to achieve repeatable, toggleable field control, trading off rapid data acquisition times for greater repeatability.

We analyze particle trajectories through velocity–position fitting. We calculate the viscosity and the magnet's field distribution using an unsteady-state force balance between viscous drag-force and magnetic field force, determined using Stokes' drag equation and the Fröhlich-Kennelly magnetization relation. Our results for glycerol-water solution viscosities and magnetic field strength are consistent with the

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

corresponding viscosities (from literature) and magnetic field strength (from manufacturer) respectively: this validates our procedure and the theoretical analysis. Finally, we develop a framework to apply this analysis to viscoelastic fluids such as the target hydrogel, using the vis

Keywords:

[no keywords provided]

Mentor(s):

Gautam Vivek Khare (Engineering)

Other Acknowledgement(s):

Kelly Schultz (Engineering)

Poster Presentation Abstract Number: 1305

Presentation Time: Session 2: 10:30-11:30am

Exploring Sleep Inertia through Biometric-Based Smart Alarm Design: A Meta-Analysis of Sleep Cycle Timing and Wake Patterns STEM

Authors(s):

Liesel Jeanette Schmidt† (HHS)

Abstract:

Sleep inertia refers to the temporary period of tiredness, reduced alertness, and impaired cognitive performance that occurs after waking, often resulting from awakening during a critical stage of the sleep cycle. The sleep cycle includes stages N1, N2, N3, and Rapid Eye Movement (REM) sleep, which range from light to deep restorative phases. Waking from the deeper stages of sleep, particularly N3 or REM, is most strongly associated with heightened sleep inertia due to greater disruption of brain activity. Each stage is characterized by distinct physiological patterns, such as changes in movement, heart rate, and brain activity, which are factors that can now be monitored through modern biometric technology. This research investigates to what extent a smart alarm clock that adjusts wake time based on users' sleep stages might impact sleep inertia. A meta-analysis of existing literature will examine biometric indicators across sleep stages and assess the effects of waking during each phase. The goal is to guide the design of future alarm systems by integrating biometric insights to better align wake times with users' natural sleep patterns.

Keywords:

Sleep Inertia; Sleep Cycle; Smart Alarm

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1306

Presentation Time: Session 2: 10:30-11:30am

How Travel Impacts the Mind

Humanities

Authors(s):

Hannah M Schultz† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

Travel; Happiness; Mental Health; Well-Being; Personal Growth

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1307

Presentation Time: Session 2: 10:30-11:30am

AI Under Fire: Safeguarding Critical Systems from Adversarial Threats STEM

Authors(s):

Shrreya Jegata Sethuramalingam† (Science)

Abstract:

As artificial intelligence (AI) becomes increasingly integrated into critical sectors, such as healthcare and safety, these systems must remain reliable and secure. While AI has the potential to assist doctors, optimize emergency response, and improve safety, its vulnerabilities can lead to serious consequences in high-stakes environments. One emerging concern is adversarial attacks, which are when small manipulations are made to input data, causing AI models to make incorrect or dangerous decisions. These attacks pose serious risks when AI systems are used where human lives depend on their accuracy. My research examines how adversarial attacks compromise and impact the reliability of AI systems in healthcare contexts. By analyzing literature on AI safety, reliability, and system vulnerabilities, I will evaluate current methods and defense mechanisms intended to make systems resistant to errors. My research will also explore real-world examples where AI manipulations have led to failures, highlighting the importance of implementing safeguards. My project aims to identify weaknesses in AI and develop strategies to mitigate associated risks. By doing so, I hope this research broadens our understanding of AI safety and ways we can develop safer and more trustworthy AI technologies for the future.

Keywords:

Adversarial Attacks; Artificial Intelligence; Defense Mechanisms; Healthcare

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1308

Presentation Time: Session 2: 10:30-11:30am

Design and Implementation of a Shield-Class Daughtercard Module utilizing an HSMC for FPGA-SRAM Interconnect Optimization STEM

Authors(s):

Priyan Kamlesh Shah† (Engineering); Andrew Doru Bogdan‡ (Engineering)

Abstract:

Modern microcontrollers and custom silicon dies use volatile memory to support high-speed data operations; however, the AFT-x07 specifically lacks sufficient on-chip memory capacity, requiring external memory integration to achieve scalable performance. Direct interfacing between the AFT-x07 and external Static Random-Access Memory (SRAM) modules is not currently possible due to hardware communication constraints such as signal-level mismatches, frequency incompatibilities, and limited I/O pin availability.

To address these challenges, our project investigates the iterative design and prototyping of a printed circuit board (PCB) daughtercard that provides a bridge between a Field Programmable Gate Array (FPGA) with a High-Speed Mezzanine Connector (HSMC) interface and the direct pin connections of a standalone SRAM integrated circuit. The proposed PCB daughtercard enables rapid volatile memory expansion without requiring a full chip re-tapeout or extended fabrication cycles, offering a fast and flexible hardware pathway for external memory integration.

This approach allows for accelerated prototyping, testing, and debugging through FPGA-controlled logic, reducing overall turnaround time compared to full application-specific integrated circuit redesigns. Key design challenges include achieving proper synchronization between the FPGA and SRAM signals and resolving interface incompatibilities between the devices. The resulting PCB bridge provides a practical middle ground - offering fast development, electrical adaptability, and modular scalability.

Our work focuses and realizes the SRAM-FPGA bridge through an HSMC interface, including schematic capture, routed board layout, and successful completion of electronic and design rule checks. Fabrication and hardware verification of the daughtercard validates the bridge's

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

effectiveness and confirms compatibility between the FPGA and external SRAM. The results demonstrate that the proposed PCB solution's quick iteration cycle and modular design make it an efficient and scalable path toward achieving external memory integration for future AFT-based architectures.

Keywords:

FPGA; SRAM; PCB Design; HSMC; System-on-Chip Extension Technologies

Mentor(s):

Weijing Sebastian Chen (Engineering); Matthew A Swabey (Engineering); Mark Johnson (Engineering); Conor James Green (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1309

Presentation Time: Session 2: 10:30-11:30am

A Game-Theoretic Control Framework for Competitive Drone Racing STEM

Authors(s):

Avantika Shah† (Science); Anubhuti Mittal† (Science); Mohamed Mahmoud Zaitoun† (Engineering); John Michael Wyman† (Engineering); Andrew Ryan Davidson‡ (Science|JMHC); Andrew Clark Cowen Cerrato* (Engineering); Alexander Haitian Zhang* (Engineering); Akul Ramasubban* (Engineering)

Abstract:

The increasing complexity of competitive drone racing necessitates control frameworks capable of managing high-speed, adversarial multi-agent interactions in real-time. Traditional path-planning methods often fall short in such scenarios, as they tend to focus on single-drone navigation or rely on simplistic, fixed predictions of an opponent's behavior. This research details the implementation and extension of a game-theoretic control framework, the Nonlinear Receding-Horizon Differential Game (NRHDG), designed for competitive racing along complex three-dimensional paths.

Our framework, based on the work of Sung et al., enhances robustness by predicting and countering an opponent's worst-case actions over a finite horizon. This improves upon standard Nonlinear Model Predictive Control (NMPC), which assumes a fixed opponent trajectory. The implementation features computationally efficient projection point dynamics for path-following and a custom potential function for dynamic switching between overtaking and obstructing maneuvers.

We expand on the original research by porting the framework to a high-fidelity Simulink environment that incorporates a plant model with realistic physical constraints like mass, inertia, and actuator limits. Furthermore, we propose using reinforcement learning to optimize the controller's strategic parameters. Validation in this environment confirms the NRHDG controller significantly outperforms the NMPC baseline in both overtaking and obstructing capabilities.

Keywords:

Drone Racing; Autonomous Systems; Game Theory; Reinforcement Learning; Path Following

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Richard Osita Ajagu (Engineering); Reed Joseph Freer (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1310

Presentation Time: Session 2: 10:30-11:30am

Effects of Leading-Edge Roughness Size and Pattern on Laminar-Turbulent Transition and Aerodynamic Performance on Low Reynolds Numbers STEM

Authors(s):

Samarth Sharma† (Engineering); Aiden James McGuiness‡ (Engineering)

Abstract:

At low Reynolds numbers, airfoil aerodynamic performance is governed by laminar flow conditions, which are efficient but sensitive to surface condition, and are easily tripped by imperfections. Roughness along the leading edge can cause early transition from laminar to turbulent flow, reducing lift-to-drag ratio and takeoff performance in aircraft that operate in this regime such as agricultural drones, and defense reconnaissance vehicles. This study examines how roughness size and patterning affect boundary-layer transition and aerodynamic efficiency at Reynolds numbers between 60,000 and 200,000. Earlier studies have described laminar separation bubbles and losses from uniform tripping, but the effects of roughness patterning, particularly spread and spanwise arrangement, remain unclear. To investigate this, the S1223 airfoil was analyzed in XFOIL under fixed low freestream turbulence, using forced transition points as proxies for leading-edge roughness of similar element density while varying size and spread. Results include baseline and early, mid, and late trip transition cases. Baseline polars show near-linear lift growth followed by a laminar separation bubble stall around 4–5 degrees at $Re = 60,000$, with stall delayed and lift-to-drag ratio improved at higher Re . Early transition increases drag and advances stall, mid transition lessens these effects, and late transition maintains low-angle lift but increases high-angle drag. Current analysis in XFOIL only approximates roughness through forced transition, but using XFLR5 with a 3D S1223 wing would allow direct study of roughness size and pattern, providing another way to assess laminar separation and improve understanding of how surface patterning influences aerodynamic efficiency.

Keywords:

Laminar Turbulent Transition; Lift/Drag Ratio; Pressure Gradient; Forced Transition; Laminar Separation Bubble

Mentor(s):

Sean Brophy (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1311

Presentation Time: Session 2: 10:30-11:30am

**Evaluating Sodium-Ion Pouch Cells for Renewable Energy
Storage in Extreme Cold Environments**
STEM

Authors(s):

Mehul Shelke† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Sodium-Ion Batteries; Renewable Energy; Cryogenics

Mentor(s):

Vilas G Pol (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1312

Presentation Time: Session 2: 10:30-11:30am

The Long-Term Climate Case for Cultivated Meat

Humanities

Authors(s):

Sofiia Shyshkovtsova† (Engineering)

Abstract:

As global demand for meat increases, conventional livestock farming poses increasing threats to climate stability and biodiversity. Cultivated meat, grown from animal cells in controlled environments, has emerged as a potential solution for environmentally friendly meat production. However, its true environmental footprint and economic feasibility still remain uncertain. This exploratory research argues that despite current inefficiencies, governments and investors should prioritize funding cultivated meat development due to its long-term potential to reduce greenhouse gas emissions. Through analysis of studies from UC Davis, Oxford, and industry reports by the Good Food Institute and McKinsey & Company, I examine the technical, economic, and ethical dimensions of the new technology. The findings suggest that environmental benefits depend heavily on energy sources and process optimization— factors that can be improved with continued investment. Strategic funding can help minimize these, rendering cultivated meat a sustainable long-term solution

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1313

Presentation Time: Session 2: 10:30-11:30am

VIP Operations Research - Price Forecasting for EV Charging STEM

Authors(s):

Shaantanu Sriram† (Engineering); Sebin Ahn† (Science); Aayushi Sahgal† (Science); Sebastian Bohrt† (Engineering)

Abstract:

The rapid proliferation of Electric Vehicles (EVs) has made efficient charging infrastructure operation essential for grid stability and station profitability. EV charging costs depend on volatile energy prices, while concentrated demand amplifies peak load risks. A primary objective of the ORSOL forecasting project is the proactive identification of cost and risk peaks. This research aims to forecast electricity prices and loads with high accuracy, enabling adaptive retail pricing policies that shift charging demand away from expensive, congested periods to maintain service quality and optimize revenue.

We developed a data pipeline integrating 3.75 years of CAISO hourly data (26,547 records) across 27 features, including fuel mix, load, and price. Our hybrid LSTM, RNN, and Temporal Fusion Transformer models capture temporal dependencies and multivariate energy dynamics. Variance Inflation Factor and correlation based feature selection mitigate multicollinearity while preserving interpretability. Domain-informed engineering aggregates renewable sources and removes redundant fields. Models trained with cross-validation and lag-feature preprocessing enhance accuracy in real-time electricity price forecasting.

Preliminary modeling of the integrated CAISO dataset shows promising forecasting potential. Incorporating renewable generation and grid load data enhances reliability during peak demand, allowing for richer model performance. Future validation with live CAISO data will extend the framework to multi node pricing across California's grid. These advances support sustainable, data driven energy forecasting and provide actionable insights for demand management, infrastructure planning, and market responsive EV charging strategies.

Keywords:

Electric Vehicle Charging; Electricity Price Forecasting; Time-Series Modeling (LSTM, Transformer); Renewable Energy Integration; Grid Stability Optimization

Mentor(s):

Sivaranjani Seetharaman (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1314

Presentation Time: Session 2: 10:30-11:30am

Reproducibility of Some Adhesion Strength Data for a Zein Tannic Acid Glue STEM

Authors(s):

Pim Rae Tee† (Science); Ryan Iden Deldart‡ (HHS)

Abstract:

Determining the adhesion strength of a glue in a reproducible manner is important when comparing the performance of new adhesives to already existing ones, such as Super Glue. We are interested in evaluating a relatively new adhesive made from zein corn protein and tannic acid. Adhesion strength was obtained from lap-shear experiments where a glued substrate pair was pulled apart at a constant rate of extension. During the experiment, the glue broke apart, and the glued bond failed. The maximum force at bond failure was recorded. This maximum force divided by the glued surface area was used to calculate the adhesion strength. The objective of our project was to determine the reproducibility of lap-shear experiments using the same adhesive and the same type of substrates under ideally the same or similar conditions. Because the adhesive preparation, the sample application to the substrates, the exact curing times, and the lap-shear testing procedures required many steps, we expected that several parameters may influence reproducibility. Here, we repeated the lap-shear experiment under similar conditions. And, for each round, we calculated the average mean values and standard deviations for at least 5 samples. The results were compared, and the data were evaluated regarding possible parameters that affect reproducibility.

Keywords:

[no keywords provided]

Mentor(s):

Gudrun Schmidt (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1315

Presentation Time: Session 2: 10:30-11:30am

Designing an Ultra-Low-Latency FPGA Accelerator for High-Frequency Trading STEM

Authors(s):

Parin Paresh Timbadi† (Engineering|JMHC); Qinjia Xu‡ (Engineering)

Abstract:

In this project, the goal was to learn about how ultra-low-latency accelerators are designed, and specifically work on the implementation of one as part of the FPGA Applications team in the System-on-Chip Extension Technologies (SoCET) research group. Key applications of ultra-low-latency accelerators include mission critical systems that require real time responses, high frequency trading in the realm of quantitative finance, and AI/ML systems that require real-time inference (e.g. autonomous vehicles). In this project, implementation towards an accelerator designed for high frequency trading (HFT) was used to explore digital design in the context of ultra-low-latency. The modules being designed in this project implemented financial networking protocols in hardware; specifically, the MoldUDP64 and TotalviewITCH 5.0 NASDAQ protocols are being implemented. The project timeline was linear across each module; first, diagrams were created, next, the design was implemented, and lastly, testbenches were written to ensure the module works as intended. This process was iterated as necessary until the intended function was achieved. The MoldUDP64 module was designed first, while the TotalviewITCH 5.0 module was designed second. Future work could include implementing more modules within the accelerator to help the project reach full end-to-end behavior, and simulate real-time trades using our hardware.

Keywords:

[no keywords provided]

Mentor(s):

Rishikesh Reddy Bathina (Engineering); Tri Than (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1316

Presentation Time: Session 2: 10:30-11:30am

**Investigating Student Awareness and Utilization of Campus
Mental Health Resources at Purdue University**
Humanities

Authors(s):

Helen Claire Torgerson† (Exploratory Studies|Other)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1317

Presentation Time: Session 2: 10:30-11:30am

Signals of Stardom: Explainable Prediction of NBA All-Star Selections

Business Case Study

Authors(s):

Tyson Mark Tucci† (DSB); Syuan-Rang Sean Wu† (DSB); Po-Wei Lee† (DSB); Francesco Joseph Facente† (DSB)

Abstract:

Can on-court performance reliably predict which NBA players will receive the prestigious All-Star honor? This project seeks to answer that question by developing a predictive model using player statistics and team context. The goal is to address the significant real-world impact of an All-Star selection on a player's valuation and career, providing a data-driven tool for team executives, player agents, and media analysts.

To build our model, we constructed a comprehensive dataset that combines historical player statistics with official All-Star rosters. Our data preparation involved cleaning the data, handling missing values, and engineering new features, most notably a variable for team win percentage to help measure the influence of team success on individual accolades.

An initial look at the data reveals a clear statistical gap between All-Stars and their peers. Unsurprisingly, players selected for the All-Star game consistently score more points, grab more rebounds, and dish out more assists. The distributions of these key stats are distinctly different, suggesting that on-court performance provides a strong and reliable foundation for a predictive model.

To validate these findings, we will develop our model using a staged approach. We will first build a simple, interpretable model to create a performance baseline. We will then employ more complex methods, such as Random Forests, to capture the subtle and non-linear patterns in the data. The final model will be chosen based on its predictive accuracy on unseen data, which will be rigorously measured using K-fold cross-validation to ensure robust results.

Ultimately, this project translates complex player statistics into a single, actionable "All-Star Probability Score." This data-driven insight can empower team executives to make more informed roster decisions, equip player agents with quantitative leverage during contract

negotiations, and provide fans with a new, objective lens through which to analyze and debate player performance.

Keywords:

Predictive Analytics; Sports Analytics; NBA; Machine Learning; Player Valuation

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1318

Presentation Time: Session 2: 10:30-11:30am

**ound Sensor Networks and Sub/Urban Health: A
Transdisciplinary Approach Using the Purdue Campuses as a
Living Lab
STEM**

Authors(s):

Irem Ucar† (Engineering); Santosh Ramesh† (Science); Ryce Pi† (Science); Zhengyi Jiang† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Soundscape Analysis; Aircraft Noise; Sensor Networks; Environmental Sustainability; Community Health

Mentor(s):

Tae Hong Park (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1319

Presentation Time: Session 2: 10:30-11:30am

Examining how shifting beliefs and economic factors are reshaping family expectations

Humanities

Authors(s):

Mara Valentina Ugaz Angeles† (HHS)

Abstract:

Over the past decades, family structures and social expectations surrounding parenthood have changed dramatically. In the past, larger families were common because having more children often meant more income, as children contributed to labor and household work. Having children is no longer seen as the ultimate goal of adulthood or marriage. These changing beliefs are reshaping society both socially and economically, affecting future generations as younger populations shrink.

This presentation uses an exploratory literature review to help illustrate how family expectations have shifted. These include articles discussing modern cultural attitude shifts (Nadal, 2024, Brown, 2023) and scholarly research examining moral perceptions and gender differences in voluntary childlessness (Ashburn-Nardo, 2017, Watling Neal & Neal, 2023, Szalma et al., 2025). Research indicates that declining birth rates are not only driven by financial pressures but also by changing values. Women's independence, access to education, and body autonomy have allowed greater freedom to choose whether to have children. Studies indicate that while the stigma surrounding child-free adults still exists, it is decreasing as societies become more accepting of diverse lifestyles and gender equality grows.

Future research could explore how these evolving attitudes toward parenthood vary across different cultures, age groups, and socioeconomic backgrounds. Investigating how media representations, workplace policies, and government incentives influence reproductive choices could also deepen our understanding. By studying these changes further, we can better understand how values, gender roles, and cultural norms continue to redefine what it means to live a "fulfilled" adult life in modern society.

Keywords:

Family; Childless; Society; Values

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1320

Presentation Time: Session 2: 10:30-11:30am

Breadboard-based 8-Bit CLA STEM

Authors(s):

Aditya Verma† (Engineering); Karan Soni† (Engineering); Vishnu Madhav Ratakonda† (Engineering); Philip Louis-Karl Zautke† (Engineering)

Abstract:

The proposed project is to design and construct an 8-bit Carry-Lookahead Adder (CLA) using basic logic gates (AND, OR, XOR, and additional gates as needed). The adder will take two 8-bit binary inputs and output an 8-bit sum along with a carry-out bit, using CLA architecture to reduce propagation delay compared to a simple ripple-carry design. The project will include schematic design, circuit simulation, breadboard implementation, and performance testing.

Tasks to be completed are as follows: the first stage is to handle schematic design, CLA logic optimization, and simulation; another is to assemble and test the circuit on a breadboard; next is to manage integration, debugging, and performance analysis; last is the documentation, presentation, and video demonstration. The planned timeline spans six weeks: week 1 for design, CLA block development, and simulation; weeks 2-3 for prototyping on breadboard and initial testing; weeks 4-5 for debugging; and week 6 for final presentation preparation.

Keywords:

Breadboard; Circuit Design; Logic Gates; Digital Design; Adder

Mentor(s):

Johnathan Hong (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1321

Presentation Time: Session 2: 10:30-11:30am

**Grounds for Doubt: Why Coffee Should Not Be Marketed as a
Preventative for Parkinson**
Humanities

Authors(s):

Hannah Celine Wade† (HHS|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Coffee; Parkinson; Prevention

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1322

Presentation Time: Session 2: 10:30-11:30am

Spectroscopic Investigation of Er³⁺ doped Materials for Visible Laser Sources and Defense Applications STEM

Authors(s):

Gabrielle Wahjosoedibjo† (United States Military Academy West Point)

Abstract:

Rare-earth (RE³⁺) doped materials remain central to the design of compact, efficient solid-state lasers, with heightened relevance for applications ranging from optical communications to military countermeasure systems. Among candidate hosts, low-maximum-phonon (LMP) hosts offer reduced multiphonon relaxation and thus enhanced radiative efficiencies. This work presents a comprehensive spectroscopic investigation of Er³⁺ doped BaF₂ crystals, focusing on visible-region emission properties for novel applications. Under optical excitation at 405 nm, strong green (~520, 555 nm) and red (~650-690 nm) emissions were observed, with increasing intensity at higher Er³⁺ concentrations (1-10 mol%). Temperature-dependent lifetime measurements revealed pronounced thermal quenching of the green emission, while the red emission remained relatively stable, suggesting varying nonradiative decay pathways associated with these transitions. Spectroscopic analyses, including temperature- and concentration-dependent decay dynamics, Judd-Ofelt modeling, and transition cross-sections were performed to evaluate radiative efficiencies and laser gain of Er³⁺ in barium fluoride crystals. These results indicate substantial laser potential of LMP hosts for visible laser applications.

Keywords:

Rare-Earth Doped Materials; Er³⁺:BaF₂ Crystals; Visible Emission; Judd-Ofelt Analysis; Solid-State Lasers

Mentor(s):

Andrew Banko (United States Military Academy West Point)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1323

Presentation Time: Session 2: 10:30-11:30am

Purdue Theater Marketing Analysis

Business Case Study

Authors(s):

Brayden Eric Walters† (Engineering|JMHC); Anh Thi Van Nguyen† (DSB); Isaac Thomas Dietz† (DSB); Anoushka Bade† (DSB); Francisco Eduardo Menendez-quintanilla‡ (DSB); Hyoungjin Kwon‡ (DSB)

Abstract:

In most markets, the marketing of a product or service is just as important as the offering itself. This is especially true in the theater industry, where shifting consumer preferences have made it increasingly challenging to attract live audiences. Purdue's Theater Department is currently facing this issue, particularly with students. Although students represent the largest population group in the Purdue area and a key potential audience, very few currently attend performances.

This project seeks to understand the factors influencing student attendance and develop strategies to increase engagement with Purdue Theater productions. A market analysis will be conducted on the Purdue student population to identify their preferences, motivations, and barriers to attendance. Key factors such as ticket cost, the purchasing process, and the perceived value of theater offerings will be evaluated to better understand the decision-making process.

Based on these insights, a comprehensive marketing plan will be developed for the Purdue Theater Department. This plan will focus on increasing visibility and attendance through a combination of digital and physical marketing strategies, including targeted messaging, social media campaigns, and on-campus outreach. Ultimately, this project aims to help Purdue Theater better connect with the student community, fostering a renewed interest in live performance and ensuring the long-term sustainability of the arts on campus.

Keywords:

Marketing; Students; Theater; Purdue

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1324

Presentation Time: Session 2: 10:30-11:30am

Workforce Retention: Leveraging Synthetic Data to Predict Employee Attrition Business Case Study

Authors(s):

Bocheng Wang† (DSB); Eli Nash Chandler‡ (DSB); Ru Yi Cai† (DSB);
Yihao Zhou† (DSB)

Abstract:

Employee attrition poses a significant challenge for organizations, often resulting in substantial financial loss, reduced morale, and disrupted team stability. Based upon this problem, our mission is, “given an employee’s work history, what are the factors that lead to their attrition?” The goal is to help organizations proactively identify at-risk employees and design targeted retention strategies grounded in analytical evidence.

This project aims to predict employee attrition, whether an employee will leave or remain, using demographic, job-related, and performance variables from IBM's fictional HR Analytics dataset. Our methodology integrates a comprehensive data preparation process to enhance efficiency and interpretability. The initial Random Forest and Gradient Boosting models showed promise in distinguishing between positive and negative cases and in identifying which factors had the most significant impact on whether an employee left. Preliminary results highlight that Monthly Income, Age, OverTime status, and Total Working Years are the most influential predictors of attrition.

The project will use multiple supervised learning models, beginning with a baseline model and gradually becoming more complex to achieve higher accuracy. We will use multiple evaluation metrics for each of our model iterations. Through calculating these metrics, we hope to balance identifying positive cases and avoiding false positives.

This project contributes to predictive HR analytics by providing a cost-sensitive framework for workforce management. By translating machine learning insights into actionable HR strategies, the analysis empowers organizations to make data-informed decisions that reduce turnover and strengthen long-term organizational performance. This is expected to lead to reduced financial losses, improved morale, and greater stability among team members during the hiring and retention of top talent.

Keywords:

Employee Attrition; Predictive Analytics; Machine Learning; HR Retention Strategies; Data-Driven Decision Making

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1325

Presentation Time: Session 2: 10:30-11:30am

The Caregiving Gap in Asian Aging Population

Social Science

Authors(s):

Yimeng Wang† (Science)

Abstract:

As many Asian countries experience longer life expectancies and declining birth rates, families face a growing caregiving gap in which older adults live longer but have fewer family members to provide support. At the same time, professional long-term care services are becoming increasingly expensive, posing economic and social challenges for both households and governments. This research examines how demographic and financial factors interact to shape the future size of the caregiving gap and explores how insurance and financial instruments can help manage the risks of aging. Using demographic and macroeconomic data, I construct models that project population aging, family structure changes, and care demand through 2040 under various “what-if” scenarios. These simulations estimate the number of older adults who may lack family-based care and the cost of filling that gap through paid services. I then analyze how long-term care insurance, hybrid annuity products, and public–private funding mechanisms could mitigate the financial strain. The goal of this research is to identify sustainable and equitable financial strategies that protect aging individuals and promote more resilient care systems across Asia.

Keywords:

Aging Population; Caregiving Gap; Long-Term Care; Insurance; Demographic Modeling

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1326

Presentation Time: Session 2: 10:30-11:30am

Developing a High-Quality Project Guide for ECE270 students STEM

Authors(s):

Yize Wang† (Engineering)

Abstract:

Traditional digital system design courses (ECE270) often encounter challenges such as complex teaching platforms and difficulty in verifying timing accuracy when introducing modern hardware description languages (HDL) and reconfigurable computing technologies to students. This project focuses on developing a high-quality set of final project guidance documents to optimize students' learning experience and outcomes. The document we designed centers around a core case: a traffic light controller based on the Pico-ice platform. This project requires students to implement a high-precision finite state machine (FSM) using SystemVerilog.

The guidance document is optimized through several key improvements. First, it includes accurate design requirements that clearly state the project's necessities and provide hints to help students grasp the practical application of SystemVerilog. Second, it emphasizes open-source tool integration by promoting the use of the ECElab.io website to aid students in learning FPGA. Finally, the practical application of FPGA is highlighted by successfully demonstrating the project using the Pico-ice board, thereby enabling students to truly understand how to utilize FPGA

This document not only provides students with a well-structured and clearly-defined design challenge, but also enables them to learn how to use the open-source tool ECElab.io and to truly experience the role of FPGA in the real world, thereby stimulating their interest in learning. Our work provides an expandable project document template for the digital systems design course, supporting students in carrying out their own digital systems design projects.

Keywords:

Student Learning; Digital System Design; FPGA

Mentor(s):

Junfei Li (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1327

Presentation Time: Session 2: 10:30-11:30am

Forecasting U.S. Flight Delays with Pre-Flight Predictors

Business Case Study

Authors(s):

Paul Ryan Warfelt† (DSB); Theodore Walter Moritz† (DSB); Maxwell Christopher Klug† (DSB); Reece Robb† (DSB)

Abstract:

Why do some flights arrive on time while others experience frequent delays, and can we use machine learning to help understand why? This project seeks to identify trends affecting flight delays.

Our analysis is based on two supporting datasets. One includes flight-level data such as airline, departure city, and delay times. The other provides quarterly data from 2021–2022 for passenger volume, average fares, revenue yield, and average trip miles. We want to enrich the dataset by adding weather information for regions around major airports, so we can distinguish between delays caused by weather and operational factors.

We began with simple linear regression to get a baseline model. We then moved on to Lasso and Ridge CV after noticing there was a lack of a linear relationship. Next, we utilized an Unpruned Decision Tree, then a Pruned Decision Tree, and eventually moved on to Random Forests. Finally, we used hyperparameter tuning to improve prediction accuracy and control data fitting. Metrics such as R-squared and RMSE were used to evaluate our models' performance via cross-validation.

Our findings will mainly benefit consumers when making decisions regarding airline travel. The average consumer will be able to see which airlines tend to experience delays and book their flights to avoid them. Additionally, there could be meaningful implications for policymakers regarding airline regulations and expectations when delays become consistent within a single airline.

Keywords:

Delay; Airline; Flight; Departure; Weather

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1328

Presentation Time: Session 2: 10:30-11:30am

From Mines to Models: A MBSE Approach for a Future Area Denial System STEM

Authors(s):

Kathryn Wegler† (United States Military Academy West Point)

Abstract:

Conventional minefields, while effective, present challenges including high cost, risk of unintended collateral damage, and lack of flexibility in deployment. Emerging technologies enable a shift toward more adaptive, precise, and scalable solutions that allow area denial capabilities to be deployed at lower echelons. This study applies a model-based systems engineering approach to capture requirements, define system architecture, and evaluate design trades for this future system. A comprehensive stakeholder analysis was conducted to incorporate perspectives from operational commanders, policymakers, and humanitarian organizations, ensuring the system meets mission effectiveness goals while adhering to ethical and legal constraints. An analysis of alternatives examined a range of technologies, including autonomous sensor networks, non-lethal interdiction systems, and precision effectors, against criteria such as cost, scalability, effectiveness, disposability, and reusability. The integrated MBSE framework provided traceability from mission-level needs to system requirements, enabling structured comparison of concepts and identification of the most promising solution space. The results highlight a conceptual design for a future area denial system that involves a network of remote sensors that detect entry into the restricted area. The system then initiates a drone to identify, localize, and potentially target agents that enter the restricted area. The analysis found that this system provides significant benefits over conventional mine-based area-denial systems.

Keywords:

Model Based Systems Engineering (MBSE); Adaptive Area Denial; Sensor-to-Drone Network

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: 1329

Presentation Time: Session 2: 10:30-11:30am

Minimizing Mismatch Losses in BIPV Systems Under Predicted Shading Conditions Using LTspice Simulations STEM

Authors(s):

Jasper Louis We† (Engineering)

Abstract:

Building-integrated photovoltaic (BIPV) systems often experience partial shading, which leads to mismatch losses: situations where shaded solar cells not only generate less power but can also act as loads, reducing overall system efficiency. While ideal photovoltaic (PV) arrays produce total power equal to the sum of individual cell outputs, real-world BIPV installations face performance degradation due to such shading effects. Previous studies have sought to mitigate mismatch losses under random shading by mathematically optimizing cell interconnections, using approaches such as Sudoku or magic-square array configurations. However, these methods are often complex and costly to implement. In most BIPV applications, shading patterns can be predicted based on building geometry and solar position data, enabling more targeted optimization. This project uses the LT Spice circuit simulation tool to analyze PV array performance under predicted shading conditions. By comparing different wiring configurations and proposing design improvements, the goal is to develop a shading-resilient and cost-effective array layout suitable for real-world deployment.

Keywords:

Photovoltaics; BIPV; Mismatch Losses; Partial Shading

Mentor(s):

Peter Bermel (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1330

Presentation Time: Session 2: 10:30-11:30am

Gelding behavior response to estrual mare urine.

STEM

Authors(s):

Reilly Cole Wennemart† (Agriculture|JMHC); Kaylie Danielle Spata† (Agriculture); Kolton N Logsdon† (Agriculture); Jenna N Honnert‡ (Agriculture); Elizabeth Ann Habeeb‡ (Agriculture|JMHC)

Abstract:

Due to aggressive and undesirable behaviors, people will geld stallions to decrease the likelihood of these behaviors being expressed. Despite this, it is not uncommon to see geldings respond with reproductive behaviors towards estrual mares. It is important to understand the potential behaviors a gelding will display when exposed to an estrual mare to ensure equine and handler safety, especially in mixed-gender equine housing. Our experiment involved comparing behavior levels based on number of urine exposures and the time of day the urine is exposed. We hypothesize that more exposures to estrual mare urine will elicit a stronger behavioral response in the geldings compared to the time of day the urine is introduced. Our study was conducted over two consecutive days, with urine exposures administered during both morning and afternoon sessions each day. We utilized a cross-over design by exposing two geldings in the AM on Day 1 and three geldings in the PM on Day 1; the following day, we did the three geldings in the AM and the two geldings in the PM. Each gelding was individually exposed to water first. After 10 minutes of washout, they were individually exposed to the urine two times for 30 seconds, with a washout period of 10 minutes between each exposure. We measured the strength of the behaviors based on the frequency and duration of the flehmen response, increase in locomotion, penile drop, increase in vocalization, sniffing and trying to lick or nuzzle [the urine], and erection.

Keywords:

Gelding; Estrus; Behavior; Mare

Mentor(s):

Casie S Bass (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1331

Presentation Time: Session 2: 10:30-11:30am

Case Study: Colorchase

Business Case Study

Authors(s):

Allie Faye Xiao† (DSB); June E Spalding† (Exploratory Studies|Other); Alexander Ritz Clark† (DSB); Ethan Wayne Scott† (DSB); Connor William Roach‡ (DSB); Nicholas Page Huesing‡ (DSB)

Abstract:

The purpose of this case study is to identify and address the strategic marketing challenges faced by Colorchase, a startup that provides a web application enabling dementia caregivers to connect with their loved ones through art. The project aims to develop a clear, actionable plan to increase brand awareness and support the growth of the Colorchase brand. This will involve conducting market research, analyzing the competitive landscape, and identifying effective positioning strategies within this specialized market.

Because Colorchase operates at the intersection of healthcare, technology, and the nonprofit sector, a key challenge lies in communicating the proven benefits of art therapy to both caregivers and partner organizations. Ultimately, this case will explore how Colorchase can position itself effectively to build awareness, credibility, and long-term sustainability in a niche and mission-driven space.

Keywords:

Marketing; Strategy; Small Business

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1332

Presentation Time: Session 2: 10:30-11:30am

Reconfiguration of the Microtubule Network and Dynamics in Hypoxic Cancer Cells STEM

Authors(s):

Ambhranee Yakkundi† (Science)

Abstract:

Cancer cells are able to adapt to hypoxic environments caused by damaged vasculature. These environments promote treatment resistance and metastatic potential through shifts in cell signaling and metabolism. Although microtubules are key regulators of signaling and migration, the reorganization of the microtubule network under hypoxia is not well understood. Here, we investigated microtubule dynamics in hypoxia and how they correlate with mitochondrial function and cancer cell migration. We discovered that while hypoxic conditions did not directly have an effect on the rate of microtubule polymerization, they did drive the formation of microtubule-rich protrusions. Glycolytic activity and nutrient availability affected the emergence of the protrusions.

Interestingly, mitochondria were transported and organized into the protrusions, where nucleoside-diphosphate kinase was also enriched. Real-time precision opto-control (RPOC) impaired local microtubule polymerization by targeting mitochondrial activity disruptions, highlighting the importance of site-specific mitochondrial function in sustaining protrusion-associated dynamics. Additionally, the presence of microtubule-rich protrusions correlated with enhanced migratory capacity. In summary, our findings demonstrate that hypoxia promotes the reorganization of microtubules and mitochondria, that localized mitochondrial activity sustains microtubule dynamics, and that these adaptations are key to the migration of hypoxic cancer cells.

Keywords:

Hypoxia; Cell Migration; Cancer; Microtubule

Mentor(s):

Chi Zhang (Science)

Other Acknowledgement(s):

Gil A Gonzalez (Science); Laura Lynn Lukov (Science); Shivam Mahapatra (Science); Seohee Ma (Science)

Poster Presentation Abstract Number: 1333

Presentation Time: Session 2: 10:30-11:30am

Benchwarmer to Breakout: Predicting the Next NBA Breakout Star Player

Business Case Study

Authors(s):

Eric Yixiang Zhang† (DSB); Paola Godina Salas† (DSB); Harshini Madhusudhanan† (DSB); Jadon Conor Salazar† (DSB)

Abstract:

How can data help decision makers distinguish future breakout stars from the rest of the players in the league? This project predicts which young NBA players —particularly rookies and sophomores —are most likely to have a breakout season in their third or fourth year. Early identification of these players can give teams and analysts a competitive edge in contract negotiations, player development, and roster management.

Our dataset includes over 32,000 player-season entries from 1947 to 2025, combining both basic and advanced metrics, including Player Efficiency Rating, Win Shares, Box Plus/Minus, and Value Over Replacement Player. After data cleaning, addressing missing values, and excluding players with minimal minutes, we develop new features that track efficiency improvements and changes in player roles over time. An initial analysis of 2020 rookies with high PER shows that breakout trajectories vary, though rising offensive usage often aligns with increased player value and development.

We employ logistic regression as a baseline model, followed by Random Forest and XGBoost to capture nonlinear trends in player progression. Model performance will be evaluated using k-fold cross-validation to estimate test error, offering a reliable proxy for how well our models will generalize to new player data. By detecting early signs of breakout potential, this project bridges traditional basketball knowledge with data science, helping NBA teams make more informed decisions on player development, contract strategy, and roster construction.

Keywords:

Predictive-Analytics; NBA Player Development; Forecasting; Breakout Season Prediction; Performance

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1334

Presentation Time: Session 2: 10:30-11:30am

Sound Quality Improvement in Robotic Cello Playing STEM

Authors(s):

Boyang Zhang† (Science); Jiashu Liu‡ (Engineering)

Abstract:

The overall aim of our project is to develop a robotic musician capable of passing the “Musician Turing Test.” In other words, we seek to create a robot cellist that can produce musical sounds which are indistinguishable from those of a human performer. Through this development, we expect to build a robotic arm which is capable of playing basic cello pieces at a level that is comparable to that of a human musician. Currently, the robotic arm is based on pre-computed position data to do the cello bowing movement. However, this method is limited because the robotic arm will only perform well when the cello is placed in a fixed and correct position. As a result, even small changes in the cello’s placement or the environment can significantly affect sound quality and performance consistency. To address this issue, we made a sensor that can detect the power and speed of the bow so that the robotic arm can adjust its movements based on the sensor data to improve the performance of the cello (Demoucron, Askenfelt and Caussé, 2009). Therefore, in order to make the UR5e robotic arm to auto-improve the sound quality, we designed an algorithm that will take bow speed, pressure, and position as input and output the score of sound quality. This algorithm is based on digital waveguide synthesis (Evangelista & Eckerholm, 2010), which is a model that simulates the bow-string fraction and sound wave, and it directly uses the bow pressure, speed, and position as parameters. This scoring function enables the UR5e robotic arm to automatically evaluate and optimize the sound quality in real time.

Keywords:

[no keywords provided]

Mentor(s):

Yung-Hsiang Lu (Engineering); Yeon Ji Yun (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1335

Presentation Time: Session 2: 10:30-11:30am

**Balancing Profit and Risk: Reinforcement Learning
Approaches to Market Making
STEM**

Authors(s):

Sarrah Johar Zojwalla† (Science|Graduate)

Abstract:

Market makers provide liquidity by continuously quoting buy and sell prices, yet they face two practical risks: inventory buildup and large losses during sudden price moves. My research analyzes finance models and reinforcement learning approaches that address this profit-risk tradeoff. I will be researching inventory-aware quoting, reward design for reinforcement learning, and risk-sensitive methods such as CVaR criteria and constrained optimization. My findings are organized into three themes: classical models that formalize inventory control, reinforcement learning designs that influence stability through reward choice, and methods that encode risk through explicit constraints or coherent risk measures. The objective is to provide an accessible map of concepts, terminology, and common evaluation practices for readers and to identify open questions and inconsistencies that motivate future study.

Keywords:

Reinforcement Learning; Inventory Risk; Constraints; CVaR; Market Making

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1400

Presentation Time: Session 3: 12:00-1:00pm

Project oCEANIC - Agent-Based Model Validation STEM

Authors(s):

Naeem Saeed Bahemia† (Science|JMHC)

Abstract:

The purpose of this study is to validate the agent-based model developed by the Project oCEANIC team. Validation was conducted by comparing it with qtVLM, an existing navigation model that employs a distinct simulation methodology. This comparison aimed to evaluate how closely Project oCEANIC's model design corresponds with its implementation and to assess its overall validity. Project oCEANIC's model specifically simulates voyages within the Yap State in western Micronesia, also known as the Caroline Islands. These simulated voyages were compared to those generated by qtVLM under differing environmental parameters. The comparison focused on key voyage metrics such as travel duration and deviation from optimal paths. By analyzing these outputs, the study sought to identify consistencies and potential discrepancies in the models' representations of oceanic navigation behavior. To compare these voyages, a Python-based analysis was performed to quantify the differences between the two simulated voyages, enabling an objective evaluation of the agent-based model's accuracy and reliability. The findings contribute to understanding the validity of Project oCEANIC's simulation framework and its ability to represent realistic voyaging strategies under dynamic oceanic conditions. Ultimately, this validation serves as an essential step in ensuring that the model can be confidently used in future research exploring ancient navigation, environmental adaptation, and human-environment interactions across the Pacific.

Keywords:

Model Validation; Agent-Based Models; Micronesia; Traditional Seafaring; Navigation Simulation

Mentor(s):

Katherine Jarriel (JMHC)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1401

Presentation Time: Session 3: 12:00-1:00pm

Key Factors Affecting Restaurants' Visits in the Urban Environment

Business Case Study

Authors(s):

Zixuan Bao† (Agriculture); Chenke Sun‡ (Agriculture)

Abstract:

This study examines factors influencing consumer visits to different types of restaurants, focusing on urban settings characterized by diverse and dynamic dining patterns. We use Indianapolis, Indiana, as a case study. Firstly, we use recent consumer foot traffic data to identify the top ten full- and limited-service restaurants with the highest number of visits. Secondly, we collect additional information on these establishments, including geographic locations, operation hours, menu diversity, and customer satisfaction, from publicly available sources such as Google Maps. Thirdly, we employ a linear regression model to assess the factors that significantly influence restaurant visit patterns. Based on our findings, we create a map that indicates restaurant locations along with data on public transportation availability, their surrounding landmarks, and customer access to nearby parking lots, to identify the relationship between spatial factors and restaurant visits. Our research outcomes provide insights not only to established restaurant owners but also to operators seeking to open new restaurant locations. In addition, given the diverse dining landscape in Indianapolis, understanding the dynamics in the food-away-from-home (FAFH) sector can offer practical guidance to urban planners who aim to build a profitable and sustainable dining environment. Our findings can be translated into urban planning and zoning policies that promote equitable food access.

Keywords:

Food-Away-From-Home; Foot Traffic; Food Access

Mentor(s):

Yingxin Tan (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1402

Presentation Time: Session 3: 12:00-1:00pm

VIP - AI4DR: AI Use in Disaster Response Image Classification STEM

Authors(s):

Joshua John Beigel† (DSB); Julia Kang‡ (Science); Logan Michael Fossum† (Engineering)

Abstract:

Rapid and reliable assessment is critical for effective emergency response and resource allocation in the circumstances of a large-scale disaster, yet traditional methods often lag behind in comparison to real-world events. This project develops automated methods to analyze disaster-related social media posts, leveraging the rapid, ground-level information that such platforms provide during crises. Using the CrisisMMD: Multimodal Crisis Dataset, a Twitter dataset consisting of several thousands of manually annotated tweets and images, we aim to classify disaster images based on the level of damage depicted. We convert raw social media images into fixed-length feature vectors through a reproducible preprocessing pipeline and produce compressed feature datasets to train image classification models. Using these features, we trained classic decision tree and random forest classifiers, assessing their performance with accompanying classification metrics and confusion matrices.

Our immediate goal is to reliably classify damage severity (little/no damage, mild, severe) from social media imagery. In the long term, our work would extend to multimodal classification with accompanying text and employing deep-learning models to improve generalization and robustness. Ultimately, this research aims to aid in reducing the lack of information on large and medium-scale natural disasters and provide specific actionable information from social media input and satellite imagery. This technology can provide an extensive understanding of the complications associated with disasters in minutes, complementing existing first responder deployment, and be a quick and efficient resource to tackle natural disaster complications before circumstances rapidly spiral out of control, possibly saving lives and reducing significant damage.

Keywords:

AI; ML; Image Processing; Disaster Response; Decision Tree

Mentor(s):

Soudabeh Taghian Dinani (Engineering); Siddeshwar Raghavan
(Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1403

Presentation Time: Session 3: 12:00-1:00pm

Facilitating space exploration through the creation of a humanoid robot able to perform complex tasks under the harsh conditions of space and other planets.

STEM

Authors(s):

Pranjal Bhatia† (Engineering)

Abstract:

This research focuses on creating a humanoid robot capable of completing complex tasks to aid astronauts in space exploration on the moon, specifically targeting the hand and arm mechanisms required for precise movements. The goal is to design an arm that allows for the attachment of various customizable end effectors or hands. Our current process includes a prototype of a complete arm with 6-degree-of-freedom (DOF) from the shoulder to the forearm, along with a 3-DOF wrist that allows the attachment of numerous customizable end effectors. Currently, we are prototyping various types of end effectors for collecting samples, gripping, cutting, drilling, and other applications. The next phase of our project is to create a final aluminum version of the entire arm, wrist, and hand system that is able to be manufactured. Then we would be able to test our design in real-world scenarios that would simulate low and zero gravity environments as well as rough and rocky terrain, and begin to gather data for programming and operational purposes. Our findings aim to contribute to the understanding of how humanoid robots can aid in space exploration on the moon by performing complex tasks and supporting astronauts and the aerospace industry.

Keywords:

[no keywords provided]

Mentor(s):

Jaeeun Kim (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1404

Presentation Time: Session 3: 12:00-1:00pm

X-Ray Fluorescence Imaging of Mouse Brain Metal Distributions for TMEM 163 Knock Out Analysis STEM

Authors(s):

Vladimir D Bondar† (Engineering)

Abstract:

Certain neurodegenerative illnesses, such as Parkinson's disease, have been linked to genetic mutations in the TMEM163 gene. Thus, studying the resulting TMEM 163 protein, whose exact functions is unknown, may provide insight into the comprehensive pathway of these diseases. While TMEM163 has been suggested to act as an ion transport, in regulation of bone metabolism, in modulation of calcium signaling, and as a facilitator of rapid purinergic transmission, it's general behavior can be described as having an affinity towards binding of divalent cations. One such behavior, as a zinc transporter protein, remains controversial. To study the metal transporter characteristics, synchrotron X-Ray Fluorescopy (XRF) was selected since it allows for nondestructive determination of location-based metal concentrations. TMEM163 Knock Out (KO) and Wild Type (WT) mice were scanned on APS beamlines, and resulting data was processed using uProbeX and xrfmaps with fitting and quantification. The resulting images were also used in cluster analysis to demonstrate selection of the various cerebellum regions.

Keywords:

XRF; Biophysics; Cluster Analysis; Brain Imaging

Mentor(s):

Yulia N Pushkar (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1405

Presentation Time: Session 3: 12:00-1:00pm

Design of miniaturized microbial light scattering detection system STEM

Authors(s):

Trisha Boodhoo† (Engineering)

Abstract:

Rapid characterization of bacteria through Elastic Light Scattering (ELS) is ideal for quality-control applications where turnaround time is critical, and the expected bacterial species are known—such as probiotic manufacturing or contamination detection in food production. The objective of this project is to design a benchtop version of an ELS device to improve portability and cost-efficiency, addressing the current benchmark model's high cost (~\$30,000) and lack of field usability. To achieve this, existing mechanisms for achieving linear and rotational motion were investigated, subsystem concepts were developed and down selected, and feasibility analyses were performed. A rotational actuation test setup was also designed to validate motion control performance. Future work includes creating detailed 3D CAD models, conducting FEA and failure analyses of gears, designing electronic schematics and a controller block diagram, developing a bill of materials and sourcing plan, and defining a validation protocol. These steps will advance the redesigned ELS device toward prototype fabrication and experimental testing

Keywords:

Elastic Light Scattering; Rapid Microbial Detection; Quality-Control Applications; Design for Portability and Cost

Mentor(s):

euiwon Bae (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1406

Presentation Time: Session 3: 12:00-1:00pm

U.S. Stock Market Movements through News Headlines: A Natural Language Processing Approach Business Case Study

Authors(s):

Caleb Zachariah Brunton† (DSB); Jose Jorge Bueso† (DSB); Jose Manuel Estrada Garcia† (DSB); Alfonsina Michelle Rodriguez† (DSB)

Abstract:

This project explores how daily news headlines can be used to forecast short-term movements in

the U.S. stock market. Using the Daily News for Stock Market Prediction dataset from Kaggle,

which contains eight years of Reddit WorldNews headlines along with the daily performance of

the Dow Jones Industrial Average, we aim to build a model that predicts whether the market will

rise or fall based on the language and topics found in news coverage.

The data preparation process involves cleaning and organizing the text by removing duplicates,

standardizing capitalization, and combining each day's twenty-five headlines into a single

document. We apply natural language processing techniques such as TF-IDF, Word2Vec, and

BERT embeddings to transform the text into numerical features that capture both word frequency

and meaning. Sentiment scores are also incorporated to reflect the overall tone of the news. We

evaluate several machine learning models, including Logistic Regression, Random Forests,

Support Vector Machines, and Gradient Boosting methods such as XGBoost and LightGBM,

using metrics like AUC, accuracy, and F1-score.

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

Preliminary results suggest that while average sentiment alone is not a reliable predictor, extreme

positive or negative tones often occur before significant market movements. These findings

indicate that investor behavior is influenced by complex interactions between news content and

sentiment. Overall, this project demonstrates how text-based analytics can improve financial

forecasting and provide investors and businesses with deeper insights into how public narratives

shape market dynamics.

Keywords:

Stock Market Prediction; News Headlines; Natural Language Processing (NLP); Sentiment Analysis; Machine Learning

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1407

Presentation Time: Session 3: 12:00-1:00pm

A Reduced-Order Model for Predicting Rotating Detonation Engine Performance STEM

Authors(s):

Benjamin Asa Cabot† (Engineering|JMHC)

Abstract:

A hallmark of rotating detonation engines (RDEs) is the presence of unsteady, multiscale physics. Modeling these physics typically requires computationally intensive two- and three-dimensional computational fluid dynamics (CFD) simulations to model. A framework is described to predict both wave structures and performance within a one-dimensional representation of an RDE combustion chamber. This framework is built on the assumption of ideal gas, constant volume combustion, and accepts as input basic information about the propellants, chamber geometry, and mixing timescale. Fluid and reaction properties are generated for a set of propellants, and applied to the source term for each cell in a one-dimensional, periodic domain. The domain is simulated with respect to time with mass, momentum, and energy exchange allowed between cells. The ability to simulate co- and counter-rotating detonation waves is demonstrated, as is the ability to compute the average performance of the simulated combustor.

Keywords:

[no keywords provided]

Mentor(s):

Alexis Harroun (Juno Propulsion)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1408

Presentation Time: Session 3: 12:00-1:00pm

Closing the Loop: Material Reuse and Deconstruction at Heavilon Hall Social Science

Authors(s):

Odalís Joana Campos Vasquez† (Liberal Arts|JMHC); Elizabeth Louise Kushnert† (Liberal Arts); Julia Elizabeth Kassis† (Agriculture)

Abstract:

Demolition practices around the United States indicate unsustainable systems that raise environmental concerns. The end result of building demolition increases material waste and consequently creates a rippling effect at social and environmental levels. Demolition of Heavilon Hall began in October 2024. Heavy machinery and specialized equipment tore the building down until its complete removal in the spring of 2025. The process requires extensive approvals, but the demolition itself takes just a couple of months. This is deemed efficient, but existing concerns regarding material reuse and disposal call for a deconstructive approach that responds in a closed-loop system. To approach this problem, we analyze literature reviews and collect qualitative data to determine what practices are currently being implemented at Purdue, we create a process map, and we define deconstruction as the target practice that should be adopted as a sustainable solution. This data serves as a starting point to identify gaps in the recyclability of building materials during the demolition process. Future phases of the project may include outreach to key decision-makers at the university to better understand policies that shape demolition and material reuse practices. This project develops a regenerative deconstruction framework to minimize waste and embed sustainability in Purdue's deconstruction systems.

Keywords:

Demolition; Deconstruction; Sustainable; Closed-Loop Systems; Regenerative

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1409

Presentation Time: Session 3: 12:00-1:00pm

**10e7 Increase in Electrochemiluminescence Lifetime in the
Tris(2,2'-bipyridyl)ruthenium(II)/Benzoyl Peroxide System
Through Parasitic Pathway Suppression
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 (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1410

Presentation Time: Session 3: 12:00-1:00pm

Early Detection of Diabetes Risk Among Indian Women Business Case Study

Authors(s):

Susan Chen† (DSB); Allison Margaret Neff† (DSB); Brayden Ryan Zink† (DSB); Srikar Kolla† (DSB|JMHC)

Abstract:

Diabetes is a chronic illness affecting millions worldwide, and early detection is essential to reduce complications and improve outcomes. We seek to answer the question: Can we accurately predict the likelihood of diabetes in Pima Indian women over the age of 21 using clinical and demographic indicators? Our goal is to build an interpretable, data-driven model that supports timely detection and actionable healthcare insights.

The Kaggle dataset includes 768 observations and eight predictors, including glucose, BMI, insulin, blood pressure, and age. During data cleaning, missing or invalid values were replaced with median values to ensure consistency. Additional features were engineered, including binary indicators for high glucose and missing insulin, and relationships among variables were explored using a correlation heatmap.

Exploratory analysis showed that women with diabetes generally exhibit higher glucose levels, with BMI and age also showing strong associations. These findings highlight meaningful interactions between metabolic and demographic factors in predicting diabetes risk.

To validate these insights, we will develop predictive models in stages—starting with logistic regression as a baseline for interpretability, followed by more complex models like decision trees to capture nonlinear patterns. Model performance will be evaluated using K-fold cross-validation, and the final model will be selected based on the highest accuracy and sensitivity.

Ultimately, this project demonstrates how predictive analytics can enhance early detection and guide clinical decision-making, public health policy, and healthcare innovation. By identifying key indicators of diabetes risk, we contribute to the broader goal of improving population health through data-driven insights.

Keywords:

Diabetes; Predictive Analysis; Data Science; Indian Women; Healthcare

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

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1411

Presentation Time: Session 3: 12:00-1:00pm

Streaming object localization data in game simulation for digital twinning STEM

Authors(s):

Pranav V Chitivel† (Science); Ananya Jajoo‡ (Science)

Abstract:

Modern construction sites increasingly rely on intelligent sensing and visualization to enhance safety, productivity, and quality decision-making. Traditional crane operations are complex and often lack support of real-time spatial awareness, leading to inefficiencies and potential hazards. To address this, we develop a modular ROS2-based live sensing framework for digital twin systems, integrating depth sensors such as LiDAR with depth processing pipelines for object localization in a physical construction lab environment. By streaming object localization data into Unity, we visualize motion of large construction machines in real-time, allowing for precise tracking, monitoring, and interaction within a digital 3D environment. This live mapping enables engineers and operators to analyze on-site dynamics, detect anomalies, and improve coordination across teams while serving as a foundation to support the next generation of safer, data-driven decision-making and site automation. Our ultimate goal is to create a scalable system that bridges the gap between physical construction processes and virtual simulations, supporting the next generation of safer, data-driven and intelligent construction technologies.

Keywords:

Digital Twin; Depth Processing; Construction Automation; Object Localization; Robotics

Mentor(s):

Jiansong Zhang (Polytechnic); Fan(Aria) Yang (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1412

Presentation Time: Session 3: 12:00-1:00pm

Predicting Undergraduate Dropout Risk for Early, Actionable Intervention

Business Case Study

Authors(s):

Leonard Shien Chiu† (DSB); Michael Ryan Gjorseski† (DSB); Joshua Ginstet (DSB); Artemii Chirkov† (DSB)

Abstract:

Which undergraduate students are most at risk of dropping out based on their demographic, socioeconomic, and academic profiles? Our project aims to predict the likelihood that an undergraduate student will drop out by integrating demographic, socioeconomic, and academic signals into a supervised learning pipeline. This problem matters because timely, accurate identification of at-risk students enables universities to target advising, financial support, and academic resources where they will have the greatest impact.

Methodologically, we establish a transparent baseline with logistic regression, then compare tree-based models and gradient boosting, alongside SVM and a small neural network, evaluated via stratified train/validation/test splits and k-fold cross-validation. Given class imbalance, we consider class weights and SMOTE; primary metrics are AUC and F1, with precision/recall and confusion matrices providing operational trade-offs. We pair performance with interpretability using feature importance, SHAP values, and partial dependence plots, and we assess fairness by training with/without sensitive variables.

Preliminary EDA (4,424 students; 35 variables) suggests early academic success, tuition status, and units approved are strong correlates of graduation, while age and some demographics correlate negatively; macroeconomic context shows a limited individual-level signal.

Expected contributions include (1) a reproducible, fair, and interpretable pipeline for student-level dropout risk; (2) evidence on which signals are most predictive early enough to matter; and (3) decision support that translates model outputs into targeted, ethical interventions. Broader implications extend to enrollment planning, advising prioritization, and resource allocation strategies that improve student success at scale.

Keywords:

Student Dropout; School; Education; Prevention; College

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1413

Presentation Time: Session 3: 12:00-1:00pm

Investigating the Molecular Mechanism of PBCV-1 Virus-Induced Lipid Production Enhancement for Renewable Energy STEM

Authors(s):

Yoonjung Choi† (Agriculture|Engineering)

Abstract:

Algal lipid production is a promising third-generation biofuel platform offering high photosynthetic efficiency and reduced competition with food crops or arable land. Microalgae primarily synthesize and accumulate lipids as triacylglycerol (TAG) via the Kennedy pathway, which involves key enzymes such as glycerol-3-phosphate dehydrogenase (GPDH), lysophosphatidic acid acyltransferase (LPAT), diacylglycerol acyltransferase (DGAT), and phospholipid-diacylglycerol acyltransferase (PDAT). However, large-scale lipid production and recovery remain major bottlenecks in algal biofuel development. The *Chlorella*-specific lytic virus PBCV-1 has been proposed as a low-energy alternative for lipid recovery through viral-induced cell lysis and has been associated with enhanced lipid yields. Yet, the molecular mechanism driving this enhancement is still unclear. In this study, quantitative polymerase chain reaction (qPCR) was used to measure the changes in expression of key lipid biosynthetic enzymes during PBCV-1 infection to understand the virus's influence on algal lipid metabolism and advance sustainable biotechnological approaches for renewable energy.

Keywords:

Biofuel; PBCV-1; Algae; qPCR; Molecular Mechanism

Mentor(s):

zhi Zhou (Engineering); Amanda Michelle Lopez (Engineering); Paul B Brown (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1414

Presentation Time: Session 3: 12:00-1:00pm

Marketing Research for Terroir Tasting

Business Case Study

Authors(s):

Iszabel Sierra Cohen† (DSB); Shelby Jo Schambach† (DSB); Rachel Hope Campbell† (DSB)

Abstract:

This project investigates the market opportunity and ideal launch strategy for Terroir Tasting, an emerging ecommerce platform that connects consumers with regional wineries through curated tasting kits and educational storytelling. The research aims to identify the most viable geographic markets and target consumer segments for an initial launch. Using secondary data from Mintel and Data Axle, the study analyzes U.S. wine consumption trends, consumer demographics, and psychographics related to experiential and online purchasing behaviors. The team also evaluates regional factors—such as income, lifestyle, and alcohol distribution laws—to recommend a launch market, with St. Louis identified as a feasible test region. The findings will inform a \$5,000 localized marketing plan and guide future expansion into larger metropolitan areas. Ultimately, the research provides insights into how ecommerce can replicate the experiential value of wine tourism and support regional wineries seeking national reach.

Keywords:

[no keywords provided]

Mentor(s):

Erin Alkire Britton (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1415

Presentation Time: Session 3: 12:00-1:00pm

Family Systems and Task Distribution: Exploring Digital Solutions to Enhance Household Collaboration

Creative

Authors(s):

Alexander Jonathan Collins† (DSB); Jason Wu† (DSB); Evan Ryan Ware† (DSB)

Abstract:

The unique ability to balance household responsibilities among family members is a consistent challenge. This challenge affects both general productivity and family dynamics as a whole. This study will explore the possibility of an app with the goal to help families effectively distribute chores and promote family collaboration through gamifying the stereotypically tedious nature of task management. The app will integrate varying components typically found within modern apps. The components we will analyze include cooperative gameplay, behavioral psychology, and systems engineering (targeting the family system) The application's end goal is to target stereotypically routine and monotonous household situations into an engaging user experience.

The research aims to accomplish 3 goals. 1st: Identify key user segments based on family structure/age demographics/lifestyle behaviors. 2nd: Evaluate the user's preferences and perceived effectiveness of gamified task management (contrasting against conventional to-do list apps and paper lists). 3rd: Look into the feasibility of implementing a cooperative digital tool within the home environment (and alongside it the behavioral/relational impacts of implementation).

Our initial thoughts are that through in-game features like quests, rewards, and shared progress we will reduce the collective cognitive load of the family while emphasizing the teamwork aspect required within a family. Our research will inform the design of the app which will streamline family organization as a byproduct. In the end, this research aims to improve modern family life.

Keywords:

[no keywords provided]

Mentor(s):

Erin Alkire Britton (DSB)

Other Acknowledgement(s):
Aamod George Samuel (Engineering)

Poster Presentation Abstract Number: 1416

Presentation Time: Session 3: 12:00-1:00pm

2x2 Matrix Multiplier

STEM

Authors(s):

David James D'Amico† (Engineering); Antariksh Mukherjeet (Engineering); Mahimasai Gajawada† (Engineering); Timothy D H Hant (Engineering)

Abstract:

The purpose of this project is the design and implementation of a digital system for performing 2x2 matrix multiplication on an ASIC. The system integrates a finite state machine (FSM), serial-in parallel-out (SIPO) shift registers, and combinational arithmetic modules to receive serial input data, store matrix elements, and compute products. The scope includes interfacing with a microcontroller for serial input/output, managing data flow through the FSM, and performing arithmetic operations in hardware. Methods focus on modular hardware description in SystemVerilog, emphasizing efficient use of logic resources and sequential control of matrix data. We plan to test the design in the future with the testbenches we will create in SystemVerilog, verifying how they work with simulators like GTKWave or other FPGA simulators.

Keywords:

[no keywords provided]

Mentor(s):

Malcolm Lloyd Seib McClymont (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1417

Presentation Time: Session 3: 12:00-1:00pm

Neurons Need Nutrition Now!

Humanities

Authors(s):

Anthia Amalia Davis† (HHS|JMHC)

Abstract:

Alzheimer's Disease (AD) has become more and more prevalent in America. Scientists theorize that increased consumption of processed foods, such as processed sugars, commonly found in the Standard American Diet (SAD) contributes to the loss of function in neurons in the brain, leading to increased risk for AD (Agarwal et al., 2023). Contrarily, the consumption of healthier foods such as healthy fats (found in avocado and natural oils), fruits, and fish feed neurons the nutrients needed to build strong support systems to combat AD (Ballarini et al., 2021). This exploratory research project aims to investigate the benefit of eating a Mediterranean Diet (MeDi), and as a result, propose how doctors can properly encourage their patients to eat healthier to prevent the onset and progression of AD. The research uses a literature review to demonstrate the benefit of eating according to the MeDi. This research is crucial to the health of American society, especially the quality of life in older populations. It will emphasize the need for increased research on how diet affects brain health in order to help the public understand how what they eat contributes to a healthy life.

Keywords:

Alzheimer; Mediterranean Diet; Memory; Neuron

Mentor(s):

Jessica M Mercado (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1418

Presentation Time: Session 3: 12:00-1:00pm

Evaluation of Thermoplastic Composite Rivets for Single-Lap Joints: Comparison with Induction and Hybrid Joining

Methods

STEM

Authors(s):

Francisco Javier De La Victoria Vazquez†; Luis Manuel Alvarez Casillas‡

Abstract:

Rivets play a critical role in joining different parts, as they are used for permanent joints and are commonly applied in aircraft structures. Currently, most fasteners are metallic; however, when used in thermoplastic composite joints, metallic fasteners introduce challenges such as galvanic corrosion and increased weight. To address these limitations, this study investigates the feasibility of thermoplastic composite rivets as a lightweight and corrosion-resistant alternative. These rivets offer advantages including high specific strength, low density, recyclability, and material compatibility with composite structures. In this work, three single-lap joint configurations are compared: one joined solely by induction welding, one joined exclusively by composite rivets, and a hybrid configuration combining rivets and induction welding.

Different composite materials were used to fabricate the rivets: short carbon fiber-reinforced PPS pellets, long discontinuous fiber (LDF)-reinforced PPS, and carbon woven fabric PPS composites. Rivets made from each material type were tested to evaluate their joint performance. For the induction welding process, a metallic susceptor was incorporated to enable efficient heat generation. The study evaluates the mechanical performance of the different rivet materials and joint types through lap shear testing and other mechanical characterizations. The results provide insight into the structural behavior of thermoplastic composite rivets and demonstrate their potential as lightweight, recyclable, and corrosion-resistant alternatives to conventional metallic fasteners in composite joining applications.

Keywords:

Fasteners; Thermoplastic Composites; Induction Welding; Single Lap Joint; Shear Stress

Mentor(s):

Garam Kim (Polytechnic); Eduardo Barocio Vaca (Engineering)

Other Acknowledgement(s):

Jordan James Wess Kalman (Engineering); Sucheol Woo (Polytechnic);
Rishabh Pammi (Polytechnic)

Poster Presentation Abstract Number: 1419

Presentation Time: Session 3: 12:00-1:00pm

Does the temporary nature of travel nursing significantly contribute to professional burnout due to increased isolation and loneliness?

Social Science

Authors(s):

Katherine Kile Degroote† (HHS|JMHC)

Abstract:

The purpose of this research project is to determine how isolation and loneliness impact burnout in travel nurses. Research will be gathered by completing a literature review of how burnout is seen in nursing and specifically travel nursing. Research will also be done on how loneliness and isolation can cause burnout in nurses and look at ways that this is seen in travel nursing. Primary research will also be completed through interviews with travel nursing and how they are impacted by this issue. The findings will be used to determine how isolation and loneliness can cause burnout specifically in travel nurses due to them constantly moving locations.

Keywords:

[no keywords provided]

Mentor(s):

Catherine Jean Shukle (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1420

Presentation Time: Session 3: 12:00-1:00pm

Engaging Local Youth for Improved Summer Sales at Red Mango

Business Case Study

Authors(s):

Konner DeWitt† (DSB); Marissa Shuluo Urbanek‡ (DSB); Christopher Charles Rubright† (DSB); Angel Wang† (DSB)

Abstract:

This study investigates strategies to help Red Mango, a frozen yogurt and smoothie shop near Purdue University, overcome summer revenue declines that occur when university students leave campus. The research focuses on attracting local high school and elementary school students and residents who remain in West Lafayette during this seasonal downturn. Using a mixed-methods approach, the project collects insights through surveys of at least 50 youth and parents and 6-8 small group interviews exploring treat preferences, visit motivations, and promotional interests. Secondary research and competitor analysis further identify effective youth-oriented strategies in the frozen dessert market. Data will be analyzed quantitatively for trends in preferences and qualitatively for recurring themes related to taste, social experience, and incentives. Recommendations will focus on actionable menu and marketing plans to generate consistent summer engagement. By aligning offerings with the needs of younger audiences, this project aims to help Red Mango strengthen community connections and establish year-round business stability through enhanced local participation during Purdue's summer break.

Keywords:

Frozen Yogurt; Youth Engagement; Summer Promotions; Menu Innovation; Community Outreach

Mentor(s):

Erin Alkire Britton (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1421

Presentation Time: Session 3: 12:00-1:00pm

Acoustic Levitation for Additive Manufacturing STEM

Authors(s):

Quintin David Dumouchelle† (Engineering)

Abstract:

The research is titled “Acoustic Levitation for Additive Manufacturing.” It explores the viability of using a pressure field generated by ultrasonic transducers to suspend metal particles in mid-air. The suspended particles would be sintered with a laser in a process similar to powder-bed fusion additive manufacturing. However, the difference is that the levitated powder would not be sintered to a baseplate. Therefore, acoustic levitation could then provide a way to study the heat transfer of sintered powder without a baseplate acting as a heat sink. The research would also explore the viability for a powder-based 3D printer in microgravity.

Keywords:

Acoustic Levitation; Additive Manufacturing; Powder Bed Fusion; Microgravity

Mentor(s):

Michael P Sealy (Engineering); Luz Sotelo (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1422

Presentation Time: Session 3: 12:00-1:00pm

Density Functional Theory: Interpretation of the Electron Density STEM

Authors(s):

Carmen Raquel Erickson† (Science|JMHC)

Abstract:

Density Functional Theory (DFT) is a widely used method for studying electronic structure in molecules and materials. DFT approximates the ground-state energy of many-electron systems by solving the single-particle “Kohn-Sham” equations to reproduce the correct electron density. This electron density, the central quantity of DFT, is often interpreted as a probability. However, when the density is integrated over a finite volume, this interpretation is only valid for single-electron systems. For many-electron systems, we show here how a spatial integral of the density over a given volume is better interpreted as the average number of electrons in that volume. We analyze numerically how both of these interpretations for the integrated density (i.e. as a probability and as an average number of electrons) differ in one-dimensional potentials holding up to six electrons. The average number of electrons was determined by integrating the density over a region of space, while the probability was calculated through the Inclusion-Exclusion Principle. As the region of interest decreases to a point, both interpretations are shown to match exactly. We further demonstrate how the probability of electrons can be approximated using an exponential form that relies solely on the average number of electrons.

Keywords:

DFT; PDFT; Electron Density

Mentor(s):

Adam Wasserman (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1423

Presentation Time: Session 3: 12:00-1:00pm

Optimization of Nose Cones to Mitigate Sonic Booms STEM

Authors(s):

Caleb James Evans† (Engineering); Harshith Morla† (Engineering);
Georgios Giannakis† (Engineering)

Abstract:

The primary barrier preventing commercial supersonic travel from becoming commonplace is the shockwave generated when an aircraft exceeds the speed of sound. This shockwave is perceived on the ground as a loud, sharp boom and can be highly disruptive. This shockwave, commonly called a sonic boom, is created by the convergence of smaller shockwaves generated primarily by the nose cone, wings, and tail. For our research, we focused on optimizing the shape of the nose cone at varying supersonic speeds to minimize the far-field sonic boom generated by this part of the aircraft. We will simulate multiple nose cone shapes in supersonic flow using computational fluid dynamics (CFD) to determine which shape is optimal. Based on our results, we will manufacture a design and test it in a supersonic wind tunnel. Because a sharp change in pressure creates a sonic boom, we will use changes in pressure to determine the effectiveness of each of the nose cone designs in mitigating the sonic boom. By mitigating the shockwave generated by the nose cone of an aircraft, the perceived loudness of the shockwave generated by the aircraft as a whole could be greatly reduced, potentially reenabling routine commercial supersonic flight.

Keywords:

Supersonics; Computational Fluid Dynamics; Aerodynamics; Sonic Boom; Nose Cone

Mentor(s):

Curtis Earl Marshall (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1424

Presentation Time: Session 3: 12:00-1:00pm

Harnessing Kinetic Energy from Vehicles for Sustainable Power: Potential and Implementation Challenges STEM

Authors(s):

Brandon Anthony Farbert† (Engineering|JMHC)

Abstract:

This study aims to synthesize the literature and assess best practices for utilizing renewable energy sources, with a focus on vertical axis wind turbines (VAWTs) for powering highway lighting systems, wireless road charging, EV charging stations, rest area facilities, traffic signals, data centers, pavement heating, and other transportation-related applications. The primary objective is to evaluate the potential of VAWTs by reviewing existing methodologies and technologies in terms of efficiency, cost-effectiveness, and environmental impact. By examining successful case studies and emerging innovations, we highlight potential benefits and challenges for implementing VAWT-based sustainable energy solutions in the transportation sector. Ultimately, this research initiates an important discussion on emerging technology for enhancing energy efficiency, reducing carbon emissions, and promoting an eco-friendly approach to the design and maintenance of transportation infrastructure.

Keywords:

Vertical Axis Wind Turbines; Kinetic Energy; Traffic Wind Turbines; Renewable Energy

Mentor(s):

Tho Le (Polytechnic)

Other Acknowledgement(s):

Yuchen Du (Polytechnic)

Poster Presentation Abstract Number: 1425

Presentation Time: Session 3: 12:00-1:00pm

How do Indiana Forest Soundscapes Change in Relation to Disruptive Weather Events?

STEM

Authors(s):

Aidan Benjamin Feirstein† (Liberal Arts|JMHC); Audrey Dickinson‡ (Agriculture|JMHC)

Abstract:

As the 21st century progresses, severe weather in the Midwestern United States is projected to increase in frequency due to the impacts of anthropogenically-induced climate change. This poses new challenges for regional biodiversity and forest stability as these storms can disrupt local ecosystems by damaging habitats, altering trophic dynamics, and contributing to increased plant and animal mortality. Previous research has documented decreased biophony, the collective sound produced by organisms living in an environment, following extreme weather events; however, most of this work has centered around coastal regions with an emphasis on examining the effects of tropical cyclones. Consequently, little is known about how severe weather patterns influence the soundscapes of temperate forest ecosystems. To address this gap, we will utilize a pre-post disturbance event design to identify changes in acoustic indices and convolutional neural network predicted species activity before and after severe weather events. We predict that sites impacted by severe weather will exhibit soundscape homogenization and reduced biophony, reflecting disruptions in typical vocalization patterns and ecosystem activity. Ultimately, by investigating how severe weather alters acoustic community structures, this work will contribute to a broader understanding of how wildlife communities in the Midwest respond to a climate increasingly characterized by episodic extreme weather.

Keywords:

Severe Weather; Forest Soundscapes; Biodiversity; Acoustics; Disturbance

Mentor(s):

Kristen Marie Bellisario (JMHC)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1426

Presentation Time: Session 3: 12:00-1:00pm

Development of Asymmetric Robust Molecular Cages Using an Imprinter-Based Approach STEM

Authors(s):

Aiden Michael Fernandez† (Science)

Abstract:

Biomimetic nanomaterials have emerged as a rapidly expanding area of research due to their promise in transforming modern healthcare applications, particularly in targeted drug delivery and biosensing. Among these systems, the use of well-defined and mechanically stable molecular cages offers a major advantage over more heterogeneous nanostructures, as their structural superiority allows for more specific and advantageous functionalization. This control is vital for creating a suite of nanoreactors that can show improved specificity within a wide range of applications. However, most molecular reactors rely on self-assembly methods, which typically produce highly symmetric architectures with limited functional diversity. Thus, new synthetic methods are needed to create asymmetrically functionalized systems. This poster provides an insight into our current development, featuring the implementation of a novel covalent imprinter structure designed to lead to some of the first fully asymmetric, sequence-defined molecular cages. For the characterization of our new molecular cages, we are using matrix-assisted laser desorption/ionization (MALDI) mass spectrometry as well as H1 and C13 nuclear magnetic resonance (NMR) spectroscopy. The successful completion of this work will further our understanding of the functional capabilities and synthesis of robust functional molecular cages with sequence-defined, protein-mimetic cavities.

Keywords:

Asymmetric Nanomaterials; New; Nanocages; Sequence Specific Nanomaterials

Mentor(s):

Severin Thomas Schneebeli (Pharmacy); Anthony Gabriel Mena (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1427

Presentation Time: Session 3: 12:00-1:00pm

Sublethal Impacts of Perfluoroalkyl Substance Mixtures and Parasite Exposure on Gray Treefrog Tadpole (*Hyla versicolor*) activity. STEM

Authors(s):

Jonathan Lester Flinn† (Science|JMHC)

Abstract:

Due to their high stability, per- and polyfluoroalkyl substances (PFAS) have been utilized in a variety of products ranging from aqueous film-forming foams (AFFF) to non-stick cookware. However, this high stability also contributes to their ability to persist in the environment, imposing a risk to both wildlife and public health. Previous studies have primarily focused on single-stressor effects, with most co-stressor events focused on host susceptibility to infection. As a result, little is known about how aquatic behavior may be influenced by both PFAS mixtures and parasites. To explore this, we first exposed Gray Treefrog Tadpoles (*Hyla versicolor*) to a mixture of PFAS at environmentally relevant concentrations over an 8-day period, with activity levels measured every two days. Following this period, the tadpoles were exposed to either trematodes, Ranavirus, or both. At the end of the experiment, tadpole activity was assessed utilizing a mixed-model ANOVA. While exposure to just PFAS did not have a significant effect on tadpole activity, there was a significant interaction between PFAS and parasite treatments. Post hoc analysis using Tukey's HSD showed that in the absence of PFAS, parasite exposure reduced activity levels. When exposed to PFAS, there was no significant difference between the control and parasite treatments. These findings suggest that while exposure to just parasites reduced activity, this effect was not amplified in the presence of PFAS. Going forward, it is important to look at potential effects these co-stressors have on other species, as well as looking at additional stressors such as predation risk.

Keywords:

Behavioral Ecotoxicology; Disease Ecology; PFAS

Mentor(s):

Jason T Hoverman (Agriculture); Olivia Ann Biasetti (Agriculture)

Other Acknowledgement(s):

Hannah Casey McNeese (Agriculture)

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

Poster Presentation Abstract Number: 1428

Presentation Time: Session 3: 12:00-1:00pm

Optimization of CUBIC Tissue Clearing Protocol for 3D Visualization of Adult Zebrafish Hearts STEM

Authors(s):

Ava Joan Roisi Flynn† (Engineering|JMHC)

Abstract:

Heart failure is a leading cause of morbidity and mortality globally, largely driven by pathological fibrosis that impairs contractility and electrical conduction. Adult zebrafish offer a unique model for studying the mechanisms of fibrosis as, unlike humans, they show robust cardiac regeneration following injury. In this study, we utilized a cryoinjury model that closely mimics human myocardial infarction to induce fibrotic scarring in the zebrafish ventricle. Fibroblasts quickly activate and deposit extracellular matrix after damage, although this temporary fibrosis is eventually eliminated as the heart regenerates.

We sought to optimize the CUBIC (Clear Unobstructed Brain/Body Imaging Cocktail and Computational analysis) tissue clearing protocol for adult zebrafish hearts in order to visualize this process in three dimensions. CUBIC was selected due to its effectiveness in delipidizing tissue, ability to preserve fluorescent signals, and suitability for large tissue volumes. After comparing two methods - attempted cannulation for perfusion and simple submersion - we found that for such small cardiac samples, submersion in CUBIC reagent R1 at 37 °C produced the best transparency. The distribution of fibroblasts, especially around the atrioventricular valve, could be seen when hearts expressing Tcf21 fibroblasts and Myl7-GFP cardiomyocyte reporters were successfully cleared.

Future work will pair optimized CUBIC clearing with light sheet microscopy to reconstruct the heart in 3D, enabling spatiotemporal mapping of fibroblast activation throughout regeneration. These findings will contribute to understanding how zebrafish resolve fibrosis and may inform strategies to promote regenerative healing in the human heart.

Keywords:

Zebrafish; Regeneration; Transparentization; Fibroblasts; CUBIC

Mentor(s):

Craig Goergen (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1429

Presentation Time: Session 3: 12:00-1:00pm

A Synthesizable AMBA AXI Bus for SoCET SoCs: Design and Verification STEM

Authors(s):

Mary Francis† (Engineering|JMHC); Oluwatomiwa Imosenomen Akintunde† (Engineering); Jai Anand Keskart† (Engineering); Zhenghao Xu† (Engineering); Akhil G Yada† (Engineering)

Abstract:

This project presents the design and verification of a synthesizable Advanced Microcontroller Bus Architecture (AMBA) Advanced eXtensible Interface (AXI) interconnect tailored for a microcontroller System-on-Chip (SoC) targeted for tapeout. Our objective is to deliver an academically rigorous, reusable, and parameterizable AXI solution that adheres to the ARM AXI specification while meeting the integration and performance needs of the SoCET MCU tapeout effort.

With this ready-made AXI design, we can replace the Advanced High-performance Bus (AHB) currently used, which bottlenecks memory bandwidth in high-speed configurations of our SoC, such as AI accelerators and GPUs. By the end of the semester, we will develop a comprehensive verification environment for the manager, subordinate, and interconnect modules. Verification will generate high-stress traffic patterns, verify handshakes, and ensure end-to-end data correctness via the ECE 337 Makefile system. Currently, the design is passing basic synthesis tests. Additionally, we will extend the interconnect with arbitration supporting both fixed-priority and round-robin policies, multiple outstanding requests, and out-of-order response handling. Future work can also include more varied arbitration schemes.

With ongoing debugging and performance validation, and by releasing the design and testbench collateral to the SoCET community, this work aims to enable additional SoC features and support further research on interconnects and Quality of Service (QoS) policies for on-chip buses. This design will be integrated into a larger microprocessor project as a key feature.

Keywords:

AMBA AXI; Microcontroller SoC; Interconnect Fabric

Mentor(s):

Cole Aaron Nelson (Engineering); Jacob Chappell (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1430

Presentation Time: Session 3: 12:00-1:00pm

Machine Learning in Motion

STEM

Authors(s):

Marisa Jean Fredrickson† (Engineering); Nathan Tian-Lin Wan† (Science); Eliana Elise Roeder† (Engineering); Somya Sakal† (Science); Christina Lee‡ (Science|Graduate); Sebastian Sea-Tian Ting‡ (Science); Devashree Parambath‡ (Science); Sooji Lee‡ (Science); Sahil Jain‡ (Science); arunima chowdhury*; Arnav Daryani* (Science); Natalia Cadence Hombs* (Engineering|JMHC); Aryan Kaul* (Science); Amber Kuoiva Khauv* (Science); Mert Ryan Kiroglu* (DSB); Hai Lam Le* (Engineering); Ryan Patrick Leonard*; Michael Ming Li* (Science); Hridhay Monangi* (Science); Abhik Mullick* (Polytechnic); Rishi Mantri* (Engineering); Pratham Jigneshbha Patel* (Science); Shamsad Rahman* (Engineering); Dean Snyder* (Engineering|JMHC); Sophia Elizabeth Steele* (Engineering); Roohee Esha Urs* (Science|JMHC); Sami Nasser Zagha* (Science); Taryn Celia Zakrzewski* (Engineering)

Abstract:

The use of technology in the performing arts has transformed the way artists express themselves. The introduction of technology into dance performances has enabled a new degree of inventiveness, opening new dimensions and possibilities for choreography.

This semester, we implemented and compared two motion-tracking approaches, Blob Tracking and YOLO-based object detection, to evaluate their effectiveness in live performance contexts. YOLO provides high accuracy, enabling precise spatial localization and multi-dancer tracking, while Blob Tracking offers a simpler and potentially faster method for capturing general motion and contour changes. Using these models, we extracted dancer endpoints and joint coordinates from a custom Python pipeline and streamed the data directly into Isadora for real-time manipulation. Within Isadora, a software program designed to incorporate interactivity between performers, projection, sound, and lights, we created dynamic scenes that respond to performers' movements through changes in color, brightness, and sound, producing immersive and responsive performance environments.

To evaluate the system's performance and artistic potential, we conducted live tests with dancers in Pao Hall during rehearsals, collecting data, and refining our tracking pipeline based on real-world movement patterns. These sessions provided critical insights into how

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

the system interprets motion under stage conditions and how technology can be harmoniously integrated into choreographic expression.

By combining YOLO object detection, Blob Tracking, pose estimation, and interactive media design, our work demonstrates the potential of machine learning to transform the relationship between technology and the performing arts, creating a seamless dialogue between human motion, sound, and visual design.

Keywords:

Machine Learning; Object Detection; Computer Vision

Mentor(s):

Renee Murray (Liberal Arts); Frederick C Berry (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1431

Presentation Time: Session 3: 12:00-1:00pm

Beyond 5G: Real-World Implementation of Modern Communication Techniques STEM

Authors(s):

Connor Bradley Frey† (Science); Priya Adiga† (Engineering|JMHC);
Andrew Thomas Johnson† (Engineering); Sebastian Enrique Pirela‡
(Engineering|JMHC); Zhi-Yu Shao‡; Andrew Owen Fewell‡
(Engineering)

Abstract:

The Beyond 5G team consists of 4 major teams. The USRP team will evaluate symbol recovery and synchronization methods. Objectives include estimating SNR using a preamble, achieving signal acquisition, correcting frequency and phase offsets, and controlling transmission SNR. The project serves as a prototype for validating receiver functionality and performance in realistic communication environments. The OFDM team will show how OFDM efficiently transmits data over noisy, real-world channels. Data is split into slower streams, modulated, and sent over many close-together subcarriers. Results show OFDM maintains reliable communication under fading and interference, proving its value in modern wireless systems. The error correcting code team will explore the use of error correcting codes in transmission schemes. Hamming codes are a type of error correcting code that uses parity bits to identify where the location of an error occurs or to let the user know if there exists an error that the code cannot handle. The symbol recovery team develops MATLAB and USRP implementations for PRACH symbol detection. We will use preamble-based matched filtering, and we are aiming for accurate synchronization and symbol recovery. This enhances the signal-to-noise ratio, which enables reliable uplink access detection. Our project generally connects the theoretical communication principles with practical real-world signal processing implementations.

Keywords:

OFDM; USRP; SDR; Error Correcting Codes; Symbol Recovery

Mentor(s):

Chih-Chun Wang (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1432

Presentation Time: Session 3: 12:00-1:00pm

Skin blood flow response to local heating across control, type 2 diabetic, and peripheral artery disease conditions STEM

Authors(s):

Josi Laura Gallo† (Agriculture|JMHC); Grace Enpei Chen† (Agriculture|Engineering|JMHC); Allison Paige Vick Miller‡ (Science|JMHC); Emily Courtney Chan‡ (Science|JMHC); Luke Thomas Benner‡ (HHS|JMHC); Brhandom Jeishryel Brisueno Lopez‡ (HHS)

Abstract:

Diabetic foot ulcers (DFUs) are a costly and disabling complication of type 2 diabetes (T2D), affecting up to one-third of patients during their lifetime. Ulcer recurrence and a higher risk of lower-limb amputation are significantly increased when peripheral artery disease (PAD) is present. Despite their clinical importance, most studies evaluate cutaneous vascular function at sites that are less prone to ulcers. Assessing microvascular reactivity at the plantar hallux may yield more clinically relevant insights. We compared local microvascular reactivity among Control, T2D, and PAD groups using laser Doppler flowmetry (LDF). Adults (67 ± 13 years) were classified by HbA1c and ankle-brachial index (ABI): Controls ($n = 17$; HbA1c $< 6.5\%$; ABI ≥ 0.90), T2D ($n = 7$; HbA1c $\geq 6.5\%$; ABI ≥ 0.90), and PAD ($n = 6$; HbA1c $\geq 6.5\%$; ABI < 0.90). At the plantar hallux, local heating was applied while LDF continuously recorded skin flux, expressed as cutaneous vascular conductance (CVC) and normalized to the individual's maximal response (CVC%max). One-way ANOVA revealed significant group differences in baseline ($P < 0.01$) and initial peak ($P < 0.02$) CVC%max. The mean flux increase from baseline to plateau was 515% in Controls, 177% in T2D, and 315% in PAD ($P < 0.01$). These findings demonstrate that heat-induced cutaneous hyperemia is significantly decreased at ulcer-prone plantar sites in T2D and PAD. Since local-heating tests are simple, noninvasive, and repeatable, assessing plantar cutaneous vascular reactivity may help stratify DFU risk and serve as an endpoint to monitor responses to therapeutic interventions.

Keywords:

[no keywords provided]

Mentor(s):

Bruno Tesini Roseguini (HHS); Bohyun Ro (HHS)

Other Acknowledgement(s):

Carolyn Marie Bakx (Interdisciplinary & Special Programs); Erik Sillaste
(Purdue University)

Poster Presentation Abstract Number: 1433

Presentation Time: Session 3: 12:00-1:00pm

Assessing Cryptocurrency Payments for Small and Medium Sized Enterprises Humanities

Authors(s):

Malhar Saurabh Gandhe† (Engineering)

Abstract:

In recent years, digital payments have become an important part of how businesses manage sales and customers. With more people using online platforms and global transactions growing, new payment options are being explored. This preliminary project studies how Bitcoin, Ethereum, and other cryptocurrencies can be used by small and medium sized businesses for everyday payments. Many small businesses face problems like high banking fees and slow transfers (Okeke et al. 1). Digital currencies like Bitcoin and Ethereum could be a possible alternative, but it also brings risks such as high volatility and unclear rules. This research looks at both the benefits and problems of using these digital currencies. I analyze peer reviewed articles and popular sources that explain how Bitcoin, Ethereum and other digital currencies work and how some businesses have already started using them. The goal is to understand if these systems are practical and reliable for small and medium sized companies. This study focuses on crypto payments benefits and drawbacks for businesses. It also highlights what changes might be needed in policy or technology to make such payments safer and more reliable. The findings can help small business owners decide if trying crypto payments is useful for them or not.

Keywords:

Cryptocurrency; Small and Medium-Sized Businesses (SMES); Bitcoin; Ethereum; Digital Payments

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1434

Presentation Time: Session 3: 12:00-1:00pm

“My dog changed my life”: A Qualitative Analysis of the Impacts of Psychological Service Dogs on Sexual Assault Survivors

Social Science

Authors(s):

Bryanne Lauren Garcia† (Education|JMHC); Emma Kay Senter† (HHS|JMHC); Tatum Reese Ebbeskotte* (Science|JMHC)

Abstract:

Sexual assault (SA) is the cause of posttraumatic stress disorder (PTSD) for many people, with previous studies showing up to 45% of women and 65% of men develop PTSD following SA. Psychiatric service dogs are one complementary intervention utilized in the treatment of PTSD, with dogs performing tasks to mitigate psychological symptoms. However, psychiatric service dog literature focuses mainly on veterans, as opposed to the entire population of adults with PTSD resulting from SA. In this pilot study, we explored the impact of psychiatric service dogs on the daily lives and PTSD symptoms of survivors of SA diagnosed with PTSD. We conducted semi-structured interviews with ten adult participants and used qualitative analysis to identify common themes in the interviews. Participants expressed the service dog process was worthwhile, despite significant time and resource investments. More specifically, interviewees shared their individualized experiences facilitated the life-changing impact of their service dog. Responses conveyed the benefit of alleviated symptoms. Conversely, participants identified costs including the wait time to obtain a dog and consistent upkeep. Overall, participants were willing to invest in the intervention despite these costs because they felt that the benefits outweighed the costs. Future studies might build on these results by examining the degree of lifestyle adaptations handlers will commit to in order to increase the efficacy of the intervention. Greater awareness of how service dogs can benefit SA survivors with PTSD will offer opportunities for this population to experience integrative, meaningful approaches to human health and wellbeing.

Keywords:

[no keywords provided]

Mentor(s):

Leanne Nieforth (Vet Med); Sarah Jean Reega (Vet Med); Emilie Mae MacInnis (Vet Med)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1435

Presentation Time: Session 3: 12:00-1:00pm

Latent Convergence as a Criterion for Graph Algorithm Termination STEM

Authors(s):

Miguel Edoardo Garcia† (Science)

Abstract:

A growing body of literature exploits the neural algorithmic reasoning paradigm to develop graph neural networks capable of executing graph algorithms such as Bellman–Ford and Breadth-First Search. Within this framework, the task of determining execution termination has typically been addressed through the addition of external termination-prediction heads, most often multilayer perceptrons, attached to the system. Recent investigations into the latent dynamics of such models, however, reveal convergent trajectories throughout message-passing iterations, suggesting that termination could instead be inferred intrinsically by comparing successive embedding states. In this work, we extend this line of inquiry by examining whether termination can emerge as an inherent property of the latent space itself, without explicit supervision or auxiliary heads. We propose a framework that measures latent stability across recurrent message-passing iterations, evaluating whether fixed-point convergence in the embedding dynamics can serve as an implicit termination criterion.

Keywords:

Neural Algorithmic Reasoning; Graph Neural Networks; Latent Dynamics; Deep Learning

Mentor(s):

Yexiang Xue (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1436

Presentation Time: Session 3: 12:00-1:00pm

**Proposed FluidFM-compatible Platform for Single Hyphae
Studies
STEM**

Authors(s):

Catherine Renee Gemrich† (Engineering|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

FluidFM; Mycelium; Hyphae; Microstructure; Single-Cell

Mentor(s):

Giacomo Paccagnan (ETH Zürich)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1437

Presentation Time: Session 3: 12:00-1:00pm

What Makes a House Valuable? Predicting Home Prices to Improve Transparency in the U.S. Market

Business Case Study

Authors(s):

Sebastian Felipe Gil Eskildsen† (DSB); James William Pope† (DSB); Roberto Andres Chinchilla Varela† (DSB); Juan Antonio Sevilla† (DSB)

Abstract:

What property characteristics are the strongest drivers of home value? Understanding property values is crucial for buyers seeking to avoid overpayments, sellers aiming to price competitively, and lenders assessing financial risk. The goal of this project is to predict final home sale prices while identifying the key factors that shape them. Beyond prediction, we are driven by the need to improve fairness and transparency in real estate decisions.

Our analysis is based on a dataset of 79 property features, including lot size, construction year, and overall material quality. To enhance accuracy, we created new variables, such as total square footage, by combining basement and above-ground living areas. Early exploratory findings revealed significant differences in value across quality levels. For instance, homes with “Excellent” exterior quality showed average sale prices nearly 400% higher than those rated “Fair,” and newer constructions consistently outperformed older homes. These patterns confirm that specific property characteristics strongly influence market value even before applying predictive models.

Our predictive modeling strategy begins with a simple linear regression model to establish a baseline for comparison. From there, we incorporate regularization techniques such as Ridge and Lasso to handle multicollinearity and improve feature selection. To capture more complex, non-linear relationships, we implement advanced ensemble methods including Random Forest, XGBoost, and LightGBM. Each model is evaluated using Root Mean Squared Error (RMSE) through k-fold cross-validation to ensure reliable performance and prevent overfitting. This structured approach allows us to compare models not only by accuracy, but by their ability to explain which features most influence home values.

The purpose of this project goes beyond predicting home prices; it aims to provide meaningful insights that support more informed and equitable

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

decisions in the housing market. By identifying which property characteristics most strongly impact value, our models give buyers greater clarity, help sellers price more confidently, and offer lenders a more objective basis for risk assessment. In a market where uncertainty can lead to unfair pricing or missed opportunities, our approach enhances transparency. Through data-driven analysis, we seek not only to improve prediction accuracy but also to understand better what truly makes a house valuable.

Keywords:

Housing Valuation; Predictive Modeling; Machine Learning; Real Estate Transparency; Feature Importance

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1438

Presentation Time: Session 3: 12:00-1:00pm

A Multifidelity Point Cloud Autoencoder for Aerodynamic Uncertainty Analysis STEM

Authors(s):

Bogomir Vincent Glavan† (Engineering|JMHC)

Abstract:

Aerospace research in computational design increasingly relies on data-driven approaches to overcome the limitations of computational fluid dynamics (CFD) simulations. While CFD remains the gold standard for aerodynamic analysis, its use in large-scale uncertainty analysis is often impractical due to high computational costs. This limitation has driven the development of surrogate models, which approximate CFD predictions at a fraction of the computational expense. As a result, surrogate modeling has become the prevailing approach for uncertainty analysis in aerospace research, enabling efficient exploration of design spaces while retaining acceptable accuracy.

This paper presents the development of an improved aerodynamic surrogate model and its application to uncertainty analysis. The primary research objectives lie in achieving both high accuracy and reliable estimation of output parameter distributions. To address this, a multifidelity point cloud autoencoder is proposed to predict aerodynamic coefficients for a range of wing geometries and flow conditions. This approach constructs the surrogate model from geometric features of a training set, while the multifidelity framework enables training across datasets of varying resolutions, improving model generalizability and robustness.

Uncertainty analysis is conducted using Monte Carlo sampling to estimate the distributions of output aerodynamic coefficients under varying input conditions. This proposed method is benchmarked against existing models, demonstrating competitive performance in handling diverse geometries. Preliminary results showed the point cloud model achieved up to a 1.5% reduction in the normalized root mean squared error for the coefficient of pressure compared to a baseline model without geometric encoding when trained on a single-fidelity dataset.

Keywords:

Computational Fluid Dynamics; Deep Learning; Multifidelity Modeling; Surrogate Modeling; Uncertainty Analysis

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

Mentor(s):

Leifur Thor Leifsson (Engineering)

Other Acknowledgement(s):

Abhijnan Dikshit (Engineering)

Poster Presentation Abstract Number: 1439

Presentation Time: Session 3: 12:00-1:00pm

Optimizing Deep Learning Models for Enhanced Detection of Subvisible Particles in Pharmaceutical Development STEM

Authors(s):

Clara Marie Anne Goffioul† (Engineering)

Abstract:

Accurate classification of flow imaging microscopy (FIM) images is essential for evaluating protein therapeutic products. Pharmaceutical production of protein-based therapeutics introduces stress (e.g., thermal, shear, etc.) that can cause proteins to aggregate, increasing the risk of adverse reactions. To monitor this, samples from production are assessed using FIM, an optical microscopy technique where images are evaluated for aggregates and other particulate matter, collectively known as subvisible particles (SVPs). The integration of convolutional neural networks (CNN) to detect spatial features with existing FIM databases has demonstrated accurate automated classifications of SVPs. However, different CNN architectures yield varying outcomes with advantages that have yet to be distinguished for optimizing SVP assessment. This project aims to optimize CNN architectures for classifying multiple SVP types from FIM data. Our dataset includes normalized and processed images of protein aggregates, oil droplets, and glass particles. Our current model, built in Python using TensorFlow and Keras, has three convolutional dropout layers followed by a fully connected output layer. Our ongoing work investigates the impact of the layer arrangements for feature identification purposes and will provide further insight into enhancing the CNN for applications with various SVPs. It focuses on reproducing the published results and testing variations in layer depth, filter size, learning rate, pooling strategy, and dropout rate to improve accuracy and generalization. The outcomes of this project will guide the design of optimized CNNs for automated detection of SVPs, supporting faster and more reliable image-based analysis in pharmaceutical and experimental research settings.

Keywords:

Flow Imaging Microscopy (FIM); Convolutional Neural Networks (CNN); Subvisible Particles (SVPs); Image Analysis; Deep Learning

Mentor(s):

Brett A Meyers (Centers & Institutes); Sourav Das (Engineering); Reza Babakhani Galangashi (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1440

Presentation Time: Session 3: 12:00-1:00pm

Training the Brain to Train the Knee

Humanities

Authors(s):

Julia Ann Gorenstein† (HHS)

Abstract:

Every year more athletes are having to deal with debilitating injuries, including ACL tears. It is widely known that women are three to eight times more likely to tear their ACL in a noncontact injury (Elliot, Goldberg, & Kuehl, 2010, as cited in Toscano & Carroll, 1). With any injury, there are methods to try and prevent them, and one important measure is neuromuscular training. Neuromuscular training is a combination of four exercises: strength training, plyometrics, agility, and proximal control, aimed to help strengthen the connection between muscles and the nervous system (Sugimoto et al., 2) . This exploratory research aims to discover the best combination of neuromuscular training to prevent ACL injuries in female athletes. To better understand this topic, I conducted a preliminary literature review to determine which exercise and combination of all four was the most effective way to prevent ACL tears. Based on research, it seems that strength training and plyometrics in an athlete's training may yield positive results (Sugimoto et al., 7). Ultimately, this research will help add to the conversation about ACL prevention in female athletes.

Keywords:

[no keywords provided]

Mentor(s):

Jessica M Mercado (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1441

Presentation Time: Session 3: 12:00-1:00pm

Cation decoration of Ti₃C₂T_x for structural and magnetic tuning STEM

Authors(s):

Bhoomika Kumar Gowda† (Agriculture|Engineering)

Abstract:

MXenes are a class of two-dimensional nanomaterials with the general chemical formula $Mn+1XnTx$, traditionally derived from the selective etching of MAX phases such as Ti_3AlC_2 . Their tunable surface chemistry and high electrical conductivity make them promising for various applications including electronics, catalysis, and EMI shielding. Surface modification through salt cation decoration can alter their magnetic and electronic properties to meet specific functional needs. In this study, Ti_3C_2Tx MXene flakes were decorated with three different cations, Co^{2+} , Ni^{+} , and Fe^{3+} , to investigate how decorative

ions influence the material's structural and magnetic characteristics. Cation decoration was performed by mixing MXene suspensions with salt solutions, allowing metal ions to decorate the flake's surface. The resulting materials were filtered, dried, and characterized using X-ray diffraction (XRD) to confirm successful synthesis, detect decoration, and calculate lattice parameters using Bragg's Law. These findings provide insight into how salt decoration alters MXene structure and magnetic behavior, guiding the future design of functionalized MXenes for advanced magnetic and electronic applications.

Keywords:

MXenes; Salt Decoration; X-Ray Diffraction; Magnetism; Ions

Mentor(s):

Annabelle Leigh Bedford (Engineering); Babak Anasori (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1442

Presentation Time: Session 3: 12:00-1:00pm

Life's Sweet Origins: Prebiotic Synthesis of Polysaccharides in Sea Spray Microdroplets and Hydrothermal Wet-Dry Cycles STEM

Authors(s):

Virginia Alessia Graziosi† (Agriculture|JMHC)

Abstract:

Understanding the chemical foundations of the origins of life remains one of the most profound and complex questions in the scientific community. Carbohydrates, formed from simple monosaccharides, play an important role in energy storage, membrane structure, and other processes crucial to life. Yet, little is known about the potential initial synthesis of complex carbohydrates as the chemical conditions on early Earth are obscure. The purpose of this study was to investigate possible prebiotic conditions on Earth that allowed the formation of complex sugar molecules from monosaccharides. Beginning with monosaccharides in varying conditions, the formation of polymers in sea spray microdroplets and hydrothermal wet-dry cycles was analyzed. This study utilizes high-throughput Desorption Electrospray Ionization (DESI) Mass Spectrometry (MS), as up to 6,144 unique reactions can be tested at a time. Low-throughput analysis to test these reactions would take multiple lifetimes, however, DESI allows us to complete analysis at a rate of one sample a second. This study revealed the formation of disaccharides and beyond in a variety of chemical reaction formats. The synthesis of polysaccharides in the varying conditions provides meaningful insight into possible early Earth environments that supported the emergence of life. Furthermore, knowing the conditions on Earth that supported the polymerization of monomers leading to complex biomolecules can be important in identifying life present on other planets.

Keywords:

Abiogenesis; Mass Spectrometry; Carbohydrates; High-Throughput; Search for Life

Mentor(s):

Myles Quinn Edwards (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1443

Presentation Time: Session 3: 12:00-1:00pm

Drivers of Cropland-Atmosphere CO₂ Exchange in U.S. Midwest Corn and Soybean Agroecosystems STEM

Authors(s):

Lauren Elizabeth Grose† (Science|JMHC)

Abstract:

Croplands play an important role in the terrestrial carbon cycle, acting as both sources and sinks for carbon dioxide (CO₂) depending on crop type, management practices, and environmental variability. In the U.S. Midwest, corn and soybean occupy nearly half of the agricultural landscape. Rotations of these crops produce notable interannual patterns in ecosystem carbon dynamics, driven largely by physiological and phenological differences between the two species, such as intrinsic rates of CO₂ uptake. Management practices, including fertilizer application and tillage, as well as meteorological factors such as temperature, soil moisture, and radiation, further shape net ecosystem exchange of CO₂ (uptake plus emission) across multiple timescales, influencing broader patterns of climate variability. To better understand these dynamics, this study aims to characterize the drivers of CO₂ concentration and net ecosystem exchange variability over agroecosystems using historical data from three sites in the U.S. Midwest that rotate corn and soybean annually, along with recently collected observations over spatially-adjacent corn and soybean plots at the AIR CheM @ Purdue lab located at Purdue's Agronomy Center for Research & Education (ACRE). By comparing data across the four sites, we will determine crop-specific physiological and management influences on net ecosystem exchange, quantify key meteorological drivers, and place local Indiana observations within the broader regional context of U.S. Midwest carbon cycling.

Keywords:

[no keywords provided]

Mentor(s):

Michael P Vermeuel (Science)

Other Acknowledgement(s):

Nathan Tyler Rose (Polytechnic); Carter Brian Swenson (Science)

Poster Presentation Abstract Number: 1444

Presentation Time: Session 3: 12:00-1:00pm

**Monte Carlo Reconstruction Of The Discovery Of The Higgs
Boson In The Decay Process**
STEM

Authors(s):

Raymond Denver Hammonds† (Science); Yeochan Yount† (Science);
Nathan Lee† (Engineering); Hayden Len Ellis† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Monte Carlo; Higgs Boson; Leptons; Standard Model; Z Boson

Mentor(s):

Andy Jung (Science); Heather Nicole Martin (Science); David Alan Ruiters (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1445

Presentation Time: Session 3: 12:00-1:00pm

Enhancing Marketing Strategies for Wildcat Creek Winery: A Consumer-Centered Approach

Business Case Study

Authors(s):

Chloe Grace Hardesty† (DSB); Brinley Renee Pressler† (DSB); Shelby Jo Schambach† (DSB); Josephine Rose Hanas† (DSB)

Abstract:

This project explores how digital marketing tools and consumer insights can strengthen brand engagement for a local Indiana business, Wildcat Creek Winery. As part of a semester-long applied marketing study, our team examined the winery's existing marketing efforts and identified opportunities to enhance visibility, customer connection, and seasonal traffic. The case centered on how small wineries can leverage data-driven decision making to compete in a saturated marketplace.

Using Sprout Social, a social media management and analytics platform, we conducted a performance audit of Wildcat Creek's online presence. Analysis of engagement metrics revealed key gaps in content consistency, audience targeting, and message alignment with brand values. Based on these findings, we developed a digital strategy emphasizing storytelling, consumer interaction, and data-guided posting schedules to improve reach and retention.

Additionally, our team proposed revitalized winter programming, an area of slower sales, by designing event concepts that integrate local partnerships, sensory experiences, and promotional campaigns aimed at fostering community connection.

Keywords:

Visibility; Strategy; Audience Engagement; Case Study

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1446

Presentation Time: Session 3: 12:00-1:00pm

Associations between Parent Verbalizations about Hunger and Fullness and Child Eating in the Absence of Hunger

Social Science

Authors(s):

Gracie Rose Harkert† (HHS|JMHC)

Abstract:

Eating in the absence of hunger (EAH) is a risk factor for childhood obesity. Parent feeding practices may influence children's ability to respond to internal hunger and satiety cues. This study examined whether parent verbalizations about hunger and fullness during meals were associated with children's subsequent food intake.

Parents participated in laboratory visits with their 5.5-year-old children (n=103). Families ate a meal together while being video-recorded. Children's hunger was then assessed using visual stomach pictures (empty, half-full, full). Children who reported being empty or half-full were given the option to continue eating. Afterward, children were given free access to five snack foods. Caloric intake during the free access task was measured. Family meal videos were coded for parent verbalizations explicitly mentioning "hunger" or "fullness" (binary present/absent variables).

Parent hunger verbalizations were present in 32% of interactions, fullness verbalizations in 16.5%, and any hunger/fullness verbalization in 40.8%. The mean EAH caloric intake was 62.7±93.3 calories. A Mann-Whitney U test compared the presence versus absence of parent verbalizations on calories consumed during the free access task. Results trended toward significance (U = 1015.500, z = -1.841, p = .066), suggesting a potential difference and thus meriting further exploration.

Verbalizations about hunger/fullness during meals trended toward an association with lower child EAH. An "other" category was coded but excluded from analysis. These verbalizations are often related to hunger or fullness but did not explicitly use those terms. Further research should examine whether broader verbalizations related to hunger/fullness are related to EAH.

Keywords:

[no keywords provided]

Mentor(s):

Kameron Moding (HHS); Ivan Mendoza (HHS); Kylie Marie Wilson (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1447

Presentation Time: Session 3: 12:00-1:00pm

Solar-Powered Charging Dock for E-Bikes and Scooters: A Sustainable Urban Mobility Solution STEM

Authors(s):

Grace M Heaney† (DSB)

Abstract:

As micro-mobility options like e-bikes and scooters continue to expand, the demand for sustainable charging infrastructure is growing. This project explores the design and modeling of solar-powered charging docks as part of Purdue's ABC-PV initiative, which focuses on integrating photovoltaic systems into everyday environments. The goal is to create a renewable, grid-independent solution for urban and campus transportation. Using Fusion 360 for structural design, the proposed dock integrates rooftop solar panels to generate kWh of clean energy per day enough to charge multiple e-bikes or scooters. System Advisor Model (SAM) simulations are used to evaluate PV performance, battery storage capacity, and economic feasibility under local weather conditions. Python modeling complements this analysis by simulating energy demand, battery behavior, and charger queueing efficiency. Preliminary results show that a single solar panel can meet the daily charging needs of an average station with minimal grid reliance. This research provides a foundation for scalable solar-mobility infrastructure that supports Purdue's commitment to sustainable energy innovation and reduced carbon emissions.

Keywords:

Solar Energy; Photovoltaics; Micro Mobility; Sustainability; E-Bike Charging

Mentor(s):

Peter Bermel (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1448

Presentation Time: Session 3: 12:00-1:00pm

Marketing Research Project with Union Club Hotel

Business Case Study

Authors(s):

Benjamin Michael Heaviland† (DSB); Krishna Vadlamani† (DSB); Yuhui Qin† (DSB); Cale Lusk Bennett† (DSB)

Abstract:

The project seeks identify and address a key marketing challenge for the Union Club Hotel and its dining outlets, specifically the Clubhouse Bar & Grill. The Clubhouse Bar & Grill does not have dedicated online platforms. Through designing and executing ethical primary research with Union Club Hotel's sales data we will identify consumer groups, perceptions and barriers and develop actionable marketing recommendations. The goal of this project is to enhance the Union Club Hotel's existing marketing platform, with a particular focus on elevating the visibility and promotional efforts of the Clubhouse Bar & Grill

Keywords:

[no keywords provided]

Mentor(s):

Erin Alkire Britton (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1449

Presentation Time: Session 3: 12:00-1:00pm

Predicting Consumer Credit Default Risk

Business Case Study

Authors(s):

Aidan Joshua Hershberger† (DSB); Yutian Ye† (DSB); Jizheng Li† (DSB); Cole R Bailey† (DSB)

Abstract:

This project aims to predict whether an individual borrower will experience serious financial distress—defined as being 90 or more days delinquent on credit obligations—within the next two years. Using the Give Me Some Credit dataset with over 250,000 U.S. consumer records, the study supports lenders and regulators in identifying high-risk borrowers, improving portfolio management, and promoting responsible lending practices.

Our methodology balances interpretability and predictive accuracy through a multi-model framework. Logistic Regression establishes an interpretable baseline, while advanced ensemble models—Random Forest, LightGBM, XGBoost, and CatBoost—capture complex non-linear relationships among demographic, financial, and credit history variables. Data preprocessing included removing duplicates, imputing missing income and dependent values, and mitigating outliers via winsorization or log transformations. Feature engineering introduced delinquency aggregates, debt burden indices, and interaction terms to enhance predictive power. To address the 7% default imbalance, SMOTE, class weighting, and threshold tuning were applied within cross-validation folds to prevent data leakage.

Model performance was assessed using ROC-AUC, PR-AUC, F1-score, and calibration metrics, with a focus on cost-sensitive thresholds that reduce false negatives. SHAP analysis provides interpretability at both global and borrower levels, highlighting debt utilization, payment history, and income level as the most influential factors.

Preliminary results indicate that gradient-boosted models outperform linear benchmarks while maintaining transparency. This project demonstrates how explainable AI can enhance predictive accuracy, fairness, and trust in modern credit risk analytics.

Keywords:

Credit Risk Prediction; Ensemble Learning; Imbalanced Classification; Financial Distress Modeling; Model Interpretability

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

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1450

Presentation Time: Session 3: 12:00-1:00pm

Ionizing Radiation Contamination, Measurement, and Management: A Comparative Analysis of US and Vietnamese Practices STEM

Authors(s):

Luke Wilson Heymann† (HHS); Bridget A Nobbet‡ (HHS); Emma Renee Williamst‡ (HHS); Alexa Giselle Bonilla† (HHS)

Abstract:

Ionizing radiation has been applied in medicine and industrial practices, being used for imaging, therapy, and sterilization. Despite its useful purposes, exposure to ionizing radiation poses severe health risks due to the damages it causes to cells and DNA. Differences in safety regulations, available resources and public awareness between the United States and Vietnam have influenced the safety and exposure control of ionizing radiation. Assessing these disparities highlights global inequities in radiation protection standards and protocols, promoting awareness of occupational exposure risks.

This study uses a comparative literature review of scholarly research, safety guidelines, government control policies for use of ionizing radiation, and documented case studies. Qualitative and quantitative data are utilized to evaluate variation of ionizing radiation safety practices between the United States and Vietnam and how that has affected safety and public exposure risk. The data found is used to identify how funding, regulation, and adherence to safety protocols affect risk of being exposed

to ionizing radiation.

Practical methods for effective measurement and safety policies regarding ionizing radiation sources are identified in this study. Results of the analysis include recommendations for ionizing radiation safety and exposure policies internationally, with goals to implement safer management of contamination sources, taking into account financial availability, domestic development and cultural importance. These findings provide guidance for improving health, safety, and conservation standards in practices that manage potential sources of ionizing radiation contamination worldwide.

Keywords:

Radiation Safety; Ionizing Radiation; Radium; Vietnam; Medical Imaging

Mentor(s):

Mark Wilson (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1451

Presentation Time: Session 3: 12:00-1:00pm

Predicting Best Actors and Directors for Up-and-Coming Netflix Movies

Business Case Study

Authors(s):

Kinaya Arielle Hines† (DSB); Robert Pedro Chambers† (DSB); Somin Yang† (DSB); Emi Victoria Robinson‡ (DSB)

Abstract:

How can Netflix strategically select talent to maximize viewer engagement, visibility, and profitability before production begins? This project aims to enhance Netflix's content development and distribution strategy by predicting which actors, actresses, and directors are most likely to generate high audience ratings for upcoming titles. Our model supports data-driven casting and marketing decisions that optimize production investments and distribution strategies across global markets.

Using supervised learning methods, we analyze a dataset of Netflix titles containing information on cast, directors, genres, descriptions, production countries, and audience ratings. Missing country data are removed, and textual descriptions are vectorized using TF-IDF to capture narrative patterns. Models, including Multinomial Logistic Regression (with Ridge and Lasso regularization), Decision Trees, and Random Forests, are employed to identify creative and contextual factors that predict audience reception. Model performance is evaluated through accuracy, macro F1-score, and k-fold cross-validation to ensure balanced and interpretable results.

Exploratory Data Analysis reveals that while the United States dominates production volume, countries such as India, Japan, and the United Kingdom exhibit unique genres and creative trends. These findings suggest that cultural context, genre, and prior performance of talent are significant predictors of audience ratings.

By combining interpretability with predictive precision, the project provides a data-informed framework for global content forecasting. This approach enables Netflix to refine promotional campaigns, adjust release schedules, and allocate production budgets strategically—strengthening its competitive advantage through evidence-based talent selection.

Keywords:

Data Mining; Strategy; Predictions; Marketing; Research

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

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1452

Presentation Time: Session 3: 12:00-1:00pm

Automated Radio Evaluation Suite: Modular Architecture for PA and Antenna Testing STEM

Authors(s):

Carson Scott Hornert† (Engineering)

Abstract:

Next-generation communication systems demand precise, repeatable RF testing. Although commercial automation tools exist, they're often out of reach for research labs, which end up using manual workflows that are slow and error prone. The Automated Radio Evaluation Suite (ARES) addresses this gap with an open-source, MATLAB-based platform that automates power-amplifier and antenna characterization. The platform quantifies DC and RF power and computes gain, drain efficiency, power-added efficiency, output power, and linearity. For antennas, it supports return loss, realized gain, and radiation-pattern measurements using reference or dual-antenna methods.

This work advances ARES from a function-oriented architecture where measurement logic was tightly coupled to specific instrument sets to an object-oriented design with abstract interfaces for DC power supplies, signal generators, signal analyzers, and vector network analyzers. Vendor-specific VISA/SCPI behavior is encapsulated in modular drivers, enabling drop-in support for new instrument command sets without invasive code changes.

The new architecture also enables simulated instruments, bypassing VISA drivers when debugging new features. Validation on a bench setup and with simulators demonstrates command compliance, robust error handling, and reduced end-to-end test time. Declarative configuration, standardized logging, and versioned calibration procedures improve reproducibility and onboarding. Collectively, these enhancements expand device compatibility and accelerate data collection and visualization.

Keywords:

Test Automation; Object-Oriented Programming; VISA/SCPI; Modularity; PA/Antenna Characterization

Mentor(s):

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1453

Presentation Time: Session 3: 12:00-1:00pm

Assessing the Effects of Welding Fumes on Cognitive, Motor, and Mood Function in Welders Using Bootstrapped Bayesian Networks. STEM

Authors(s):

Michael Charles Howest†

Abstract:

The purpose of this study is to understand which metals and metal mixtures affect cognitive and motor functions, as well as increase mood symptoms (CMM variables). Prior studies have examined individual metals and their effects on welders; this study investigates the combined effects of multiple metals and varying exposure levels on CMM variables. Steel welding produces fumes that consist mainly of Aluminum, Copper, Iron, Manganese, and Zinc. Exposure to these metals has been linked to decreased CMM variables. Because welders are frequently exposed to these fumes, this study investigates how cumulative exposure to these metals affects cognitive, motor, and mood (CMM) functions, and which CMM variables are most strongly associated with increased exposure. Data from 46 welders were analyzed using Bootstrapped Bayesian Network conditional probabilities to model complex dependencies among metals, covariates, and CMM outcomes. Expected results are predicted to reveal significant negative associations between metal exposures and several CMM variables, particularly psychomotor speed (nondominant hand), visual search, and auditory simple attention. All metals showed an impact, but Manganese appeared to have the strongest and most consistent impact, suggesting it is key in impacting CMM performance. Welders exhibited increasingly poorer performance as exposure levels increased. Additionally, higher numbers of metals in the exposure mixture further compounded these effects, increasing cognitive and motor decline. The results show the importance of monitoring and mitigating metal exposures and mixtures to protect the cognitive, motor, and mood symptoms of welders.

Keywords:

[no keywords provided]

Mentor(s):

Jonathan R Kuhn (Purdue Northwest); Ulrike Dydak (HHS)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1454

Presentation Time: Session 3: 12:00-1:00pm

SoCET: PID Controller ASIC Accelerator for an Inverted Pendulum STEM

Authors(s):

Edward Zhaolong Hu† (Engineering); Steven Li† (Engineering|JMHC);
Andrew Yu-en Loh† (Engineering); Sim Seyha Ou† (Engineering)

Abstract:

Proportional-Integral-Derivative (PID) controllers are essential for stabilizing systems that require continuous feedback, including industrial processes, projectile guidance, automotive systems, and consumer electronics. PID controllers excel at stabilizing single-input single-output (SISO) systems, such as a rotary inverted pendulum, which is a notoriously unstable system requiring a fast read-calculate-response cycle. This project investigates how an external ASIC can expedite the calculations more efficiently and effectively than microcontrollers since ASICs are designed for a specific application and can be optimized for lower power consumption and greater speed. After the PID controller system is properly tuned through the Ziegler-Nichols method to remain stable, two separate experiment series will be conducted using the same rotary inverted pendulum hardware: one series will have no acceleration, and the other will be accelerated through an external ASIC with Dadda tree multipliers and other hardware accelerator structures. Using the sensors' data, the stability of the pendulum in both experiments will be compared through their individual error over time in MATLAB. Additional comparisons will include power consumption and physical layout differences.

Keywords:

PID Controller; ASIC; Control System; Accelerator; System-on-Chip

Mentor(s):

Malcolm Lloyd Seib McClymont (Engineering); Mark Johnson
(Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1455

Presentation Time: Session 3: 12:00-1:00pm

Wildcat Creek Winery Improvements

Business Case Study

Authors(s):

Micah Danel Huckaby† (DSB); Jacob Randal Patty† (DSB); Abigail Marie Carroll† (DSB); Emily Rose Christman† (DSB); Patience Rae Bridges‡ (DSB|JMHC); Samuel Stephen Sosebee‡ (DSB); William Monroe Resnick‡ (DSB)

Abstract:

Wildcat Creek Winery is a local winery in Lafayette, Indiana, owned and operated by Purdue alumna Nyssa Cranton, and has been in operation since 2008. The winery ferments, bottles, and sells its wine on-site using juices and fruits sourced from regional growers. Despite its strong local roots, the winery has struggled with customer acquisition and suffers from low visibility within the Greater Lafayette community. We believe there is significant room for growth in brand awareness, long-term customer loyalty, and community engagement.

The purpose of this study is to identify opportunities for Wildcat Creek Winery to strengthen its marketing strategy around customer engagement, specifically through enhancing its social media presence, collaborating with local businesses, and developing targeted promotions that appeal to Purdue students and members of the Greater Lafayette area. Research will be conducted through surveys distributed to both current customers and individuals unfamiliar with the winery.

The findings will help determine where Wildcat Creek Winery can improve its outreach and how to attract previously unaware consumers. Ultimately, this study aims to provide actionable recommendations that will help the winery increase awareness, attract new customers, maintain consistent engagement, and build a loyal customer base within the community.

Keywords:

Winery; Local; Promotions; Awareness

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1456

Presentation Time: Session 3: 12:00-1:00pm

Effects of AI Workshop on CS Students' Perceptions of AI STEM

Authors(s):

Cheyenne Mie Huggins† (Science)

Abstract:

Artificial intelligence is now a common tool that students utilize for various purposes. However, with the detrimental effects that AI can have when learning new concepts, these students need to understand when it is most appropriate to use AI and what problems may arise from its use.

Our research looks into incoming computer science students' perceptions of AI regarding AI's weakness, ethical concerns, and when best to use it in and outside of the classroom. Students participated in an AI workshop, which discussed how to use AI in the classroom ethically and some of the pros and cons of AI at large. We recorded students' perceptions of AI before and after they underwent an AI workshop using a pre-survey and a post-survey, both quantitative and qualitative, about students' perceptions and understanding of AI.

From our qualitative analysis, we found that students have overwhelmingly used AI for studying, learning, or related topics. Through our quantitative analysis, we have found that students' understanding of AI was not significantly altered. We attribute this to the brevity of the workshop and the fact that a majority of students had a fair amount of experience with AI before the workshop began and had thus solidified their views before the workshop. Overall, though the workshop had an impact on some students, there is evidence to suggest that AI intervention for first-year CS students should be a long-term process that takes into account how knowledgeable these students are about AI in this technologically focused age.

Keywords:

Education; Computer Science; Artificial Intelligence

Mentor(s):

Mary Anne Smart (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1457

Presentation Time: Session 3: 12:00-1:00pm

Maximizing use of Photovoltaics in Electric Vehicles STEM

Authors(s):

Vandana Dhriti Iyer† (Engineering)

Abstract:

Electric vehicles are growing rapidly as an alternative to traditional gas and hybrid cars, driven by the ongoing improvements in battery technology. As electric vehicles begin to play a huge role in sustainable transportation, there are still concerns about improving the energy efficiency and driving range. Completely relying on solar energy would increase the energy efficiency and has been considered by many existing vehicle companies. In practical terms, it is difficult to fit enough solar panels on the car to power the entire car. This study will simulate the amount of energy that can be produced due to the limited surface area of the car and determine how much energy is required to power an electric vehicle. By comparing these values and doing algebraic calculations to estimate the solar energy generation capacity constrained by the limited panel area, efficiency, and irradiance, I will use the SAM software to maximize the amount of energy produced by the photovoltaics through the power production and battery storage models. I will create behind-the-meter models that represent different battery chemistries to simulate energy use. I will also create models to represent scenarios when the electric vehicle is driving versus when it is parked. These discoveries will improve our understanding of how to maximize the energy efficiency and increase the driving range of the vehicle through photovoltaic systems.

Keywords:

[no keywords provided]

Mentor(s):

Peter Bermel (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1458

Presentation Time: Session 3: 12:00-1:00pm

VIP EdTechDev: Developing an Accessible Physical Computing Course STEM

Authors(s):

Tanya Jain† (Science); Jia Varshney† (Science); Chengxuan Li† (Science); Grace Katherine O'Hara‡ (DSB); Julia Madison Dolpiest‡ (DSB); Drew Raymond Hawley‡ (Science)

Abstract:

The purpose of this project is to create an interactive and thorough lesson plan to introduce students to physical computing through Raspberry Pi Pico and MicroPython. While we eventually plan to develop improved instructional tools, our current focus is on designing the structure and content of the course, including concept explanations, guided activities, and comprehensive projects. We are developing this course to best provide college students with hands-on experience no matter their experience level or degree type.

This semester, we continued to develop course material and labs using technologies such as Jupyter Book, Myst Markdown, MicroPython, and Raspberry Pi Pico. This course was developed as part of Purdue's ongoing commitment to furthering accessible hardware and software education. Overall, the course aims to lower barriers to entry in physical computing by offering every interested student the opportunity to build strong foundational hardware skills through projects, ranging from lighting an LED to building a drone. We will be conducting ongoing testing to determine the effectiveness of the course as an entry point for students, while guiding improvements to the curriculum and ensuring a manageable workload.

Keywords:

Engineering Education; Physical Computing; Problem Solving; MicroPython; Raspberry Pi Pico

Mentor(s):

John H Cole (Engineering); Jack Scarfo (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1459

Presentation Time: Session 3: 12:00-1:00pm

Purdue VIP: Windracers Development and Evaluation of a Custom PCB for Enhanced Aircraft Identification in the PURT Testing Facility STEM

Authors(s):

Lillian Ji† (Engineering); Anh Kim Ho† (Engineering); Joanna Yuping Wu† (Engineering); Jai Nanda Lakamsani‡ (Polytechnic)

Abstract:

This research focuses on the development and testing of a custom-made printed circuit board (PCB) to replace the current active marker board. The board would allow for identification of the aircraft within the PURT facility through a unique identifying frequency of flashing lights. It would enhance the scalability and efficiency of experimentation within the PURT testing facility through the ease of production and use with the updated PCB. Through iterative prototyping, circuit simulation, and experimental validation, the study demonstrates how the new PCB design can significantly enhance the operational efficiency and experimental throughput of the PURT facility. Future work includes analyzing the vehicle's flight to optimize the center of mass and flight attributes through placement of the PCB.

Keywords:

PCB Design

Mentor(s):

James Michael Goppert (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1460

Presentation Time: Session 3: 12:00-1:00pm

AI-Enhanced Nanodrug Delivery: Revolutionizing the Future of Cancer Treatment STEM

Authors(s):

Abigail Jimenez† (HHS)

Abstract:

As cancer reminds one of the world's deadliest diseases, AI is improving the precision of drug delivery systems through microscopic innovation. With global cancer cases expected to rise to 33 million annually and cancer related deaths projected to reach 18.2 million by 2050, the need for a great change is urgent. Research shows that AI can enhance nano-drug delivery by personalizing treatments to individual patients, improving the ability of drugs to bypass biological barriers, and directly targeting tumors, while minimizing harm to healthy cells. Furthermore, AI-drive systems can be adjusted to treat various types of cancers more efficiently, increasing effectiveness and reducing side effects. These advancements suggest that AI incorporated nano-medicines will play a transformative role in the oncology field, leading to safer, more personalized, and more successful cancer treatments in the future.

Keywords:

Nano-Drug; Nano-Medicines; Drug Delivery Systems

Mentor(s):

Sidney Ducleroir (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1461

Presentation Time: Session 3: 12:00-1:00pm

**Biogenic Membranes with Ultralow Thermal Conductivity for
Enhance Water Desalination
STEM**

Authors(s):

Dev Vishwash Joshi† (Engineering); Mirza Orunav Shahpert
(Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Membrane Distillation; Desalination; Thermal Conductivity; Thermal
Efficiency

Mentor(s):

Waqas Alam (Engineering); David Warsinger (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1462

Presentation Time: Session 3: 12:00-1:00pm

ECE Labs.io upscaling - Making FPGA more accessible STEM

Authors(s):

Pradyunn Vikram Kale† (Engineering); Justin Samuel‡ (Engineering)

Abstract:

ECE Labs.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. The new board that I am verifying and correcting aims to combine power and communication all over 1 wire using Ethernet. To verify the board, I am using a variety of test cases to verify each peripheral work, more specifically, to verify the RP2040 is communicating with the GPIO expanders correctly, the GPIO expanders are allowing for FPGA flashing in a proper manner. The reason we aim to replace the current boards that ECE Labs.io uses with these ones is because it consolidates high speed data and power into one wire. This allows for better organization in the server room, and much easier debugging when something does go wrong. There is less room for error. This makes hardware design much more accessible for students because it opens up possibility to scale because we are only using one wire as opposed to 3 for each board. This allows more students to use the website at the time and thus makes it more accessible. The expected outcome is that our cable management will be much better, allowing for better debugging when things do go awry, and allows for an upscale in the number of FPGAs usable by the website, meaning more people can use the site at once.

Keywords:

FPGA; Ethernet; Raspberry Pi; GPIO

Mentor(s):

Junfei Li (Engineering); Brett Michael Heckman (Engineering); Rhea Vashishtha (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1463

Presentation Time: Session 3: 12:00-1:00pm

Hardware-Aware PTMPicker: A Pragmatic Approach to Pre-trained Model Selection STEM

Authors(s):

Gunvanth Reddy Kandula† (Science|JMHC); Hyeonwoo Heo† (Engineering); Milo Li Reed† (Engineering); Adrian Pathupally Mathew† (Science); Soham Rattan‡ (Engineering); Charles Chen‡ (Science)

Abstract:

The rapidly increasing use of Pre-Trained Models (PTMs) in various fields to eliminate the need for the resource-intensive training traditionally associated with artificial neural network implementations have led to a surge of new PTMs into model repositories. Despite the astonishing volume of PTMs available, only a few are particularly suitable for each unique task, making the problem PTM selection key to unlocking the full potential PTMs. Additionally, accuracy is not the only concern, as there are usually hardware limitations that need to be accounted for in real-world applications. Specifically, we need to output a ranking of the top k PTMs given a specific task, dataset, hardware constraints, and corresponding importance ratings. After exploring a myriad of current PTM selection methods, we propose a pipeline involving the frameworks PTMPicker, Fennec, and NeuSight. Each of these frameworks addresses at least one of the current issues with PTM selection and allows for hardware-aware selection, something existing approaches struggle to integrate. Our approach will be evaluated on task-specific benchmarks with a variety of hardware specifications to simulate real-world hardware constraints.

Keywords:

Pre-Trained Models; Hardware Aware; PTM Selection

Mentor(s):

James C Davis (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1464

Presentation Time: Session 3: 12:00-1:00pm

Predicting Post-Injury Performance in the NFL

Business Case Study

Authors(s):

Dexter McCann Kelleher† (DSB); Jaime Hyun-Kiu Lee† (DSB); Benjamin Evan Keim† (DSB); Anish Reddy Kuthuru‡ (DSB)

Abstract:

How are serious injuries associated with NFL players' performance? This project aims to evaluate the predictive value of significant injuries for NFL players' performance in the season following recovery. The motivation behind this research comes from the high stakes of professional football, where injuries can alter careers and influence team success. By applying analytical methods to this issue, we hope to provide insights that benefit players, coaches, and organizations in understanding recovery outcomes.

Our dataset combines over two decades of publicly available information from NFL.com Injury Reports, Pro Football Reference, and Kaggle's NFL datasets, totaling thousands of player observations. We cleaned and merged multiple data sources, handled missing values, encoded categorical features, and engineered new variables, including injury severity, performance ratio, and recovery duration. Exploratory data analysis revealed that running backs and receivers tend to experience greater post-injury declines than quarterbacks or linemen, highlighting apparent positional differences in recovery patterns.

To predict post-injury performance, we first developed a baseline linear regression model to capture direct relationships, followed by a more complex random forest model to account for nonlinear associations and interactions. Model performance was evaluated using k-fold cross-validation on a held-out dataset, with RMSE as the primary accuracy metric.

This project not only contributes to smarter decision-making in professional football but also emphasizes the growing role of data analytics in understanding sports' performance and recovery. By combining sports, medicine, and data science, our study shows how predictive modeling can improve player safety, guide team strategy, and help shape a more data-informed future for the NFL.

Keywords:

NFL Injuries; Predictive Modeling; Sports Analytics; Post Injury Performance; Feature Engineering

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1465

Presentation Time: Session 3: 12:00-1:00pm

Identifying the Higgs Boson from CMS Simulated Events STEM

Authors(s):

Matthew Christopher Kim† (Science); Shihui You† (Polytechnic); Gabriel Hammond† (Science); Suhani Sunder‡ (Science)

Abstract:

The objective is to study simulated events where the Higgs Boson decays into a Z boson pair, which will each subsequently decay into two leptons. We intend to filter these four lepton events into three decay channels: 4 electrons, 4 muons, and 2 electrons 2 muons, by their various properties. This includes the transverse momentum, pseudorapidity, and lepton quality. We intend to pair the filtered leptons via their invariant mass to recreate the Z boson pairs and identify the signal of the Higgs boson. By applying these cuts and reconstruction techniques, we hope to separate the Higgs signal from the background noise such as lepton and Z boson productions. Otherwise, we will present on our findings so far, as well as the difficulties we face.

Keywords:

[no keywords provided]

Mentor(s):

David Alan Ruiter (Science); Heather Nicole Martin (Science); Andy Jung (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1466

Presentation Time: Session 3: 12:00-1:00pm

Metal-Insulator-Metal Capacitor Fabrication Optimization with Statistical Process Control STEM

Authors(s):

Jozue Kim† (Engineering); Kyle Zhen-Han Wang† (Engineering); Robert James Gentle† (Engineering); Azizul Zikry Mohd Amaluddin† (Engineering); Haneul (Sky) Kim‡ (Polytechnic)

Abstract:

Metal–insulator–metal (MIM) capacitors with HfO₂ as an insulator can show unwanted surface growth and oxidation when Ni is used as the bottom electrode, which harms surface quality and device behavior. In the scope of this project, we evaluate one practical mitigation by adding a thin Pd cap above Ni using a whole-wafer, unit-process approach designed for speed, repeatability, and low cost. Our team runs the same flow in parallel, and we analyze outcomes with statistical process control (SPC). Our split compares Ti/Ni (baseline) to Ti/Ni/Pd under matched conditions. Metals are deposited by PVD e-beam evaporation; patterning uses a Spinner and MA-6 mask aligner; HfO₂ is deposited by Cambridge Nanotech Fiji ALD; and openings are formed by RIE. Without fabricating full devices, we examine the wafers with a Park NX20 AFM, Keyence VHX-7000, and Woollam M-2000 ellipsometer to judge uniformity, cleanliness, and overall surface condition before and after etching. A single XPS check at the end will provide chemical confirmation.

Scope note: This Pd-cap path is one of several parallel approaches our six-team cohort is exploring under the same SPC framework. Together, these coordinated studies provide a practical, data-driven way to screen bottom-electrode options for HfO₂ MIMs using tools common to university fabs, before committing to full electrical fabrication and testing.

Keywords:

Statistical Process Control (SPC); Metal-Insulator-Metal; Fabrication; Cleanroom; Capacitor

Mentor(s):

Zhihong Chen (Engineering); Joerg Appenzeller (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1467

Presentation Time: Session 3: 12:00-1:00pm

Bridging Theory and Practice: A Software-Controlled Analog Circuit Platform for ECE 20007 STEM

Authors(s):

Geuntae Kim† (Engineering|JMHC)

Abstract:

This research focuses on developing a modular analog circuit matrix board designed to enhance experiential learning in Purdue's ECE 20007 (Electronic Measurement Techniques) course. The system enables students to construct and analyze real-world resistor, capacitor, and inductor (RLC) networks using a digitally controlled, reconfigurable testbed. The board integrates an RP2040 microcontroller for digital control and employs CH446Q crosspoint switches, solid-state relays, and daisy-chained 74HC595 shift registers to configure circuit topologies dynamically. Through these programmable connections, students can observe practical voltage-current responses corresponding to their theoretical circuit models. The design process involved optimizing the selection of passive components through subset-sum analysis to maximize available combinations while minimizing the total number of parts and switch count. Supporting elements—such as op-amps (LF356N), comparators (LM239N), and timers (LM555CN)—extend the educational range to active analog circuits. To ensure robustness, the system incorporates bidirectional TVS diode protection, careful signal and ground layer separation, and decoupling strategies across power and control lines. Ultimately, this project bridges theoretical circuit analysis with hands-on experimentation, allowing students to visualize and measure analog behavior in a scalable, software-controlled hardware environment. This modular system will be tested in upcoming ECE 20007 lab sessions to evaluate its effectiveness in improving student comprehension and reducing circuit-assembly time.

Keywords:

Reconfigurable Hardware; Analog Circuit Education; RP2040 Microcontroller; Experiential Learning

Mentor(s):

Junfei Li (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1468

Presentation Time: Session 3: 12:00-1:00pm

Optimizing Instruction Scheduling with a VLIW Processor Design STEM

Authors(s):

Joshua David Klug† (Engineering); Michael Lee‡ (Engineering); Navya Harini Datla† (Engineering)

Abstract:

Efficient scheduling of instructions is critical for improving processor performance, as it determines how and when instructions are issued into functional units for execution. Prior solutions, such as scoreboarding, can consume significant amounts of power and area. Additionally, they can suffer performance limitations due to Flynn's bottleneck, the idea that even if we have many functional units capable of executing operations in parallel, performance can still be limited by the rate at which instructions are fetched, decoded, and issued from a single instruction stream. To address these inefficiencies, this work explores a Very Long Instruction Word (VLIW) processor enhanced with aspects of Explicitly Parallel Instruction Computing (EPIC) concepts to better exploit instruction-level parallelism (ILP). By allowing independent instructions to execute simultaneously across different functional units, our design aims to decrease power consumption and area while also increasing the number of instructions executed per cycle, and thereby improving performance. However, this approach increases compiler complexity, requiring the generation of packetized instructions that can fully utilize the resources available in the hardware. Additionally, gains in performance depend on the level of ILP present within the workload. Moving forward, our team will implement this VLIW architecture to develop a scheduler core that maximizes performance while maintaining power efficiency and minimal area. This hardware has the potential to accelerate AI workloads such as matrix multiplication, offering an efficient solution for next-generation processors.

Keywords:

AI Hardware Acceleration; Very Long Instruction Word (VLIW)

Mentor(s):

Rishikesh Reddy Bathina (Engineering); Sooraj Chetput Venkataraghavan (Engineering)

Other Acknowledgement(s):

Jay Rahul Shah (Engineering); Evan Lee Miller (Engineering)

Poster Presentation Abstract Number: 1469

Presentation Time: Session 3: 12:00-1:00pm

**Designing a program to create SystemVerilog implementation
of a diagram on ECE Labs.io
STEM**

Authors(s):

Jason Andrew Klutho† (Engineering)

Abstract:

ECE Labs.io is an online platform that allows students to have remote access to real Field-Programmable Gate Arrays (FPGA) to design, implement, and test hardware labs and projects without the need to purchase or set up physical hardware. The software team develops and maintains the website and focuses on improving reliability and user experience. One of the features on the website is the diagram page where students can create logic schematics and blocks to show the functionality and flow of signals in a digital system. This research aims to develop a Python program that can convert the diagram made by the student into synthesizable SystemVerilog code. The program can create implementations for both combinational and sequential circuits in behavioral, structural, and data flow modeling types. This integrates seamlessly into the ECE Labs.io workflow by serving as a bridge between the diagram creation page and the FPGA testing environment, and it streamlines the learning process as students can move directly from a visual design to hardware implementation. The program is expected to be fully integrated with the next version of ECE Labs.io by the end of the semester.

Keywords:

[no keywords provided]

Mentor(s):

Junfei Li (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1470

Presentation Time: Session 3: 12:00-1:00pm

Design Improvements and System Integration of a Timber Frame Construction Robot STEM

Authors(s):

Taran Sid Koduri† (Engineering); Berra Ulku Kalci† (Engineering); Angel Francisco Castillo Aldaco‡

Abstract:

Despite modern advances, the construction industry is slow to implement automation in its processes, jeopardizing productivity and environmental sustainability. By implementing robotic collaboration, costs can decrease and injury risk can be lowered, bridging the gap towards a higher level of robotic automation in the industry. This paper improves the end effector design of a patented timber-frame construction device by replacing and refining the motor mount from an earlier prototype. A mobile base and new robotic arm were added to emphasize human to robot collaboration while also helping with improving fit, alignment, and maintenance. Parts of the end effector exhibiting operational issues were also updated, and all updated sections were assembled and tested, resulting in a sturdier prototype and a clearer path to reliable field use.

Keywords:

Construction; Robotic Automation; Collaborative Robotics; End Effector; Timber Frame Construction

Mentor(s):

Jiansong Zhang (Polytechnic); Megan Amy Rudo (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1471

Presentation Time: Session 3: 12:00-1:00pm

Real-Time Evaluation of Cellist Posture Using On-Device Computer Vision STEM

Authors(s):

Kayoon Koh† (Science); Trevor Mission Ju† (Engineering); Preston Tang Mo† (Engineering); Ziang Wang* (Science); Michael X Zhang* (Engineering); Ekaterina Tsziao* (Science); Shrinand Perumal* (Science); Sanjana Tatavarthi* (Science); Jackson Patrick Shields* (Science); Paige Lorenz* (Science); Sivamurugan Velmurugan* (Science); Luke Jaehyeon Choi* (Science|JMH)

Abstract:

Maintaining proper posture is crucial for cellists to prevent musculoskeletal injuries and improve performance. However, limited lesson frequency often leaves beginners without consistent feedback, allowing poor habits to develop during independent practice. Our research addresses this issue through Cello Evaluator, a mobile application that provides real-time, on-device posture assessment using computer vision. The application integrates a lightweight inference pipeline for analyzing wrist, elbow, and bow posture. Posture classification of the hand and elbow is achieved using Google Mediapipe's Pose and Hand Landmark Detection models, which extract hand, wrist, elbow, and shoulder landmarks. A YOLOv11 object detection model identifies the bow and string regions, while linear algebraic methods are applied to evaluate bow angle, bow positioning, and shoulder height. The extracted landmarks and computed coordinates are then fed into two Deep Neural Networks (DNNs) that classify wrist orientation (supinated, pronated, neutral) and elbow height (high, low, normal). Cello Evaluator supports both pre-recorded video processing and live-camera feedback, providing annotated bounding boxes for the bow and string areas, key points of the tracked bow hand, and textual guidance for posture correction. User testing will begin in late October with 20 cellists of varying skill levels participating in a usability study. By analyzing error rates from each session, we anticipate a measurable reduction in postural errors with continued use.

Keywords:

Computer Vision; Posture; Music Technology; Evaluation; Deep Neural Networks

Mentor(s):

Yung-Hsiang Lu (Engineering); Yeon Ji Yun (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1472

Presentation Time: Session 3: 12:00-1:00pm

Atalla - Convolution & Systolic Array

STEM

Authors(s):

Saandiya KPS Mohan† (Engineering); Nikhil Kishore Vaidyanath‡ (Engineering); Myles Joshua Pristin Querimitt† (Engineering); Mixuan Pan† (Engineering)

Abstract:

Convolution is a mathematical operation used in machine learning tasks but often becomes performance bottleneck in models like CNN (Convolutional Neural Network) and NLP (natural language processing) due to their heavy computational demands, high memory bandwidth requirements, and latency from moving data between memory and compute units. The SoCET AI hardware team is designing an AI accelerator processor using a systolic array architecture for efficient convolution execution. Our earlier implementations were unable to correctly feed input data into the systolic array, resulting in significant latency and wasted memory bandwidth. To address this, (1) we use a vector core developed to construct a Toeplitz matrix directly streaming data into the systolic array, enabling convolution to be executed as a General Matrix Multiplication (GEMM), and (2) each MAC uses a depth-optimized Wallace Tree multiplier customized for FP16 and BF16 mantissas with implicit one handling, carry-save compression and a short rounding final adder. This design minimizes redundant memory access and hardware usage through structured tiling and on-chip reuse while continually supplying the systolic array through vector registers. The outcomes of this approach include ability to use systolic array for both convolution and GEMM, constant throughput, and decreased area. Limitations include requiring extensive compiler support, 32 or more cycles of instruction latency, and potential underutilization of the systolic array, which depends on the number of kernels and operations occurring at once. Next steps will include implementing and verifying this design, along with defining worst and best case latencies such that instruction can be interleaved to pipeline the process at a software level.

Keywords:

Convolution; Systolic Array; Wallace Tree; Vector Core; AI Hardware

Mentor(s):

Malcolm Lloyd Seib McClymont (Engineering); Anand Raghunathan (Engineering); Sooraj Chetput Venkataraghavan (Engineering); Fan Jing

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

Hoon (Engineering); Mark Johnson (Engineering); Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Vinay Pundith (Engineering)

Poster Presentation Abstract Number: 1473

Presentation Time: Session 3: 12:00-1:00pm

Fisher Funeral Chapel

Business Case Study

Authors(s):

Daniel Joseph Kral† (DSB); Ian George Sellar† (DSB); Liam Bennett Arnold† (DSB|JMHC); Ramiro Jose Gonzalez† (DSB); Sara Negishi‡ (DSB|JMHC); Riya Dadheech‡ (DSB)

Abstract:

This case study examines Fisher Funeral Chapel, a family-owned funeral and cremation service operating in Logansport and Lafayette, Indiana. It provides a comprehensive overview of Fisher Funeral Chapel as a whole, examining its past success, revenue drivers, and overall operations while developing a basic understanding of the funeral services market in Northwest Indiana. The study includes an evaluation of competitor dynamics, market positioning, and promotional outreach to identify the key factors influencing Fisher's growth and opportunities within the region.

Data will be collected through market research, basic competitor analysis, and select internal business records from Fisher Funeral Chapel. These insights will inform an assessment of the regional market environment, Fisher's internal operations, and competitive positioning. This analysis will identify current challenges and potential avenues for expansion.

The ultimate goal of this study is to assist Fisher Funeral Chapel in strengthening its differentiation, increasing pre-funded contract sales to ensure long-term stability and growth, and enhancing its community outreach and promotional efforts. The study will conclude with actionable recommendations to support sustainable growth and reinforce Fisher's leadership in the regional funeral services market.

Keywords:

Case Study; Marketing; Marketing Strategy

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1474

Presentation Time: Session 3: 12:00-1:00pm

Sex Differences in Distortion Product Otoacoustic Emissions Following Small Arms Fire-like Noise Exposure STEM

Authors(s):

Hrishikesh Murli Krishna† (Science); Jax Patrick Marrone‡ (Engineering)

Abstract:

Distortion product otoacoustic emissions (DPOAEs) are acoustic signals generated by the cochlea in response to two different frequency tones interacting nonlinearly with the basilar membrane. The nonlinear interaction is due to the active motility of outer hair cells (OHCs), which amplify vibrations of the basilar membrane, subsequently producing distortion components. DPOAEs in subjects with outer hair cell damage possess a diminished or absent distortion product (DP), making DPs a useful metric of cochlear function.

This study investigates the longitudinal effects of small arms fire-like (SAF) impulse noise exposure on DPOAEs and examines potential sex-based differences in cochlear recovery. Previous studies have shown that DPOAE responses differ between sexes, with females showing greater resilience to auditory stressors, suggesting potential sex-dependent mechanisms in cochlear recovery (Guimaraes et al., 2004). Adult male and female rats were exposed once to SAF noise. Baseline DPOAEs were collected before exposure, and post-exposure DPOAEs were collected over various time points during a 56-day period. Post-exposure DP amplitudes were analyzed relative to baseline to assess any changes to OHC function. Ongoing analysis aims to expand these findings by including additional functional group analyses to further understand sex-dependent patterns and differences in OHC recovery following SAF noise exposure.

Keywords:

Sex Differences; Small Arms Fire-Like Noise; Hearing Loss; DPOAEs; Rats

Mentor(s):

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1475

Presentation Time: Session 3: 12:00-1:00pm

University Students Writing Across Genres: A Study on Genre-Writing Approach Pedagogy Humanities

Authors(s):

Gabrielle Ruth LaBelle† (Liberal Arts)

Abstract:

Many university students, especially at STEM institutions such as Purdue University, struggle with writing. The simple idea of writing, whether it be a cover letter or a lab report, can be intimidating to the average university student. One factor that may add complexity to writing is the genre—writing shifts from one genre to another, from the audience to the language required. However, students are not taught that there is more than one way to write, especially when it comes to approaching different genres. Genre-writing approach pedagogy teaches writing based on the context and purpose of the specific genre, then models a sample text by analysis of its features, followed by constructing a similar text with guidance from instructors, and finally, independent writing of the genre. This type of writing pedagogy, or method of teaching, may better prepare students for successful writing in both academics and their long-term professional careers. In this project, I will examine previous experiments of genre-writing approach pedagogy within groups of university students to make a claim on how this method specifically impacts university students, both the positives and negatives of teaching writing with this approach, and whether this method should be implemented on a larger scale.

Keywords:

Writing; Genre; Genre-Writing Approach; University Students; Teaching

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1476

Presentation Time: Session 3: 12:00-1:00pm

The Impact of College Residence Living on Student Well-being
Humanities

Authors(s):

Layla Marie Lanari† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1477

Presentation Time: Session 3: 12:00-1:00pm

Employee Retention Methods Using IoT and AI integration Business Case Study

Authors(s):

Aelish Marie Ligon† (Engineering); Zoey Zhu Bussick† (DSB); Eann M Gatuna† (DSB)

Abstract:

By analyzing workplace behavior and wellness data, organizations can gain deeper insights into the factors influencing job satisfaction and turnover. The model envisions tracking office attendance, working hours, and workspace utilization through secure Internet of Things (IoT) systems, while optionally linking personal wellness devices or apps to collect information on stress levels, activity, and rest patterns.

Artificial Intelligence (AI) algorithms would process these continuous data streams to identify trends related to employee engagement and burnout risks. Predictive models could then forecast potential turnover or disengagement before they occur, allowing management to take early, targeted actions - such as balancing workloads, offering flexible schedules, or initiating wellness interventions.

The combination of IoT's real-time monitoring and AI's analytical capabilities enables a shift from reactive human resource management to proactive employee support. This approach promotes a healthier work environment, enhances decision-making, and builds a culture centered on wellbeing and retention. Ultimately, this research aims to demonstrate how intelligent data systems can help organizations in 2025 retain talent, boost satisfaction, and create sustainable workplace engagement.

Keywords:

Employee Retention; IoT; AI; Turnover; Efficiency

Mentor(s):

Steven R Dunlop (DSB); Saanvi Singh (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1478

Presentation Time: Session 3: 12:00-1:00pm

Liability and Legal Aspects of Self-Driving Vehicles

Humanities

Authors(s):

Andruw Kuang-Le Lin† (Engineering)

Abstract:

Developments in the automotive and artificial intelligence industries have led to increased levels of automation in self-driving vehicles, with Waymo unveiling fully automated vehicles in certain markets. This new technology presents a critical issue. Who is responsible for accidents that are caused by self-driving cars? With more than 40,000 vehicle accidents a year in the U.S. alone, this is an essential question (Copp et al. 6752). In this exploratory research project, I investigate the legal liability aspects of self-driving cars and how lawmakers should go about creating rules in the future, as well as looking at existing studies on public perception on how the blame from accidents should be distributed. The purpose of this research is to create recommendations for law and policymakers on how to go about creating a new set of laws revolving accidents involving self-driving vehicles. To investigate this issue, I consult studies previously done on liability in self-driving car accidents, in forms of survey results and thought models. This research project highlights the challenges that humanity faces when the legal liability aspects associated with artificial intelligence become increasingly complex. The findings of this research have potential to provide suggestions to how liability should be handled surrounding artificial intelligence in the automotive industry.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1479

Presentation Time: Session 3: 12:00-1:00pm

Metazoom

STEM

Authors(s):

Pei-Chi Liu† (Engineering); Yan-Jun Lin† (Engineering); Shravan Pradeep† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Yuanrui Chen (Engineering); Harshana Weligampola (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1480

Presentation Time: Session 3: 12:00-1:00pm

Medical Imaging Artificial Intelligence: How to Ease Patients' Minds Humanities

Authors(s):

Chloe Christine Louk† (HHS)

Abstract:

Artificial intelligence (AI) is expanding exponentially every day, bringing groundbreaking advancements of MRI technology into the healthcare system. With new MRI technology containing AI enhancements, radiologists are able to analyze medical images faster than ever. However, patients have concerns with AI in radiology due to a lack of transparency and ethical issues. Current research shows that patients' most pressing issue against AI in healthcare is the potential "lack of human supervision in care" (Moy 54). This exploratory research aims to find how best to incorporate AI imaging in radiology departments with the goal of best meeting patient needs and enabling transparency in diagnoses. To investigate this issue, I conducted a preliminary literature review on current uses of medical imaging AI, how radiologists can work alongside AI, and how radiologists communicate to their patients about the use of AI. Additionally, I considered what benefits AI in medical imaging holds for both patients and radiologists. This research highlights the importance of a transparent radiologist-patient relationship to gain positive views of AI, as well as how the implementation of AI in medical imaging will provide benefits to the patient and the radiologist, which will contribute to the advantages of implementing AI into healthcare.

Keywords:

[no keywords provided]

Mentor(s):

Jessica M Mercado (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1481

Presentation Time: Session 3: 12:00-1:00pm

Context-Driven Semantic Modeling for Object and Activity Prediction STEM

Authors(s):

Katherine Ma† (Engineering); Raymond Chi† (Engineering); Aram Kaloust† (Science); Alexandre Wade Rosental† (Engineering)

Abstract:

This VIP project focuses on developing a gaze-based object prediction system that anticipates the object a user is focusing on and, ultimately, infers their intended action within complex environments. The work builds on a transformer-based gaze estimation and object recognition model by integrating temporal and contextual cues from egocentric video datasets. Using the HD-EPIC dataset as a foundation, our system leverages a transformer-based architecture to process both eye-gaze vectors (already done) and environmental context frames (recently working on), enabling fine-grained prediction of gaze-object interactions.

In the current phase, the project expands beyond gaze localization to add richer semantic meaning to model predictions. We are developing a pipeline that integrates object classification using YOLOv8 with natural language reasoning modules to generate interpretable activity summaries. The system first detects and classifies objects across video frames, grouping temporal interactions into structured event sequences. These sequences are then processed through lightweight NLP reasoning to infer plausible activities, transforming raw detection data into concise, human-understandable narratives. This approach bridges the gap between low-level gaze detection and high-level action understanding, enabling the model not only to recognize what users are looking at, but also to describe what they are doing in context.

Future work will explore multimodal learning approaches that integrate gaze, hand motion, and scene context for a more comprehensive understanding of human intent. The long-term goal is to advance gaze-based AI systems capable of generalizing across diverse real-world environments, with applications in assistive technologies, human-robot collaboration, and cognitive behavior modeling.

Keywords:

Machine Learning; Computer Vision; Egocentric

Mentor(s):

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1482

Presentation Time: Session 3: 12:00-1:00pm

Impact of the Habitat for Humanity Build Process on Quality of Life: Neighborhood Revitalization in Greater Lafayette Social Science

Authors(s):

Leo Pearson Malachowski† (Engineering|JMHC); Bridget Katherine Heindl† (Liberal Arts|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, Purdue University Habitat for Humanity - Campus Chapter, and the Purdue John Martinson Honors College.

Through surveys and interviews, we aim to assess the impact of housing on well-being, neighborhood connectedness, and community culture, gathering insightful information about the physical and emotional factors that contribute to overall well-being. 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. Combining key aspects of livability from Veenhoven, with an emphasis on connected communities from the QOLF Framework 2.0, enables us to examine both environmental livability and individual life-ability, while also considering connected communities, equity, and overall life satisfaction.

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 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 enhance the community's livability.

Keywords:

Community Revitalization; Quality of Life; Affordable Housing; Community Engagement

Mentor(s):

Jason Ware (JMHC)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1483

Presentation Time: Session 3: 12:00-1:00pm

Combined Two-Color Resonance-Enhanced Multiphoton Ionization (2-Color REMPI) and Coherent Microwave Scattering for Diagnostics of Electric Propulsion Systems STEM

Authors(s):

Mathis Malaussen† (Engineering); Liam Allen West† (Engineering)

Abstract:

Advancing non-intrusive diagnostics for plasma characterization is essential for improving the understanding and performance of electric propulsion (EP) systems. In this work, an approach using two-color Resonance Enhanced Multiphoton Ionization (2-color REMPI) is developed as a potential diagnostics tool for the characterization of EP plumes. REMPI enables selective ionization of certain species by using laser wavelengths tuned to a resonant intermediate energy state of the species. The number density of the ionized species is then determined using coherent microwave scattering (CMS). 2-color REMPI expands on this concept by using two separate beams of different frequency, allowing the volume of isolation to be well-defined. This study focuses on the initial implementation and experimental validation of the 2-color REMPI method used in this context, tested at atmospheric conditions. Ionization of molecular oxygen (O₂) was demonstrated using a pulsed laser with one beam at 355nm, and a tunable parametric beam at 241.2nm, giving a total energy where the targeted resonance of O₂ occurs. Signal generation was verified using an ICCD camera. Results confirm that the two-beam configuration can successfully generate measurable ionization corresponding to the targeted transition of O₂. These findings establish a foundation for the use of 2-color REMPI to EP diagnostics, where species-specific measurements are needed without perturbing the existing plasma. Ongoing efforts aim to extend this demonstration to a broader range of pressures and implementing coherent microwave scattering (CMS) into the system, allowing for higher precision.

Keywords:

Two-Beam Rempi; Electric Propulsion; Plasma Diagnostics

Mentor(s):

Alexey Shashurin (Engineering)

Other Acknowledgement(s):
Nicholas Vytautas Babusis (Engineering)

Poster Presentation Abstract Number: 1484

Presentation Time: Session 3: 12:00-1:00pm

Beyond the Bell: A Qualitative Comparative Analysis of Relational Practices That Shape Pre-Service Teachers' Understanding of Student Needs

Social Science

Authors(s):

Lucas Allen Mathiest† (HHS)

Abstract:

Pre-service teachers often develop important professional insights through informal interactions that take place outside the traditional classroom setting. Activities such as eating lunch with students, supervising recess, and monitoring hallways offer meaningful opportunities to observe student behavior, build rapport, and gain practical understanding of school dynamics. This study employs Qualitative Comparative Analysis (QCA) to explore which combinations of relational practices most effectively support reflective growth and instructional readiness among pre-service teachers. Written reflections collected during structured field experiences are analyzed using NVivo to identify key conditions, including proactive engagement, responsiveness to student behavior, emotional awareness, and consistent presence in informal settings. QCA is used to examine how various combinations of these conditions relate to outcomes such as increased confidence, enhanced observational skills, and a stronger understanding of student needs. By focusing on everyday school interactions beyond formal instruction, this research provides insights into how early field experiences can be intentionally designed to enhance teacher preparation. The findings emphasize the developmental value of relationship-building and reflection in preparing future educators to work effectively across a range of educational settings.

Keywords:

Pre-Service Teachers; Teacher Preparation; Relational Practices; Field-Based Learning; Qualitative Comparative Analysis

Mentor(s):

Jasmine Begeske (Education); Sariya Shabnam (Education)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1485

Presentation Time: Session 3: 12:00-1:00pm

How The City Decides When You Can Breathe

Business Case Study

Authors(s):

Max Elliott Matteucci† (DSB|JMHC); Andrew Logan Oberholzer† (DSB);
Andrew Lawrence House† (DSB); Ella Sage Dawes† (DSB)

Abstract:

How can cities anticipate dangerous fluctuations in air pollution to protect public health and guide policy? With industrialization growing worldwide, air pollution remains a pressing global concern. Carbon monoxide (CO) poses serious risks because its concentrations shift rapidly with weather and human activity. Our project addresses this challenge by forecasting hourly CO levels. By identifying pollution peaks throughout the day, we aim to provide insights that help residents make safer decisions and equip policymakers with evidence-based tools to mitigate risks.

Using the UCI Air Quality dataset, which contains a year of hourly pollutant and weather measurements in Milan, we examined patterns in CO alongside temperature, humidity, and traffic-related activity. Exploratory analysis revealed significant temporal and seasonal trends, with peaks during commuting hours. These findings highlight how environmental conditions and human behavior interact to drive CO variability, framing the foundation for predictive modeling.

To validate these insights, we employ a staged modeling approach. First, a baseline linear regression establishes a benchmark. We then extend to more complex methods, including tree-based algorithms evaluated through k-fold cross-validation, RMSE, MSE, and both R and adjusted R-squared. The final model is selected based on minimizing prediction error, ensuring both reliability and interpretability in short-term forecasts.

The broader impact extends beyond technical modeling. Accurate CO predictions can support public health preparedness, enabling hospitals to anticipate spikes in admissions and allocate resources. Policymakers could use forecasts to adjust traffic timing, expand car-free zones, or issue alerts to limit outdoor activity.

Keywords:

Health; Air Quality; Machine Learning; Regression; LLM

Mentor(s):

Davi Cordeiro Moreira (DSB)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1486

Presentation Time: Session 3: 12:00-1:00pm

Dimerization and Functional Characterization of Adenylyl Cyclase Isoforms 6 and 9 STEM

Authors(s):

Isabella Marie Mayr† (Agriculture|JMHC); Sarah Lisa Steffey*
(Pharmacy|JMHC)

Abstract:

Adenylyl cyclases (ACs) catalyze the conversion of ATP into cAMP, a key signaling molecule that regulates numerous physiological processes. Among the nine membrane-bound AC isoforms, AC6 and AC9 are of interest due to their distinct regulatory mechanisms and potential to interact functionally. While all AC isoforms are stimulated by Gs, AC6 is also inhibited by Gi and Ca²⁺ and strongly stimulated by forskolin. However, AC9 is reported to be relatively insensitive to forskolin and remains the least characterized isoform. Previous data suggests that AC9 may play a role in negatively regulating the AC6 activity. To understand the regulatory mechanism and functional interplay of AC6 and AC9 interaction, we investigated the potential dimerization of AC6 and AC9 using a cell-based NanoBRET assay and functional activity using an HTRF™ cAMP assay. NanoBRET analysis provided evidence for homodimerization of AC6 and AC9, and heterodimerization between the two isoforms. Functional assay results revealed that AC6 remains robustly responsive to forskolin but insensitive to calcium. AC9 exhibits modest cAMP accumulation in response to co-stimulation with isoproterenol and forskolin. Together, these findings supported that AC6 and AC9 dimerizes, and such interactions may influence cAMP signaling output. Given their expression in tissues critical for cardiac and neural signaling, understanding the interactions of AC6 and AC9 provided new insight into cAMP regulation and may contribute to the development of targeted therapies for disorders involving dysregulated G-protein–coupled receptor pathways.

Keywords:

Adenylyl Cyclase; G Protein Signaling; Dimerization; Drug Discovery; Signaling

Mentor(s):

Sadikshya Aryal (Pharmacy); Val Watts (Pharmacy)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1487

Presentation Time: Session 3: 12:00-1:00pm

American vs European Construction: The Building Methods that have Shaped Human Propensity Humanities

Authors(s):

Isabella Sophia Metternich† (Exploratory Studies|JMHC|Other)

Abstract:

A person's environment has significant effects on their living habits and lifestyles. American builders rely on generic models to promote residential mobility and keep people yearning for more, whereas in Europe, they focus on establishing a long-term residence rooted in community and tradition. These ideals were fabricated in the very foundation on which their society was built. This exploratory research project focuses on how the construction industries within the United States and Europe have influenced their populations' decision-making, expectations, socioeconomic views, and life habits. To investigate this issue further, I have conducted extensive research and connected ideas from other case studies, various articles, and statistical analyses. These sources explained specific building methods, materials, and approaches used in both regions, and the living preferences of residents. The data set indicates that America tends to prioritize mass production, cost-effective, and efficient construction practices, while Europe emphasizes durability, tradition, and longevity in its projects. The findings from this research have the potential to reveal building methods that have a major influence on lifestyle choices and human tendencies, and if these will play a key role in the future of the construction industry.

Keywords:

Construction; Lifestyles; America; Europe; Building Methods

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1488

Presentation Time: Session 3: 12:00-1:00pm

Does Sexual Orientation Moderate the Associations Between Sexual Anxiety and Sexual Esteem and Drinking Motives to Cope and Conform?

Social Science

Authors(s):

Ramsey David Frederick Miller† (HHS)

Abstract:

Introduction: Sexual anxiety and sexual self-esteem are linked to changes in stress which may influence drinking. What is not yet understood are the associations between sexual anxiety and sexual self-esteem, and drinking motives to cope or conform, which are strong predictors of problematic alcohol use, as well as if sexual orientation impacts this association. The current study aimed to evaluate these associations and the potentially moderating effect of sexual orientation among a sample of college students, who typically exhibit higher levels of stress.

Methods: We surveyed a sample of undergraduate students (N=1,024) taking an introductory psychology course about their sexual behaviors and alcohol use, and then examined the associations between sexual self-esteem and sexual anxiety with drinking motives to cope and conform. Sexual orientation was examined as a potential moderator to these associations.

Results: We expect to observe a positive association between sexual anxiety and drinking motives to cope and conform; and a negative association between sexual self-esteem and drinking motives to cope and conform. We also expect to observe a moderating effect of sexual orientation on this association.

Discussion: The results of this study may help guide the development of sexual health interventions that target one's sexual self-concept and subsequent drinking motives to cope and conform.

Keywords:

Sexual Anxiety; Sexual Esteem; Drinking Motives; Sexual Orientation

Mentor(s):

Jennifer Lynn Brown (HHS); Luis A Gomez (HHS)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1489

Presentation Time: Session 3: 12:00-1:00pm

U.S. Hub Airports: Predicting Airline Arrival Delays Business Case Study

Authors(s):

Newla Moot† (DSB); Alacya Madison Lynch† (DSB); Kristen Taylor O'Leary† (DSB); Cydney Allyn Culver† (DSB)

Abstract:

What causes flight delays, and how accurately can we predict them? Flight delays remain a persistent challenge in the U.S. air transportation system. This project develops a predictive analytics framework to estimate flight arrival delays at major U.S. hub airports. By focusing on hubs, the study captures delay patterns that are operationally significant to both airlines and passengers.

The dataset includes over three million flight records from the U.S. Department of Transportation, covering variables such as departure time, origin and destination airports, taxi times, distance, and cause-of-delay indicators. Data preparation involved filtering to hub airports, encoding categorical variables, and engineering features such as time-of-day, day-of-week, and congestion measures.

Preliminary results show that departure delays, airport congestion, and carrier-specific factors are the strongest predictors of arrival delays. To validate these findings, several predictive models will be tested, beginning with linear regression and advancing to ensemble methods. While linear models provide interpretability, tree-based methods significantly improve predictive accuracy, reflecting the complexity of delay propagation within hub networks. Model performance will be assessed using K-fold cross-validation, with Mean Squared Error (MSE) as the primary evaluation metric.

This project contributes to both academic and industry discussions by offering a scalable approach to delay prediction. Insights can inform airline scheduling, airport resource allocation, and passenger communication strategies, ultimately improving efficiency and customer experience.

Keywords:

Airports; Flights; Delays; Departures; Arrivals

Mentor(s):

Davi Cordeiro Moreira (DSB)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1490

Presentation Time: Session 3: 12:00-1:00pm

Campus Involvement and Career Preparedness

Humanities

Authors(s):

Ashley Marie Moseley† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

Purdue University; Career; Opportunities; Professional; Career-Readiness

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1491

Presentation Time: Session 3: 12:00-1:00pm

Segmentation model and path planning STEM

Authors(s):

Sameer Ravi Murthy† (Science); Bea Alyannah Magsayo Cortes† (Engineering); Yash Rajendra Ashtekar† (Engineering); Tanay Jain† (Science)

Abstract:

The purpose of this project was to improve on the autonomous go-kart developed by Autonomous Motorsports Purdue (AMP) by improving its perception capabilities. Our team focused on two main areas, semantic segmentation and object detection. The existing segmentation model was based on the BDD100k dataset, which provides general driving scenes but lacks specificity for the AMP go-kart. To address this, we fine-tuned the model using a custom dataset collected by the club, consisting of approximately 1,000 images. We then expanded this dataset through a variety of data augmentation techniques such as flipping, cropping, and padding so as to improve model robustness and generalization. Additionally, we introduced an object detection pipeline to enable the kart to recognize and localize key elements on the track, such as cones and other go-karts. Given the dataset already given by AMP, we synthetically generated training examples by spawning cones and go-karts within existing images so as to implement object detection. This approach allowed us to use data specific to the go kart without requiring extensive new data collection. The synthetic data was then annotated and used to train object detection models capable of identifying track boundaries, obstacles, and other vehicles in real time. These advancements enhance the go-kart's overall autonomy, enabling more accurate environmental understanding and paving the way for future races with other autonomous go karts.

Keywords:

Data Augmentation; Computer Vision; Segementation; Fine Tuning; Synthetic Data Generation

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Reed Joseph Freer (Engineering); Richard Osita Ajagu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1492

Presentation Time: Session 3: 12:00-1:00pm

Statistical Process Control on Metal-Insulator-Metal Capacitors STEM

Authors(s):

Laksh Nagpal† (Engineering); Robert Maxwell Neitzke† (Engineering);
Venya Bhardwaj† (Engineering); Ahmad Hazim Akmal Bin Rosmahidi†
(Engineering); Nolan Cai Tai‡ (Engineering)

Abstract:

Metal-Insulator-Metal (MIM) capacitors are widely used in Integrated Circuits (ICs), particularly in Radio Frequency (RF) and analogue applications, due to their stability and high capacitance density. This project 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 process parameters and the subsequent application of statistical methods to optimise both yield and quality in microelectronics manufacturing processes.

The capacitors are fabricated on identical 4-inch silicon wafers, each containing five evenly spaced arrays of capacitors with varied dimensions. The material stack consists of a Titanium/Palladium bottom electrode, an HfO₂ insulating dielectric layer, and an Aluminum top electrode. The fabrication process involves Physical Vapour Deposition (PVD) for depositing metal layers, Atomic Layer Deposition (ALD) for depositing the dielectric layer, photolithography for patterning, and Reactive Ion Etching for structuring. SPC data is collected on metal and oxide film thickness, as well as electrical properties of the manufactured capacitors, using an Atomic Force Microscope, an F40-UV thickness measurement instrument, a spectroscopic ellipsometer, and a semi-automatic probing station.

Through SPC, this project aims to analyze the impact of varying MIM capacitor dimensions on capacitance while simultaneously examining variations in film thicknesses and step heights throughout the manufacturing processes. By identifying process abnormalities such as surface roughness or leakage currents and improving manufacturing consistency, the team aims to minimize intra-wafer and batch-to-batch deviations while maximizing capacitor yield for more reliable production.

Keywords:

Nanofabrication; SPC; Capacitors; Semiconductors

Mentor(s):

Zhihong Chen (Engineering); Joerg Appenzeller (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1493

Presentation Time: Session 3: 12:00-1:00pm

Developing Undergraduate Inorganic Laboratory Projects through the Synthesis and Characterization of Manganese\Rhenium Tricarbonyl Complexes STEM

Authors(s):

William Isaiah Need† (Science); Nijaul Wyatt Drollinger* (Science); Lilia Elizabeth Raes* (Science)

Abstract:

Manganese and rhenium tricarbonyl complexes are important model systems in inorganic and organometallic chemistry due to their structural and photochemical properties. In this study, a multi-week laboratory project was developed for inorganic chemistry students that focuses on the synthesis and characterization of Mn(I) and Re(I) tricarbonyl complexes with bidentate nitrogen-containing ligands. The synthesis requires air-free synthesis techniques. The complexes were purified via vapor diffusion crystallization and characterized using ¹H-NMR, FTIR, cyclic voltammetry, and UV-Vis spectroscopy. The procedure is reproducible and enhances the undergraduate inorganic teaching labs by greatly increasing the number of synthetic and characteristic techniques for students.

Keywords:

Synthesis; Characterization; Cyclic Voltammetry

Mentor(s):

Hannah Elise Starr (Science)

Other Acknowledgement(s):

Jeremy Hugh Lawrence (Science)

Poster Presentation Abstract Number: 1494

Presentation Time: Session 3: 12:00-1:00pm

How Many Hours Will You Sleep? Utilizing Synthetic Data to Predict Quantity of Sleep

Business Case Study

Authors(s):

Kundana Nittala† (DSB|JMHC); Esther L Larson† (DSB|JMHC); Emilio Andres Pino† (DSB); Shree Krishna Tulasi Bavana† (DSB)

Abstract:

Getting a good night's rest is essential for mental clarity, physical functionality, and a strong head start to the coming day. The project aims to predict hours of sleep achieved or lost through coffee consumption using health and demographic information. Understanding the correlation between particular controllable variables and the amount or quality of sleep may allow individuals to make choices to improve their quantity of sleep, and, consequently, their quality of life.

This synthetic dataset includes the variables age, gender, country, coffee intake (cups), caffeine (mg), sleep hours, sleep quality, BMI, heart rate, stress level, physical activity hours, health issues, occupation, smoking (Y/N), and alcohol consumption (Y/N). Most variables' distributions are fairly even, as expected with synthetic data.

The goal is to build a base model using linear regression, followed by a more flexible model. Comparing the accuracy between the derived regression estimates will aid in selecting the best approach and model. The model is expected to quantify the impact of controllable lifestyle factors, such as caffeine intake and stress, on sleep duration. This can easily predict sleep quality, which could be used in an app where consumers input lifestyle and demographic information and receive a projected sleep quality.

Ultimately, the predictions offer personalized, actionable data to help individuals optimize their sleep. An app where users enter demographic info and then can adjust lifestyle statistics to understand the impact on predicted sleep quality will empower customers to take control of ensuring a better night's rest.

Keywords:

Health; Coffee; Sleep Quality; Caffeine Intake; Demographics

Mentor(s):

Davi Cordeiro Moreira (DSB)

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

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1495

Presentation Time: Session 3: 12:00-1:00pm

Training a Deep Neural Network to Identify the Higgs in LHC Run 2 Data STEM

Authors(s):

Cadance William Lucas Ormsby† (Science|JMHC); Ethan De-Chuan Wang† (Engineering); Layla Isabelle Shihab† (Science)

Abstract:

This project aims to develop a Deep Neural Network (DNN) to assess the likelihood that observed decay products originate from a Higgs Boson decay chain. Using Run 2 data from the LHC, the model will be trained on labeled signal and background events. After standardization, the data will be split into training and testing sets so that the model may be evaluated on different data than it was trained on. The model will consist of at least 3 forward fed layers, featuring one hidden layer utilizing a ReLU activation function to introduce non-linearity into the model. The model will train using binary cross-entropy loss—a metric for binary classification—and the Adam optimizer, which will allow for dynamic learning rate adjustments that efficiently update the model's weights. Model performance will be assessed using a confusion matrix, ROC curve, and validation loss metrics. The goal is to produce a classifier capable of distinguishing Higgs signatures from noisy background processes with high accuracy.

Machine learning offers a powerful complement to traditional physics analysis, uncovering patterns in high-dimensional data that may elude first-principles approaches. By applying DNNs to collider data, models like these contribute to the evolving toolkit of computational physics and may help refine or extend the Standard Model.

Keywords:

Deep Neural Network; Higgs Boson; LHC; Training; Machine Learning

Mentor(s):

Andy Jung (Science); Heather Nicole Martin (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1496

Presentation Time: Session 3: 12:00-1:00pm

Abstract Matchbox Coworking Studio

Business Case Study

Authors(s):

Daniel Thomas Osborne† (DSB); Jacob Michael Cohen† (DSB);
Marshall Alex Prince† (DSB); Paulette Arely Fernandez† (DSB); Emory
Fortin‡ (DSB); Samuel Lewis Denny‡ (DSB)

Abstract:

MatchBOX Studio has seen a significant decline in foot traffic in recent years and is struggling to reach its target audience of Purdue faculty and graduate students. The purpose of this study is to identify which factors influence this audience's decisions, explore ways to re-engage them, and assess whether MatchBOX's current value propositions align with their needs and interests.

We plan to begin by visiting the studio to understand the full range of features and pricing options offered. Surveys will then be distributed to current users to determine what they like, dislike, and would change about their experience. Based on these insights, we will formulate a strategic marketing campaign to more effectively reach the target audience.

We expect the data to reveal that while awareness of MatchBOX exists among some Purdue affiliates, perceived value and convenience are key deterrents to participation. Respondents are likely to highlight the importance of proximity to campus, affordability, and networking opportunities. Interview data may also point to a growing preference for hybrid work environments, suggesting a misalignment between MatchBOX's offerings and the work habits of its target demographic.

Based on the results, we will recommend whether MatchBOX should revise its marketing strategy to better communicate its value to Purdue affiliates or consider targeting new demographics. The following are appended: (1) survey instrument and interview guide, (2) data and methodology, and (3) summary of strategic marketing recommendations.

Keywords:

Marketing; Consumer Behavior; Co-Working

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1497

Presentation Time: Session 3: 12:00-1:00pm

Mako-Assisted vs. Conventional Hip and Knee Arthroplasty: A Patient Outcome Comparison STEM

Authors(s):

Kiley Ann Osswald† (Engineering); Kyndall Lauren Osborne‡ (Science)

Abstract:

This study compares postoperative outcomes for total hip (THA) and total knee arthroplasty (TKA) procedures performed with and without Mako robotic assistance using retrospective chart reviews of patients treated by Dr. Hur and Dr. Maratt from 2020-2024 using data from Forté Sports Medicine and Orthopedics. Data were gathered through CODE and EMR, evaluating complications, physical therapy progress, and patient-reported HOOS and KOOS scores. For knee procedures by Dr. Hur, Mako assistance generally aligned with smoother recovery trends, reduced pain, and fewer adverse events, reflecting benefits of improved precision and soft-tissue protection. Hip outcomes, using Dr. Maratt's patients, were more variable with minimal overall differences and mixed results across complication categories. Together, the findings suggest that robotic assistance may provide procedure-specific advantages depending on the surgical context and outcome measures. Limitations include a two-surgeon scope, fellow involvement, and the retrospective nature of the study. Future work will explore opioid usage, time spent in the operating room, physician fatigue, and subscale outcomes to clarify where robotic guidance most strongly impacts surgery and recovery.

Keywords:

Mako Robotic Assistance; Total Hip Arthroplasty (THA); Total Knee Arthroplasty (TKA); Postoperative Outcomes; Patient-Reported Outcomes

Mentor(s):

Christopher Curless (Forté Orthopedic Research Institute)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1498

Presentation Time: Session 3: 12:00-1:00pm

Development of Janus Particle Microstructures in Polymer Matrices Through Dielectrophoretic Assembly STEM

Authors(s):

Nicholas Joseph Ostendorf† (Engineering); Aryan Dayal‡ (Engineering)

Abstract:

Space exploration's harsh environmental constraints necessitate the ability to fabricate resilient, reliable parts. Additive manufacturing provides the ability for rapid fabrication of user-designed parts, but current materials lack the quality and customizability of properties required for space-grade applications. Particle-polymer composites offer an intriguing solution to this problem. This research investigates the feasibility of using Janus particle reinforced polymers to fabricate materials with customizable properties. Janus particles are composed of two hemispheres, both with different properties. Metallodielectric Janus particles consisting of a dielectric SiO₂ hemisphere and a conductive platinum hemisphere were used. When exposed to an electric field, these two faces experience different interactions, causing the particles to assemble into unique structures. To fabricate these particles, SiO₂ particles were coated with platinum on one hemisphere using a sputter coater. The morphology of these particles was characterized using scanning electron microscopy. The particles were then dispersed in HDDA and HEMA monomers. The mixture is placed into an experimental cell where an AC electric field is applied, with strengths varying from 25-300 V/cm and frequencies varying from 25-300 kHz. Various structures, such as chains and bundles, were identified and characterized using optical microscopy. To identify processing parameters, a phase diagram was created, displaying what inputs are necessary to fabricate various microstructures. This work demonstrates that electric-field assembly of Janus particle-polymer materials is a viable method for creating a wide array of customizable microstructures, offering a promising approach for fabricating novel materials with additive manufacturing.

Keywords:

Additive Manufacturing; Composites; Janus Particles; Dielectrophoresis; Phase Diagram

Mentor(s):

Carlos J Martinez (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1499

Presentation Time: Session 3: 12:00-1:00pm

I2C UVM Testbench STEM

Authors(s):

Preston Daniel Perkins† (Engineering); Omar Habib Habli† (Engineering|JMHC); Jeffery Xiaotian Liu† (Engineering)

Abstract:

As a part of UVM within SoCET, our subteam was tasked with creating a testbench for an existing I2C controller using UVM (Universal Verification Methodology). UVM is a framework of predefined macros, functions, and classes that uses object-oriented principles to promote reusability, randomization, and easy modification. It allows the user to input specific stimuli into the DUT and monitor the corresponding outputs. I2C is a widely used serial communication protocol between “manager” and “subordinate” modules supporting bidirectional data sends. There are two data lines: SDA, which carries data able to be driven by both manager and subordinate, and SCL, which is a manager-driven clock. The particular I2C manager we are verifying takes CPU inputs from a bus interface, then processes internally to drive SCL/SDA and sample SDA. This project has two components: Analysis and revision of the existing design, and development of the testbench. Currently, analyzing documentation and source code has allowed us to create a list of max-coverage test cases and a diagram for testbench architecture. We have also discovered a number of bugs we are currently fixing with the design team, the most important being the inability of the bus to pass write data into the manager. Our testbench includes two agents: one designed to act as a subordinate, and one to act as the bus interface. We have completed the transaction, which includes DUT stimuli and monitored outputs, and are currently working on the sequencers for both agents.

Keywords:

[no keywords provided]

Mentor(s):

Mark Johnson (Engineering); Ayush Singh (Engineering); Anas Zyad Abughali (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1500

Presentation Time: Session 3: 12:00-1:00pm

Embedded Iontophoretic Biosensing Hardware Design for Metabolic Wearable Sensors STEM

Authors(s):

Kayla Renae Phillips† (Engineering|JMHC)

Abstract:

Early detection and continuous management of metabolic disorders such as diabetes, obesity, and electrolyte imbalances remain critical challenges in clinical care. Conventional diagnostic methods rely on intermittent blood draws and laboratory testing, limiting real-time insight into a patient's physiological state. Continuous, noninvasive monitoring of metabolic markers can provide clinicians with dynamic data for more precise diagnosis, personalized treatment, and prevention. This research project aims to design and fabricate the hardware for a self-powered electrochemical wearable sensor using a BLE MCU for enhanced metabolic monitoring. The hardware controls sensors that wirelessly monitor metabolic parameters in real time and is being designed using KiCad PCB software. Sensors will be fabricated using PET for a flexible PCB design. The system integrates iontophoresis-based extraction, a clinically validated method that drives small currents across the skin to obtain sweat containing biomarkers like glucose, lactate, and electrolytes. A wearable iontophoresis system is currently in development, utilizing a boost converter, current mirror, and analog switch. This research project includes several phases: signal conditioning design and fabrication, and integration into human-machine interfaces. Additional research is needed to complete human-machine integration. By fabricating these sensors and testing them on human skin, the project seeks to advance the field of electrochemical monitoring, ultimately contributing to improved patient care and outcomes.

Keywords:

Sensors; PCB; Metabolic; Iontophoresis; PET

Mentor(s):

Robert Jose Ccorahua santo (Engineering)

Other Acknowledgement(s):

Wenzhuo Wu (Engineering)

Poster Presentation Abstract Number: 1501

Presentation Time: Session 3: 12:00-1:00pm

Intelligent Acoustic Sensing and Soundscape Modeling at Purdue STEM

Authors(s):

Sophia Victoria Pimentel† (DSB)

Abstract:

The project develops an intelligent acoustic sensing network across Purdue's campuses to monitor and model environmental noise. Custom sensors equipped with edge computing and wireless modules collect real-time acoustic data, which are processed using digital signal processing, machine learning, and spatial analytics to classify and visualize sound patterns. Building on the Soundscaper system, we create an interactive map interface that generates synthetic, data-driven soundscapes. Using frameworks like Citygram and GetNoisy, we also study how Purdue Airport's expansion impacts local noise environments. The system demonstrates how sensor technology, AI, and sound synthesis can translate environmental data into actionable insights for urban design and community engagement.

Keywords:

Acoustic; Sound; Network; Noise; Environment

Mentor(s):

Tae Hong Park (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1502

Presentation Time: Session 3: 12:00-1:00pm

The Role of Artificial Intelligence in Enhancing Performance, Strategy, and Fan Experience in the NBA STEM

Authors(s):

Shaheer Raza† (Science|JMHC)

Abstract:

The utilization of Artificial Intelligence (AI) within the National Basketball Association (NBA) has been crucial in the growth of the organization, its teams, and its players. The usage of AI helps these teams create new strategies for scouting other teams, analyze the performance of players, enhance fan experience, and create a better experience overall for all those involved in the NBA. For teams specifically, it is possible to use the statistics found to better analyze the outcomes of games and predict how players will perform on opposite teams. In an independent research of using AI to predict the outcomes of games, it was found that the AI was able to successfully predict around 98% of games. This shows the advancement of AI on a small scale, meaning that on a larger scale, teams can use AI to scout and predict player behavior. The research in this paper will be a literary analysis of the methods that are in place currently in the NBA and how AI is used to better everyone who is a part of the NBA. What is found here highlights how AI enhances athletic and organizational efficiency, as well as how it lays the foundation for a more data-driven and equitable future in professional basketball.

Keywords:

AI; Artificial Intelligence; NBA; Player Performance

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1503

Presentation Time: Session 3: 12:00-1:00pm

Walking Adaptations on Indoor and Outdoor Stairs and Inclines STEM

Authors(s):

Harlie Elizabeth Robbins† (HHS); Sridevi Ramkumart
(Engineering|JMHC)

Abstract:

Assessing human gait is crucial for diagnosing neurological conditions and monitoring recovery after therapy. While several clinical tests exist, they often fail to capture how people move in their everyday environments and may overlook early signs of dysfunction. Early detection is essential, as it enables timely interventions that can prevent more serious mobility issues later on.

To address this limitation, we use inertial measurement units (IMUs), which are portable, non-invasive sensors that provide high-resolution acceleration data, to assess gait in real-world conditions. Our goals are to identify locomotion tasks that are both feasible and sufficiently challenging for a wide range of adults, and to determine which IMU-derived outcome measures can reliably detect early gait abnormalities.

In our initial study, IMUs were placed on participants' ankles to record acceleration during walking on flat surfaces and while ascending and descending stairs, both indoors and outdoors. Preliminary results showed higher average ankle acceleration outdoors, possibly due to harder outdoor surfaces causing harder heel strikes. The lower accelerations on stairs likely reflect more cautious movements imposed by step constraints.

Our outcomes have the potential to differentiate between common gait tasks. Our plan is to recruit individuals across the age span to identify whether these measures are sensitive to age and compare our metrics with standard clinical gait assessments. If our outcomes capture additional information on movement, this approach could enhance early detection of gait changes and improve long term monitoring.

Keywords:

Human Gait; Wearable Devices

Mentor(s):

Satyajit S Ambike (HHS); Jeffrey M Haddad (HHS)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1504

Presentation Time: Session 3: 12:00-1:00pm

Pink Team Cleaning Services

Business Case Study

Authors(s):

Madelyn Marie Roberts† (DSB); Alexandra Li Alderink† (DSB); Yilin Xiut (DSB); Caitlin Yvonne Bain† (DSB); Giavanna Noelle Buscarini‡ (DSB); Christina S Li‡ (DSB)

Abstract:

The purpose of this case is to understand and attack marketing related challenges with Pink Team Cleaning Services. Growth has plateaued due to the lack of a marketing strategy or sales team. The Lafayette market is saturated, and while the company seeks expansion into Indianapolis and other industrial towns, it is still determining the best outreach methods- whether cold calling, partnerships, or other tactics. With a website redesign underway and plans to refine its ideal customer profile, Pink Team has the foundation to scale further but needs a structured marketing roadmap to reach new markets effectively. We have four main deliverables we want to present to the client. The first is a client profile development based on industry research and an already existing profile from Pink Team Cleaning services. The second is a marketing strategy blueprint which will include short and long-term strategic recommendations and tactics for brand positioning, digital marketing and geographic expansion. The third is an industry analysis report, including an overview of the industrial cleaning market, competitive benchmarking and trends, and opportunities for differentiation. The final deliverable will be a social media strategy recommendation, with an evaluation of current platforms and recommendations for content based on the industry standard.

Keywords:

Marketing; Strategy; Cleaning; Case Study; Marketing Mix

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1505

Presentation Time: Session 3: 12:00-1:00pm

A Dissemination of Albumin and Prealbumin Correlation Concerning Nutrition and Inflammation

Humanities

Authors(s):

Miranda A Ruvalcaba† (HHS)

Abstract:

Nutrition is imperative for proper care in any patient; however, intensive care units are struggling to decide if biomarkers such as albumin and prealbumin are an aid or an issue. These proteins are found in the blood and are currently under debate as to whether their value stands in nutritional aid or inflammatory presence. While serum albumin and prealbumin may reflect baseline malnutrition and comorbid illnesses, recent research has found that serum levels are reactant to initial body responses concerning inflammation (Yeh et al, 2018). The purpose of this exploratory research is to investigate the correlation albumin and prealbumin share between nutritional values and inflammatory substances. To delve into this issue, I conducted a preliminary literature review of multiple articles and studies in PubMed to better understand how beneficial these proteins are to nutritional therapy in critical care patients. Searches through peer-reviewed sources in Purdue Libraries and PubMed were directed with key words such as: albumin, prealbumin, transthyretin, biomarker, clinical nutrition, inflammation, and ICU. This research highlights the need for further research into albumin and prealbumin correlations between nutrition and inflammation to identify when the substance is a reliable measurement source for patient nutrition. Better understanding of albumin and prealbumin reactants in the body could result in improved nutrition therapy and decreased mortality rates in critical care units.

Keywords:

Albumin; Biomarker; Clinical Nutrition; ICU; Inflammation

Mentor(s):

Jessica M Mercado (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1506

Presentation Time: Session 3: 12:00-1:00pm

The Country Mansion

Business Case Study

Authors(s):

Bristol Ryan† (DSB); Raechel Thara Davids† (DSB); Rishi Sai Kattunga† (DSB); Thira Rayne Minauskas† (DSB); Kiera Young‡ (DSB); Hayden Christopher Marecki‡ (DSB)

Abstract:

The Country Mansion, a historic estate in Dwight, Illinois, is currently being restored and revitalized to serve as a premier high-end destination for weddings, corporate retreats, and other events. The key strategic marketing challenge is how to effectively rebrand and reposition the venue to appeal to a wider and younger audience while also justifying a significant increase in rental pricing (from approximately \$5,000 per event to \$25,000–\$30,000 multi-day packages). The challenge also includes determining how to market the venue's unique heritage, differentiate it from local competitors, and create a sustainable branding strategy that blends rural history with modern amenities. Additional considerations include the absence of overnight accommodations (currently under restoration to add space for 24 guests), decisions regarding name changes and rebranding, food service offerings, and attracting both corporate and wedding clientele. Competitors in the area include other historic venues and machine-shed-style wedding facilities.

Keywords:

Case Study; Marketing

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1507

Presentation Time: Session 3: 12:00-1:00pm

Wildcat Creek Winery

Business Case Study

Authors(s):

Ethan William Scheuneman† (DSB); Krish Aggarwal† (DSB); Maha Sohail Chaudhry† (DSB); Arnav Bhatia† (DSB); Andre Kunrath Menna Barreto Fialho‡ (DSB); Tanmayi Sharat‡ (DSB); Nitish Reddy Vanga‡ (DSB)

Abstract:

This project addresses the primary marketing challenge for Wildcat Creek Winery: a significant lack of local visibility and consumer awareness, particularly in the West Lafayette community. Despite offering events and seasonal products, the winery struggles to reach customers who are not already following their social media. The owner, an experienced winemaker with limited time and resources for marketing, seeks to increase brand recognition and effectively launch a new wine.

A student consulting team will analyze several strategic opportunities to solve this issue. Key strategies include penetrating the untapped local market, using storytelling to build an authentic brand, and enhancing the on-site customer experience. The team will investigate repositioning the winery as a sophisticated yet accessible entry point into the wine world by offering tastings of global wines alongside its own products. The objective is to change the perceived reputation of an Indiana-based winery, attracting a broader customer base and leveraging the high sales conversion rate of in-person tastings.

To support these strategies, the team will conduct market research through customer surveys to gauge interest in events and promotions. The final deliverables will include a research report, data-driven graphs, and a PowerPoint presentation with actionable recommendations to increase awareness and drive sales.

Keywords:

Winery Marketing; Local Visibility; Brand Awareness; Market Penetration; Customer Experience

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1508

Presentation Time: Session 3: 12:00-1:00pm

Birth on Her Terms: Autonomy, Risk, and the Transformation of Hospital Culture Through Midwifery-Led Care Humanities

Authors(s):

Amanda Schuler† (HHS|JMHC)

Abstract:

The United States has been facing a maternal mortality crisis in recent years with postpartum hemorrhaging (PPH) as one of the leading causes of preventable maternal death (Erickson et al., 2020). More women have chosen to give birth at home under the supervision of midwives following the COVID-19 pandemic. This preliminary research examines how hospital-based maternity care barriers, and perceived coercion, all influence patients' decisions to have homebirths. In contrast, midwifery-led practices can guide safer, more considerate hospital procedures (Schafer et al., 2023). I intend to review peer-reviewed research that examines the results of homebirths and collaborative care to investigate this topic. According to prior research, midwives successfully treat severe cases of PPH with minimal blood transfusions and emergency transfers to hospitals (Erickson et al., 2020). While critics argue that homebirths pose risks, particularly for high-risk pregnancies, evidence suggests that midwifery-led care can reduce unnecessary interventions, foster patient autonomy, and effectively manage complications such as PPH. Studies demonstrate that midwives prioritize maternal well-being, identify complications early, and employ less invasive interventions, such as uterotonic medications or uterine balloon tamponades, with high success rates. Other sources draw attention to the tensions between midwives and paramedics during emergency transfers (Humphreys & Ranganathan, 2025) and safety issues in unregulated or high-risk homebirths (Goyal et al., 2020). This research highlights the need to standardize communication protocols between hospital staff and midwives, as well as the need to incorporate specific midwifery-informed practices into hospital care. This research will contribute insights toward building a more patient-focused maternity care system.

Keywords:

[no keywords provided]

Mentor(s):

Jessica M Mercado (Liberal Arts)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1509

Presentation Time: Session 3: 12:00-1:00pm

Evidence of increased cerebral lactate levels in autism: The role of the locus coeruleus - norepinephrine system STEM

Authors(s):

Grace Lauren Scott† (HHS); Seung-Yeol Yoon‡ (Science)

Abstract:

Background: Lactate release by astrocytes serves as a signaling molecule, crucial for synaptic plasticity and activity. Prior research using magnetic resonance spectroscopy (MRS) has shown that increased concentrations of cerebral lactate are present in autism. A driver of lactate production is norepinephrine (NE), which is released during firing of the locus coeruleus (LC). The LC-NE system has been shown to function differently in autistic individuals, but it remains unclear whether increased LC-NE activity in autism is associated with elevated cortical lactate.

Objectives: To examine lactate levels in autistic and neurotypical children (NT), and to determine whether elevated LC-NE activity in autism, as indexed by pupil diameter, is associated with group differences in cortical lactate levels.

Methods: Participants were 20 autistic and 20 matched NT children. Lactate was measured using MRS in the visual cortex (VIS), temporal-parietal junction (TPJ), and frontal eye fields (FEF). Children completed a baseline eye-tracking task to measure pupil diameter.

Results: Autistic and NT children did not differ in FEF or TPJ lactate concentrations; however, in VIS, autistic children evidenced significantly increased lactate as well as elevated mean level across all three regions. Compared to NT peers, autistic children showed increased pupil diameter. Critically, there was a significant relationship between increased pupil diameter and lactate concentrations.

Conclusions: Autistic children exhibit greater levels of cortical lactate and elevated tonic LC-NE activation. Rather than due to a metabolic dysfunction, our findings suggest that elevated cortical lactate may be the consequence of persistently heightened LC-NE activation in autism.

Keywords:

Autism; Lactate; Norepinephrine; Locus Coeruleus; Pupil

Mentor(s):

Brandon Keehn (HHS)

Other Acknowledgement(s):

Yesol Kim (HHS); Ulrike Dydak (HHS)

Poster Presentation Abstract Number: 1510

Presentation Time: Session 3: 12:00-1:00pm

**Incentive Design for Home Heating System: Simulation Study
for Incentivized-UCRL2 Algorithm
STEM**

Authors(s):

Soham Samir Seksaria† (Science)

Abstract:

Utility companies utilize demand-response programs to shape the overall customer demand to meet the supply in an efficient and environment friendly manner. However, the preferences of the customers are often unknown to the company which hinders determining the incentives that can be offered to the customers. We formulate the problem of eliciting the customer preferences and ensuring that they follow actions that optimize both their own and the company utilities as an incentive design problem. In our prior work, we have designed an algorithm "Incentivized-UCRL2" based on Reinforcement Learning framework that solves this problem. This study illustrates the use of this Incentivize-UCRL2 learning algorithm through simulations using realistic models of a home heating system to show that efficient demand management can be achieved.

Keywords:

UCRL2; Markov Decision Processes; MDP; Incentive Design

Mentor(s):

Shivam Bajaj (Engineering); Vijay Gupta (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1511

Presentation Time: Session 3: 12:00-1:00pm

Exploring Crisis Preparedness: An Investigation of the Crisis Management Plan at Purdue University

Humanities

Authors(s):

Maggie Rose Self† (HHS)

Abstract:

Crisis Management is a process that helps prepare, respond to, and recover from emergencies. Colleges and Universities all have some sort of plan to handle a crisis, should something happen on campus. Having a crisis plan in place ensures that students and staff remain safe in times of crisis. In this exploratory research, I investigate what plan Purdue has in place to make handling crises easier. I also investigate what plans and resources other universities have shared and why it is important to have a plan in place. To better understand how Purdue handles crises that happen on campus, I interviewed Associate Dean Steven Yeagley, who oversees Crisis Management at Purdue. I asked him about his role as Associate Dean, what his team handles and responds to, and what type of crises he sees over the school year. My research highlights the role of a Crisis Team and a Crisis Management Plan, and why it is important to have in place at a school like Purdue.

Keywords:

[no keywords provided]

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1512

Presentation Time: Session 3: 12:00-1:00pm

Predicting Country GDP Growth: A data driven approach to economic modelling and decision making

Business Case Study

Authors(s):

Ace Setiawan† (DSB); Gavin Patrick Connolly† (DSB); Gabriel John Carlson† (DSB); Sean Patrick Patterson† (DSB)

Abstract:

Economic growth drives national stability, global trade, and development. Yet predicting growth remains a challenge as economies evolve and interact with social, demographic, and environmental factors. This project aims to identify which measurable factors best predict a country's annual GDP growth. By doing so, we hope to provide insights that help governments target key areas for investment and assist businesses in identifying markets with growth potential.

Our analysis combines two datasets: a cross-sectional dataset with current-year indicators for countries worldwide and a time-series dataset tracking historical data from 1960 to the present. Together, they provide tens of thousands of country-year observations. We chose to retain outliers to preserve real-world variability and impute missing values using regional averages. Preliminary analysis shows strong relationships between GDP growth and factors such as emissions and unemployment, along with a steady global increase in GDP, concentrated among major economies.

We will merge both datasets and train predictive models that incorporate cross-sectional and historical data. Beginning with linear regression as a baseline, we will refine performance through parameter tuning, feature selection, feature engineering, and ensembling with more advanced models. Evaluation will emphasize R^2 and RMSE to balance accuracy and interpretability.

This project demonstrates how predictive analytics can transform publicly available data into actionable insights. By applying machine learning to model GDP growth, we aim to show how analytical forecasting can inform real-world decision-making—helping governments, businesses, and institutions better evaluate policy, investment, and global opportunities.

Keywords:

Machine Learning; Economic Forecasting; GDP Growth; Predictive Modeling; Policy Insights

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1513

Presentation Time: Session 3: 12:00-1:00pm

Accelerating a Polyphase Filter bank on an FPGA for NASA STEM

Authors(s):

Jaanav Bhavin Shah† (Engineering|JMHC)

Abstract:

To find Earth-like planets, NASA's future Habitable Worlds Observatory will need to process faint astronomical signals with exceptional speed. This research meets that demand by developing an accelerated digital signal processing (DSP) system. Our project concentrates on a core component, a Polyphase Filter Bank (PFB), which is essential for managing the immense real-time data streams from the observatory's ultra-sensitive Microwave Kinetic Inductance Detectors (MKIDs).

Our methodology is to start working from a baseline hardware design generated in MATLAB/Simulink at Arizona State University. Our approach is to re-engineer this design at the register-transfer level (RTL), implementing parallel architectural changes directly into the VHDL/Verilog code. The specific goal is to increase the system's operational frequency and data throughput. To validate these improvements, the design will be prototyped and verified on a large-scale Synopsys HAPS-100 FPGA system, using the same professional Electronic Design Automation (EDA) toolchain (Xilinx Vivado, Synopsys ProtoCompiler, and Siemens QuestaSim) used in the semiconductor industry.

The expected outcome is a quantifiable increase in processing speed. This increased efficiency is a necessary step for enabling the HWO to perform spectral characterization of exoplanet atmospheres. Our work contributes to the creation of next-generation, space-qualified hardware and more powerful computational methods for future astronomical missions.

Keywords:

NASA; FPGA; DSP; MATLAB; VHDL

Mentor(s):

Rishikesh Reddy Bathina (Engineering)

Other Acknowledgement(s):

Mark Johnson (Engineering)

Poster Presentation Abstract Number: 1514

Presentation Time: Session 3: 12:00-1:00pm

Achieving Dynamic Stability in a Full-Body Humanoid Robot Simulation using ROS2 for VIP Humanoid Robot Club STEM

Authors(s):

Milan N Shah† (Engineering); Chee Ying Tay* (Engineering)

Abstract:

The development of bipedal humanoid robots presents significant control challenges, particularly in achieving stable locomotion and balance. Testing control algorithms directly on physical hardware is often costly, time-consuming, and carries a high risk of damaging the robot. To mitigate these issues, our research focuses on the creation of a comprehensive simulation of a humanoid robot within the Robot Operating System 2 (ROS2) framework. The primary goal is to develop a digital twin that accurately models all the physical components of the robot, including, but not limited to, its torso, head, arms, and legs.

Our approach centers on implementing and validating advanced control strategies to ensure dynamic stability under various conditions. The simulation is designed to achieve three key objectives by the time of presentation: 1) maintain balance and stand independently on surfaces with varying inclination angles and friction constants; 2) resist external noise and disturbances of all reasonable proportions without falling; and 3) execute basic movements while actively keeping its center of mass stable.

The anticipated outcome is a fully functional simulation that serves as a reliable environment for developing and refining locomotion and balance algorithms for the robot. This virtual environment will accelerate the software development lifecycle for the Humanoid Robot Club, providing a safe and efficient platform for rapid prototyping and validation before deployment on a physical robot.

Keywords:

VIP; Humanoid Robot; Bipedal Locomotion; Simulation; Dynamic Stability

Mentor(s):

Jaeeun Kim (Engineering); Yan Gu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1515

Presentation Time: Session 3: 12:00-1:00pm

Facilitating space exploration through the creation of a humanoid robot able to perform complex tasks under the harsh conditions of space and other planets.

STEM

Authors(s):

Drish Jaykishan Shah† (Polytechnic); Madhav Amit Arora† (Polytechnic); Quinn Robert Traas† (Engineering); Elvin Xuyang Li† (Engineering); Pranjali Bhatia‡ (Engineering); Gabriel Duarte Rengifo‡ (Engineering); Arya Bhargale‡ (Engineering); Charlotte Eva Regnier‡ (Engineering); Henry David Pham‡ (Engineering)

Abstract:

This research focuses on creating a humanoid robot capable of completing complex tasks to aid astronauts in space exploration on the moon, specifically targeting the hand and arm mechanisms required for precise movements. The goal is to design an arm that allows for the attachment of various customizable end effectors or hands. Our current process includes a prototype of a complete arm with 6-degree-of-freedom (DOF) from the shoulder to the forearm, along with a 3-DOF wrist that allows the attachment of numerous customizable end effectors. Currently, we are prototyping various types of end effectors for collecting samples, gripping, cutting, drilling, and other applications. The next phase of our project is to create a final aluminum version of the entire arm, wrist, and hand system that is able to be manufactured. Then we would be able to test our design in real-world scenarios that would simulate low and zero gravity environments as well as rough and rocky terrain, and begin to gather data for programming and operational purposes. Our findings aim to contribute to the understanding of how humanoid robots can aid in space exploration on the moon by performing complex tasks and supporting astronauts and the aerospace industry.

Keywords:

Robotics; Space; Humanoids; Mechanical

Mentor(s):

Jaeeun Kim (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1516

Presentation Time: Session 3: 12:00-1:00pm

Expression and Purification of Polyketide Synthases STEM

Authors(s):

Ethan Zachary Shatz† (Agriculture|Engineering)

Abstract:

This project aims to develop robust expression and purification systems for polyketide synthases (PKSs) that could enable biosynthesis of gem-dimethylated polyhydroxyalkanoates (gdPHAs), a promising class of sustainable plastics. Worldwide production of plastics is a nearly \$1T industry and surpassed 400 million metric tons in 2022, yet only about 10% of plastics are recycled. Plastics such as PHAs and polylactic acid offer more sustainable alternatives, but they lack many desirable properties of commodity plastics, including toughness, solvent resistance, thermal stability, and processability. Recently, gdPHAs have been synthesized and shown to be biodegradable, chemically recyclable, and melt-processible, but there are no known metabolic pathways to incorporate gdPHA monomers into PHAs. To address these challenges, we focused on the expression and purification of PKSs. However, these enzymes are often difficult to produce in functional form, therefore establishing reliable bacterial expression systems and purification strategies is a critical step to obtaining active enzymes. Expression and purification strategies for PKSs were established, including bacterial protein expression, Ni-NTA affinity chromatography and FPLC purification, and SDS-PAGE analysis to verify enzyme expression. These experiments represent a key step toward functional protein production that will support future kinetic assays as well as the analysis of rate-limiting steps and enzyme promiscuity, eventually enabling biosynthetic routes for tunable, sustainable bioplastics.

Keywords:

PKS; Sustainability; Enzymes; Biosynthesis

Mentor(s):

Karthik Sankaranarayanan (Engineering); Bianca de Paula Macedo (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1517

Presentation Time: Session 3: 12:00-1:00pm

Mission and Market: Actionable Growth Strategies for Millie's Thrift Store

Business Case Study

Authors(s):

Katherine A Sheehan† (DSB); Breckon Lee Riley† (DSB|JMHC); Gunit Kaur† (DSB|JMHC); Benjamin Herbert Withers† (DSB); Rusheel Rao Nadipally‡ (DSB); Adeola William Olashore‡ (DSB)

Abstract:

The purpose of this project is to increase the market share of Millie's Thrift Store among young consumers in the Lafayette, Indiana area. Millie's is a nonprofit organization with three store locations serving Lafayette and West Lafayette. The stores collect donations from the local community and sell those items at affordable prices. Millie's is currently seeking to expand its visibility and appeal among young adults, primarily Purdue University students.

To help Millie's reach this goal, we will conduct secondary market analysis and additional research to identify current market opportunities and effective methods for growth. We will then compile this research into a presentation that includes actionable, evidence-based recommendations. This project aims to help Millie's strengthen its presence among young consumers and further its mission to serve the community.

Keywords:

Thrift Store; Marketing; Case Study; Promotion

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1518

Presentation Time: Session 3: 12:00-1:00pm

Predicting Sports Injury Risk: A Data-Driven Approach to Athlete Health Management

Business Case Study

Authors(s):

Yusuf Anis Sherali† (DSB); Shashank Venkata Seerum† (DSB); Sanjay Anthony Jaikaran† (DSB); Jeenay Vipul Dedhia† (DSB)

Abstract:

Which factors best predict near-term sports injuries, and how can teams use those signals to prevent time lost? This project analyzes demographic, physical, training, and lifestyle inputs to estimate injury risk. The goal is practical: give coaches, trainers, and medical staff clear guidance that reduces preventable injuries and supports long-term athlete health.

The study uses the SIRP-600 dataset with 600 athletes and ten attributes. The outcome is injury occurrence. Exploratory analysis shows patterns that practitioners can use. Prior injury is a strong risk signal. Heavy training without adequate recovery increases the risk, while steady conditioning and sufficient sleep lower it. Age and BMI relate to risk in a non-linear way, with higher risk at the extremes. Basic cleaning fills small gaps and keeps scales comparable so these patterns are easy to interpret.

Modeling follows a staged plan. I start with logistic regression as a simple baseline, then test a decision tree and a random forest. Models are compared with K-fold cross-validation. Final selection is based on the lowest test error, with recall as the primary metric to catch at-risk athletes.

The results will guide weekly risk flags, targeted recovery and conditioning plans, and scheduling choices that balance workload and rest. Staff can triage attention, act early, and track whether prevention efforts work. Teams gain a repeatable method to align medical, performance, and coaching decisions with evidence.

Keywords:

Sport Injury Prediction; Data & Modeling Focused; Preventative Analytics; Performance Optimization; Predictive Analytics

Mentor(s):

Davi Cordeiro Moreira (DSB)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1519

Presentation Time: Session 3: 12:00-1:00pm

The Country Mansion- Selling the Tranformation Business Case Study

Authors(s):

Kushagra Sisodia† (DSB|JMHC); Alexander Michael Denysenko† (DSB|JMHC); Jake Everett McDermott† (DSB); Samuel James Beebe† (DSB|JMHC); Om Hemant Pandharipande‡ (DSB); Jathniel O Ahonsi‡ (Science)

Abstract:

This project focuses on the reimagination of The Country Mansion in Dwight, Illinois which is a historic estate currently undergoing major renovations with the goal of achieving top-tier Midwest destination status by 2030. Once fully restored, the property will host weddings, corporate retreats, and large gatherings, offering overnight accommodations for up to 24 guests. The project's purpose is to develop a comprehensive brand and marketing strategy that revitalizes the mansion's image and positions it competitively against similar high-end venues.

To accomplish this, our team will gather data from multiple sources, including benchmarking analyses of comparable Midwest destinations, interviews with potential customers and event planners, and secondary market research to identify emerging hospitality trends and customer expectations. This research will help define the target audience, uncover what experiences most resonate with them, and explore potential names and brand identities that reflect the property's transformation.

The project will culminate in a research poster and final presentation that synthesize key insights. Ultimately, this work aims to provide the property's owner, Carson Woods, with a clear, data-driven path for positioning The Country Mansion as a modern, high-value destination rooted in classic Midwest charm.

Keywords:

Rebranding; Destination Marketing; Hospitality Strategy; Market Research; Luxury Positioning

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1520

Presentation Time: Session 3: 12:00-1:00pm

Secondary Metabolic Response of *Serratia marcescens* to Cannabidiolic Acid Exposure STEM

Authors(s):

Kayla Nikole Skertich†

Abstract:

Phytocannabinoids are plant-derived compounds, widely known for their diverse biological effects in humans. However, their influences on microbial systems are largely unexplored. This study examines how the model bacterium *Serratia marcescens* responds to stimulation with cannabidiolic acid (CBDA), a naturally-occurring precursor to cannabidiol (CBD). Although CBD has been shown to inhibit bacterial growth in some cases, our previous work demonstrated that *S. marcescens* maintained a normal growth response while exhibiting enhanced production of its characteristic red pigment, prodigiosin. This secondary metabolite has been reported to exhibit immunomodulatory and anti-cancer effects. We hypothesized that CBDA exposure would elicit a similar response.

To test this, *S. marcescens* was exposed to various concentrations of CBDA. Growth was monitored over a 20-hour incubation with hourly optical density readings at 600 nm (OD600). In addition, prodigiosin was extracted and quantified. CBDA exposure induced a dose-dependent enhancement in prodigiosin synthesis with no measurable effect on growth, mirroring previous CBD findings. Given that CBDA readily converts to CBD upon exposure to light and heat, a parallel experiment was conducted to control for these conditions, yielding consistent results.

These findings support the emerging idea that microbes can recognize and metabolically respond to phytocannabinoids. This provides a framework for exploring how other metabolites and other microbial species, including those residing within the healthy human gut, may respond to phytocannabinoid exposure.

Keywords:

Serratia marcescens; Cannabidiolic Acid; Prodigiosin; Secondary Metabolism; Microbial Response

Mentor(s):

Michael I Zimmer (Purdue Northwest)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1521

Presentation Time: Session 3: 12:00-1:00pm

Investigating the Role of PP2A-B56a in Cell Identity in NSCLC STEM

Authors(s):

Emily Grace Smith† (Science|JMHC)

Abstract:

Lung cancer is the third most common type of cancer, 87% of which is Non-Small Cell Lung Cancer (NSCLC). Mutations in KRAS and EGFR are the most common in NSCLC, however targeting KRAS has proven difficult, so we must find another part of the pathway to target. PP2A, a critical “off-switch” phosphatase, regulates downstream effectors of EGFR and KRAS. Previous studies have shown that the specific B regulatory subunit B56a shows significant tumor suppressive abilities. This project investigates the role of PP2A-B56a in Human Bronchial Epithelial Cells (HBEC), that have a KRAS G12V mutation and p53 knockdown. These alterations make the cell partially transformed, but not yet tumorigenic. Because B56a has been shown to have tumor suppressive capabilities, we hypothesize that loss of this PP2A subunit will lead to an increase in the tumorigenic capabilities of these partially transformed lung cells. From findings in our lab, HBEC-KP with an shRNA mediated knockdown of B56a has shown potential loss of cell identity through a 3D network formation assay, where they lose normal network structure. Transformation assays, like proliferation and clonogenic assays, as well as mRNA and protein expression analysis, will investigate if the loss of B56a subunit has potentially tumorigenic qualities and leads to a loss of cell identity.

Keywords:

[no keywords provided]

Mentor(s):

Brittany Nicole Heil (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1522

Presentation Time: Session 3: 12:00-1:00pm

Soundwaves as a form of physical treatment in Medicine STEM

Authors(s):

Maxwell James Stewart† (Polytechnic)

Abstract:

Sound consists of air vibrations at different frequencies. Recent research suggests that sound frequencies can interact mechanically with the human body in ways beyond auditory perception. Resonant frequencies can potentially influence the circulatory system, skeletal system, nervous system, and muscular system. This paper will explore how targeted sound frequencies can stimulate healing processes and promote therapeutic outcomes without invasive procedures or extensive treatment. The research will focus on existing studies and information on cellular resonance and vibroacoustic therapy to examine how sound vibrations and frequencies influence the body. This paper will offer insight into how sound-based procedures could be developed, explored, and implemented as treatment options in medicine.

Keywords:

Sound Vibrations; Vibroacoustics; Resonance; Frequency; Treatment

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1523

Presentation Time: Session 3: 12:00-1:00pm

We are Greater Together: Greater Lafayette Chamber of Commerce Research Analysis Business Case Study

Authors(s):

Elle Miriah Stowers† (DSB); Lauren Riley Clark† (DSB); Parker Nadaline Sikora† (DSB); Margaret Elizabeth Padgett† (DSB)

Abstract:

This project examines membership trends within the Greater Lafayette Chamber of Commerce using data from the organization's GrowthZone CRM system. The goal of this research is to identify underrepresented business segments or areas within the Greater Lafayette region and uncover patterns that can inform targeted outreach strategies. By combining data analysis with marketing insights, the project seeks to develop recommendations on how the Chamber can more effectively communicate its value to both current and prospective members. The findings will support data driven decision making related to member recruitment, engagement, and retention, ultimately helping the Chamber strengthen its role within the local business community.

Keywords:

[no keywords provided]

Mentor(s):

Erin Alkire Britton (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1524

Presentation Time: Session 3: 12:00-1:00pm

Interdisciplinary Shortcomings in ASD Assessment

Humanities

Authors(s):

Sanjna Aravinda Suresh† (HHS)

Abstract:

Diagnosis for Autism Spectrum Disorder (ASD) relies on comprehensive methods and high-standard tools like the ADOS-2 and ADI-R, which are widely used because of their effectiveness (Christopher & Lord, 2022). However, obtaining accurate diagnoses and successful intervention depends heavily on having efficient interdisciplinary diagnostic teams (IDTs), which face systemic challenges on the daily, including communication issues and a lack of specific resource guides for school-based practitioners (Kunze & Machalicek, 2022; McKenney et al., 2015). This exploratory research argues that the effectiveness of high-standard assessment tools for students with ASD is impaired by the lack of support and relevant resources available to professionals who conduct the diagnostic assessments. To investigate this issue, I conducted a preliminary literature review that gathered the most effective practices, documented the obstacles IDTs encounter, and identified research gaps across numerous academic sources. By focusing my research on the specific needs of ASD diagnoses in students, I provide important insights by highlighting the gap between current diagnostic guidelines and the potential capacity for effective tools in educational settings. This contributes to the urgency in developing higher standards for diagnostic resources and reforming existing policies.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1525

Presentation Time: Session 3: 12:00-1:00pm

At the Brink of Automation: How Generative AI Is Reshaping Entry-Level Job Opportunities STEM

Authors(s):

Jakub Szacillo† (Science)

Abstract:

The advent of generative AI (artificial intelligence) has fundamentally altered how humanity gets work done. Across academia and the workplace, the integration of AI has depressed the importance of skills like writing and critical thinking. However, the impact of AI varies between occupations, changing based on each profession's level of AI exposure (the degree to which a job can be automated by generative models). Fields with high levels of AI exposure, such as software engineering, risk greater disruption, whereas occupations with low levels of AI exposure, such as electrical work, remain comparatively insulated. This exploratory research paper will analyze whether the introduction of generative AI in 2022 significantly shifted entry-level employment patterns across occupations with varying AI exposure. The analysis draws on labor market data, expert opinions, and anecdotes of changing workplace dynamics. Preliminary research suggests that while the overall job market in the United States remains resilient, entry-level roles in high AI exposure occupations have begun to contract, declining about 13 percent compared with low AI exposure occupations (Brynjolfsson, Chandar, & Chen, 2025; Jones & Heikkilä, 2025). This data indicates that effects are more exaggerated among younger workers, indicating a hiring slowdown specifically for new workers. This research carries serious implications for the health of the labor market and for new graduates entering the workforce. Without deliberate action, there is a compounding risk that an entire generation could become disillusioned with the economy and, more importantly, society.

Keywords:

Entry-Level Employment; Generative AI; AI Exposure; Hiring Slowdown; Employment Patterns

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1526

Presentation Time: Session 3: 12:00-1:00pm

Shaping Music Practice with Automated Evaluation STEM

Authors(s):

Ashwin Kazuki Thamp† (Engineering); Vera T Gao† (Engineering);
Aryan Kiran Kumar Chamarajanagar† (Science); Kaya Tacert† (Science)

Abstract:

This project aims to use digital technology to transform how musicians practice, posing particular utility to intermediate music learners. To bolster the productivity of practice time, our research aims to develop a mobile app that tracks the performance of a string player through given sheet music, providing visual in-score feedback of their pitch accuracy, intonation, and tempo. The app employs score-based alignment with synthesized MIDI data and Dynamic Time Warping (DTW) to align the reference with live performance audio. To optimize the human-to-computer interaction and the app's educational engagement, we refine the visual and temporal delivery of alignment feedback, expand the app's music catalogue and test datasets, and enhance functionality and responsiveness. We further optimize DTW by moving costly computations to native code for the device (i.e., Java for Android), reducing the amount of time that the app spends analyzing the user's recording dramatically. In addition to real-time cues, a post-performance TempoGraph helps diagnose consistency issues, supporting a dynamic approach to asynchronous practice while allowing for live performance nuance. A user account system also persists performance data across sessions, storing alignment paths, intonation calculations, and tempo metrics to enable analysis of practice patterns and progress tracking. To this end, we are conducting usability testing and preparing structured user studies to examine how real-time visual feedback influences practice behavior, error correction, and learning efficiency. Through this evaluation-driven phase, the project seeks to validate Evaluator Sound as an effective, interactive companion that bridges the gap between autonomous practice and guided instruction.

Keywords:

Signal Processing; Score Following; Dynamic Time-Warping; Real-Time Synchronization; Mobile Application Development

Mentor(s):

Yeon Ji Yun (Liberal Arts); Yung-Hsiang Lu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1527

Presentation Time: Session 3: 12:00-1:00pm

Investigating the Effect of Anti-tracking in Co-location Food and Energy Production STEM

Authors(s):

Sunny Townsend† (Engineering); Nicholas Paul Santorelli‡ (Engineering)

Abstract:

Integrating solar photovoltaic (PV) systems into agricultural areas offers a promising strategy to improve land-use efficiency. However, this approach often faces resistance due to concerns that solar panels may reduce crop productivity by shading plants. A potential solution is an anti-tracking system, in which solar panels adjust their orientation based on real-time energy production. This dynamic adjustment can redirect more sunlight to plants during critical light periods, mitigating shading effects.

To evaluate this concept in agrivoltaic applications, we designed an experiment to investigate the effects of anti-tracking models on plant growth. In this study, C3 (cool-season) grass is used as a model crop, since many of the world's most important food sources, including rice, wheat, and barley, are C3 plants. Four micro-farm plots will be constructed: one control plot of unshaded grass, one with stationary co-located solar panels, and two with one-axis anti-tracking co-located panels.

The experiment will run outdoors for 4-5 weeks in the fall in West Lafayette, with each plot receiving equal amounts of soil, water, and total irradiance (prior to PV interference). Plant growth will be monitored through regular measurements of mean, maximum, and minimum blade lengths. At the end of the study, the biomass of each plot will be harvested and weighed to determine overall crop yield.

We hypothesize that the anti-tracking models will promote greater plant growth compared to the stationary model by providing more evenly distributed light, though yields may remain slightly lower than the unshaded control.

Keywords:

Solar Energy; Agriculture; Crop Production

Mentor(s):

Peter Bermel (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1528

Presentation Time: Session 3: 12:00-1:00pm

Fisher Funeral Chapel Marketing Study

Business Case Study

Authors(s):

Zoe Angela Tu† (DSB|JMHC); Ruby Jean Woodson† (DSB); Avery Hweichi Lee† (DSB); Nayan Suresh Nair† (DSB); Sophia Pauline Patrinost‡ (DSB); Lucas Michael Keeney‡ (DSB)

Abstract:

In today's technological day and age, it is quite the task for companies across all industries to navigate the ever-changing digital realm of marketing. This is no different for Lafayette's very own Fisher Funeral Chapel, a third-generation family-owned funeral company with only two locations in Northern Indiana. Fisher Funeral Chapel has thrived in the industry since 1950, relying on word-of-mouth marketing strategies that have created a community-rooted brand that has prospered for the last seventy-five years. Our goal is not to change the culture of Fisher Funeral Chapel, but to expand upon their digital presence as well as target families identified as pre-need, a proactive approach to family loss which is planned before one passes away. It is obvious that the community-based identity is what has led to the sustainable success that Fisher Funeral Chapel has achieved. Therefore, we are not in pursuit to change this reputation but instead to modernize the digital marketing footprint and redesign to our target market, all in respect to the carefully curated hospitality that Fisher Funeral Chapel currently offers.

Keywords:

Marketing; Funeral; Chapel; Indiana; Digital

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1529

Presentation Time: Session 3: 12:00-1:00pm

Generation of Microglial iPSCs and Gene Expression STEM

Authors(s):

Diya None Vishwakarma† (HHS)

Abstract:

Microglia are the resident immune cells of the brain and play key roles in maintaining neural health, clearing debris, and regulating inflammation. They are also highly relevant to neurodegenerative diseases such as Alzheimer's, Parkinson's, and multiple sclerosis, where their activation is linked to disease progression. However, obtaining human microglia is extremely difficult since they can only be isolated through surgical procedures or post-mortem tissue. To overcome this limitation, we use human induced pluripotent stem cells (iPSCs) to generate microglia-like cells that closely resemble their in vivo counterparts and allow controlled studies of human-specific mechanisms.

In this project, to differentiate the iPSCs into microglia, we followed an 18-day protocol. From days 0–4, iPSCs are aggregated into embryoid bodies and treated with BMP4, VEGF, and SCF to induce mesoderm. Between days 4–11, cultures receive SCF, M-CSF, IL-3, FLT3L, and TPO to promote hematopoietic progenitor formation. Finally, from days 11–18, the cells are maintained with FLT3L, M-CSF, and GM-CSF to expand myeloid precursors, producing free-floating microglial progenitors ready for maturation and study.

Introducing or overexpressing genes in these iPSC-derived microglia is crucial to study disease-relevant pathways. However, transfection of iPSC-derived microglia is challenging due to their fragile nature, low proliferation rate, and strong antiviral responses that limit nucleic acid uptake. In this project, we optimize transfection conditions and reagents to efficiently introduce different genes into iPSC-derived microglia, enabling the study of gene function and pathogenic mechanisms relevant to neurodegenerative diseases.

Keywords:

Microglia; Pluripotent Stem Cells (iPSCs)

Mentor(s):

Jitika Rajpoot (Science)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1530

Presentation Time: Session 3: 12:00-1:00pm

No Glovebox? No Problem. Accessing Hypoxic Electroanalysis Using Dense Gases in a Fishbowl STEM

Authors(s):

Amber K Wang† (Science)

Abstract:

For many years, traditional deoxygenation methods, including gloveboxes and inert gas purging systems, have been essential for air- and moisture-sensitive electroanalysis. These techniques have offered opportunities to make discoveries in systems that are not naturally accessible in ambient conditions. However, these methods are costly, require diligent maintenance, and pose contamination risks that limit accessibility. Here, we propose an alternative and cost-effective approach to creating and maintaining a hypoxic environment for electroanalysis by taking electrochemical measurements in a fishbowl filled with a dense gas blanket. Nitrogen, butane, and argon gases were investigated by collecting a series of cyclic voltammograms to study the oxygen reduction reaction over an extended period under a blanket of each gas. We demonstrate that the oxygen reduction reaction peak returns significantly more slowly in the presence of butane than in systems with less dense gases, such as argon or nitrogen. Our results support the effective use of a dense gas blanket to prevent atmospheric oxygen diffusion, thereby conserving hypoxic conditions suitable for oxygen-sensitive electroanalysis, which mitigates the need for costly equipment.

Keywords:

Hypoxic Environment; Electroanalysis; Butane; Cyclic Voltammetry; Fishbowl

Mentor(s):

Patrick James Herchenbach (Science); Jeffrey Edward Dick (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1531

Presentation Time: Session 3: 12:00-1:00pm

Floorplanning on AFTx08

STEM

Authors(s):

Minghan Wang† (Engineering); Asavari Deshmukh‡ (Engineering); Yun-Hsuan Chiu† (Engineering); Yu-En Lee† (Engineering)

Abstract:

The purpose of our team is to make a computer chip called AFTx08. Chips are made by etching a pattern on silicon which results in a die. To achieve this, one of the steps done is floorplanning which includes the process of mapping and planning where the components of the chip will be placed. The objective of floorplanning is to increase performance of the chip, minimize area, and decrease the power consumed. As part of the System-on-Chip Extension Technologies (SoCET) project, our team is responsible for performing the floorplanning stage of the physical design process for the AFTx08 chip. The floorplanning will be divided into three key subsystems: arranging IO pads around the die, organizing power grids, and placing large IP blocks, called macros, on the chip. With inputs of design netlist and foundry requirements, we will be able to decide the die area, pre-route power and place I/O pads and macros. The expected outcome is a design ensuring that the floorplan adheres to all manufacturing and design constraints. Effective floorplanning is a critical step in the SoC design flow as it directly impacts chip performance, power efficiency, and routability. Achieving this for the AFTx08 will enable reliable operation of the chip for the SoCET team.

Keywords:

System of Chip; Design Flow; Floorplan

Mentor(s):

Timothy Francis Hein (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1532

Presentation Time: Session 3: 12:00-1:00pm

Predicting 30-day Readmission Risk in Diabetic Patients Business Case Study

Authors(s):

Cole Anthony Wernert† (DSB); William Gray Gattoni† (DSB); Owen Alexander Hershberger† (DSB); Grant Thomas Romero† (DSB)

Abstract:

This project aims to develop a predictive model that estimates the probability of 30-day hospital readmission for diabetic patients at the point of discharge. The main research question guiding this study is: which factors most strongly predict short-term readmission among diabetic inpatients, and how can these insights improve care and reduce costs? Hospital readmissions within 30 days represent a major challenge for healthcare systems, as they increase costs and negatively impact patient outcomes. Diabetic patients are particularly at risk due to the complexity of managing comorbidities and post-discharge care.

The synthetic dataset, obtained from Kaggle's Hospital Readmission Dataset, contains over 100,000 patient encounters with more than 50 variables describing demographics, treatments, and outcomes. After cleaning the data, missing values were imputed, class imbalance was addressed, and data leakage was prevented. Feature engineering captured hospitalization history, comorbidity burden, and discharge-related factors. Exploratory analysis identified variables such as length of stay, previous admissions, and discharge disposition as highly predictive of readmission.

The modeling process begins with a regularized logistic regression baseline for interpretability and expands to more complex models, including Random Forests and Gradient-Boosted Trees, to capture nonlinear relationships. Models are trained using stratified k-fold cross-validation and evaluated on a separate test set with metrics such as AUROC, AUPRC, and recall at top-K thresholds. Calibration techniques ensure reliable probability estimates.

By identifying high-risk patients, this project supports hospitals in implementing targeted interventions, such as personalized discharge planning, patient education, and follow-up care, to reduce avoidable readmissions and improve patient outcomes.

Keywords:

Readmission; Cost; Comorbidities; Diabetes; Healthcare

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

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1533

Presentation Time: Session 3: 12:00-1:00pm

Pink Cleaning A Marketing Case Study

Business Case Study

Authors(s):

Josephine Lee Whitcomb† (DSB); Isabella Truly Holloway† (DSB|JMHC); Lynette Garcia-Gonzalez† (DSB); Ellen Nicole Van Dokkenburg† (DSB); Charlene Valentine Cheng‡ (DSB); Meera Sachdeva‡ (DSB); Aswatha Sundaresan‡ (DSB)

Abstract:

The purpose of this study is to develop a successful marketing strategy for Pink Cleaning to use in growing and expanding their business into larger cities, such as Indianapolis. With strong brand recognition in Lafayette, Indiana, and a clear mission statement focused on customer satisfaction, Pink Cleaning is experiencing stagnant growth. Currently, the company relies on word-of-mouth, branded vehicle exposure, and event participation to promote its services; however, these efforts have not led to an increase in paying customers.

With gaps in Pink Cleaning's current market approach, such as the absence of a formal marketing strategy and a limited digital presence, we plan to focus on promotion, online and media development, and creating a structured brand positioning. The marketing mix currently highlights the services offered and clear pricing but lacks clarity in promotion and placement. Creating an up-to-date digital footprint on social media, utilizing email campaigns, and establishing a defined position for Pink Cleaning will drive growth.

By emphasizing competitive advantages such as specialized cleaning services, a customer-focused approach, and revenue donations to charitable organizations, Pink Cleaning will stand out. By strengthening its differentiation and reputation, Pink Cleaning can achieve sustainable business growth in new cities, increase brand awareness, and become more appealing to corporate clients. Ultimately, Pink Cleaning will be recognized as a leader in commercial cleaning known for excellent all-around service and community care.

Keywords:

Marketing; Small Business; Strategy

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1534

Presentation Time: Session 3: 12:00-1:00pm

Frequency-Specific Mapping of Dopamine Expression in the Lateral Olivocochlear System Following Sound Exposure STEM

Authors(s):

Katelyn Rosalie- Elise Wilcox† (HHS|JMHC)

Abstract:

Background: The auditory system has built-in mechanisms to shield itself from acoustic damage. Repeated exposure to low-level sound enhances auditory resilience, but the mechanism for this hearing protection is unknown. One possibility is the lateral olivocochlear (LOC) efferent system, which provides feedback to the cochlea. LOC neurons express many neurotransmitters that modulate auditory nerve activity. After sound exposure, cholinergic LOC neurons can also express dopamine, suggesting a potential mechanism for hearing protection. Previous work demonstrated that sound-induced dopamine upregulation in LOC neurons is related to sound intensity. Here, we investigated whether sound-induced LOC dopamine upregulation is frequency-specific.

Methods: C57BL/6J mice were exposed to 15 minutes of broadband noise (94 to 103 dB SPL), which caused temporary threshold shifts. LOC neurons were analyzed at 1 day, 1 week, and 3 weeks post-exposure. Brainstem tissue was cleared, immunolabeled for cholinergic (choline acetyltransferase, ChAT) and dopaminergic (tyrosine hydroxylase, TH) markers, and imaged on a confocal microscope. TH-positive LOC neurons within the lateral superior olive (LSO) were quantified. The LSO was divided into high-, mid-, and low-frequency zones based on established lateral-medial tonotopic gradients.

Results: Sound exposure caused a significant increase in TH+ LOC neurons, along with a notable shift in their spatial distribution in the LSO. Sham-exposed mice showed few TH+ LOC neurons overall, with most occurring in the high-frequency zone. In comparison, sound-exposed mice showed an increased number of TH+ neurons in all frequency regions of the LSO, with higher counts in high- than mid- than low-frequency zones.

Conclusion: These findings suggest a frequency-specific dopaminergic response to acoustic stress within the central auditory system. The observed increase in TH-positive LOC neurons in high-frequency zones

following sound exposure could reflect a compensatory or protective response to sound-induced injury.

Keywords:

Efferent System; Cochlear Synaptopathy; Tonotopy; Neuroprotection; Dopamine

Mentor(s):

Jane Ann Mondul (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1535

Presentation Time: Session 3: 12:00-1:00pm

Language as a Window into Cognition: The Processing of Syntactic Ambiguity by Native Speakers of English

Social Science

Authors(s):

Sarah Wu† (Liberal Arts|JMHC); Lucia Barrera Lamagna‡ (Liberal Arts); Shayna Ashley Ramirez† (Liberal Arts)

Abstract:

This study investigates how native English speakers use grammatical knowledge in attempting to interpret temporary syntactic ambiguities. In particular, relative clauses describe preceding nouns, but it is not always clear which one: In 'The brother of the councilman who sneezed during the meeting apologized,' the relative clause 'who sneezed during the meeting' can describe either 'the brother' or 'the councilman.' When such sentences unfold word by word in real time, however, native English speakers tend to assume at 'who' that the relative clause will describe the second noun, 'the councilman' (e.g., Carreiras & Clifton, 1999). For our part, we ask whether native English speakers use gender and number cues to confirm and/or revise these assumptions in real time. To examine this, 50 native English speakers will read 24 stimulus sentences word by word, pressing SPACE to move from one word to another. Our stimuli contain relative clauses with reflexives that manipulate gender and number to force particular interpretations. For example, in 'The grandmother of the boy who injured himself at the playground refused to go back,' participants are predicted to initially assume the relative clause describes 'the boy' and then read 'himself' quickly, as it confirms their assumption. In contrast, in 'The grandmother of the boy who injured herself at the playground refused to go back,' participants are predicted to initially make the same assumption but then read 'herself' slowly, as it signals their erroneous assumption. We will discuss the study's motivation, design and predictions; data collection is ongoing.

Keywords:

Cognition; Language; Psycholinguistics; Sentence Processing; Syntax

Mentor(s):

Kyle Robert Swanson (Liberal Arts)

Other Acknowledgement(s):

Vanessa Sheu (Liberal Arts)

Poster Presentation Abstract Number: 1536

Presentation Time: Session 3: 12:00-1:00pm

Beyond the Box Score – Predicting Playoff Success in the NBA

Business Case Study

Authors(s):

Michael Downing Yancy† (DSB); Diego Alberto Caverot† (DSB); Nicholas Richard Boyd† (DSB); Elliott Jameson Soderberg† (DSB)

Abstract:

What measurable team factors and skills are most important to predict playoff success in the NBA? Our project goal is to leverage NBA team statistics from the uniform best-of-seven playoff era (2003 – present) to identify which non-obvious, advanced metrics serve as the best indicators and/or predictors of a team's success in the playoffs.

Our dataset was compiled from team data for both the regular season and playoffs from 2003 onwards, including a distinct measure of each team's playoff series wins each year. We will aim to utilize a Poisson regression model using statistics, or combinations of statistics to give us a prediction count outcome 0-4 of how many playoff series a team will win based on their metrics, and seek to obtain which of these team statistics are the most critical drivers of success in the postseason. Using a Poisson regression model as our baseline, we hope to develop a more advanced model using decision trees to increase complexity as we progress.

As statistics continue to grow and evolve, more and more NBA events are measured, quantified, and tracked. Determining which of these are historically most important for advancing deep into the playoffs can help NBA decision-makers and coaches better identify skill sets, players, strategies, and overall team compositions that provide the best chance of winning playoff series. These are potentially million-dollar decisions, including whether to offer contracts in free agency, spend draft capital, or make trade acquisitions. Teams need to be confident that incoming players will bring valuable skill sets and contributions to justify the cost of acquiring them.

Keywords:

NBA; Analytics; Playoffs; Statistics; Basketball

Mentor(s):

Davi Cordeiro Moreira (DSB)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1600

Presentation Time: Session 4: 1:30-2:30pm

Predictive-Reactive BIPV Electrical Array Reconfiguration STEM

Authors(s):

Marawan Sultan Mah Abdulsattar† (Engineering)

Abstract:

As cities pursue sustainability goals, integrating solar panels into building materials, known as Building-Integrated Photovoltaics (BIPV), is a promising approach. The dynamic shading in urban environments, however, creates a distinct electrical engineering problem. When panels in a solar array are exposed to different levels of sunlight, electrical bottlenecks occur, causing significant power loss. Current strategies for this problem involve either a static wiring layout designed from annual shade forecasts, or dynamic systems that use sensors to reactively change connections. This project will investigate a method that combines these two approaches by exploring a practical framework for Electrical Array Reconfiguration (EAR) designed for the predictable shading common in urban settings. The core idea is a hybrid control strategy that uses scheduled adjustments combined with real-time feedback. The first layer uses a "shading forecast," generated from a building model in West Lafayette, Indiana, to anticipate predictable shading and execute optimized reconfigurations at set times. This predictive system will be combined with a reactive layer of sensors, enabling the controller to make minor adjustments or respond to unpredictable events like cloud cover. The project will include the design and simulation of the control architecture for this hybrid strategy to study the trade-offs between system performance, response time, and complexity. By comparing the potential energy output with established benchmarks, the goal is to evaluate an EAR strategy that improves efficiency and is better suited to the specific challenges of urban BIPV systems.

Keywords:

BIPV; Electrical Array Reconfiguration; Partial Shading; Energy Yield Optimization

Mentor(s):

Peter Bermel (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1601

Presentation Time: Session 4: 1:30-2:30pm

Bitterness Reduction in Foods and Beverages: A Literature Review of Readily Available Solutions STEM

Authors(s):

Shams Adigozalzade† (Agriculture)

Abstract:

Bitter taste can make good foods and drinks hard to enjoy. Bitter compounds like caffeine and quinine are consumed by people in coffee, tonic water, and green tea daily. This research reviews how and why bitterness could be softened, and which everyday kitchen ingredients actually help to mask these compounds. Focus of this research are based on three big ideas: adding other tastes (like sweetness, salt, or sour) to “balance” bitterness, using smells that suggest sweetness (like vanilla) to nudge our perception, and what combinations have helped in masking bitter in foods before. This research detects peer-reviewed studies and practical sources, then sorts out the most promising, easy-to-find options like sugar and honey, low levels of salt, lemon or other acids, dairy and plant fats, proteins, vanilla or fruity aromas. The goal is to match these tools to common bitter compounds such as caffeine, quinine, cocoa polyphenols, and brassica flavors, noting simple trade-offs (for example, added sugar or sodium). But also, it would be important to research whether any of these additions will have a change in sensory or any organoleptic features. This research would be a “what to try first” guide for home kitchens and student food labs. Overall, it is finalized with ideas for quick taste tests to confirm which fixes work best in real recipes.

Keywords:

Bitter Masking; Coffee/Green Tea; Sour/Salt/Sweet; Flavor; Aroma Effects

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1602

Presentation Time: Session 4: 1:30-2:30pm

Characterization of Kerf Angle Zones in Abrasive Waterjet Machining of Composite Laminates STEM

Authors(s):

Luis Manuel Alvarez Casillas†; Francisco Javier De La Victoria
Vazquez‡

Abstract:

Abrasive Waterjet (AWJ) machining is particularly well-suited for fiber-reinforced composite materials because it is a cold, non-contact cutting process that avoids heat-affected zones, mechanical tool wear, and delamination. Composites are inherently abrasive and challenging to machine with conventional tools, which can wear rapidly and introduce thermal or mechanical damage. AWJ overcomes these limitations by using a high-velocity stream of water and abrasive particles to erode the material, making it ideal for precision machining of composites. However, kerf angle formation remains a key challenge, as taper and surface quality can affect assembly tolerances and structural performance. A detailed understanding of kerf profile geometry in composites, where fiber orientation and heterogeneous microstructure significantly influence material removal, remains limited. This study investigates kerf profile formation in carbon- and glass-fiber-reinforced composites and compares the results with those obtained from steel, aluminum, and plastics. Specimens with thicknesses of 6.35 mm, 12.7 mm, 19.05 mm, and 25.4 mm are cut under varying traverse speeds, and the resulting kerf profiles are characterized to quantify the rounded, tapered, and straight zones through the thickness. In addition, accelerometers were implemented on the samples, in order to evaluate how the vibrations on them behave during machining, to see how materials and their thickness affect the cutting performance of the waterjet. The findings provide practical guidelines for selecting AWJ parameters to minimize kerf angle and improve dimensional accuracy, supporting the broader use of AWJ for high-precision composite component manufacturing.

Keywords:

Abrasive Waterjet; Roughness; Cutting Speed; Material; Kerf Angle

Mentor(s):

Garam Kim (Polytechnic)

Other Acknowledgement(s):
Rishabh Pammi (Polytechnic)

Poster Presentation Abstract Number: 1603

Presentation Time: Session 4: 1:30-2:30pm

Metal-on-Metal Contact Through Reactive Ion Etching of Silicon Dioxide | VIP SPC MIM Team 1 STEM

Authors(s):

Ryan Prado Bailey† (Engineering|JMHC); Athavan Arvind† (Engineering); Leo Jeffrey Janert† (Engineering); Sarah Marie Kolp† (Science); Benjamin Aaron McDowell‡ (Engineering)

Abstract:

Metal-Insulator-Metal (MIM) capacitors are widely used in radio frequency and analog applications. This research focuses on developing a high-yield method for MIM capacitors using a metal-on-metal contact, allowing for easy interfacing. Statistical process control involves measuring key parameters in the process flow to quantify tool accuracy and precision. A series of thin-film deposition (PVD, ALD) and lithography steps were performed to create the conditions under which the access points to the bottom electrode of the MIM device would be etched. This was repeated multiple times while optimizing the etch recipe for etch rate consistency and cleanliness. Throughout processing, the surface roughness was measured with atomic force microscopy (AFM) and the cleanliness was inspected with a microscope. Finally, using this optimized etch method, a full MIM capacitor was fabricated. This enabled collection of SPC data on the PVD, ALD, and lithography tools while optimizing the etch recipe for improved repeatability and cleanliness of the access pad to the bottom electrode of the capacitor.

Keywords:

Semiconductor Manufacturing; Statistical Process Control; Reactive Ion Etching; Capacitor

Mentor(s):

Zhihong Chen (Engineering); Joerg Appenzeller (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1604

Presentation Time: Session 4: 1:30-2:30pm

Complete Online Database of Invertebrate Fossil Genera STEM

Authors(s):

Samyukta Balaji† (Engineering); Ellis Reuben Selznick† (Engineering); Ekaterina Tsyao† (Science); Behruz Izbaev† (Science)

Abstract:

The Treatise on Invertebrate Paleontology is an extensive collection of references created on fossil and living invertebrates. Spanning more than fifty volumes and written by over 300 paleontologists, it details nearly 100,000 genera across every known phylum, class, order, and family. Each entry describes taxonomy, morphology, and both stratigraphic and paleogeographic ranges, making the Treatise an essential resource for paleontological research.

In partnership with the University of Kansas, our team is bringing this monumental work into a digital format that can be searched, explored, and connected in new ways. Our online Treatise provides open access to fossil data through a series of interactive, cloud-based databases. Each major invertebrate group such as Brachiopods, Echinoderms, Porifera (sponges), and Graptolites, has its own website (for example, brachiopod.treatise.geolex.org). Users can look up genera, examine when they first and last appeared in geologic time, and explore where they were discovered around the world.

Entries include classification, age range, and distribution data, with images being added for thousands of genera. The site also includes tools to create diversity plots that visualize how groups evolved through time, which can be exported for use in TimeScale Creator and other research software.

By moving the Treatise online, we are preserving a vital scientific legacy while making it easier for researchers, educators, and fossil enthusiasts to explore Earth's ancient biodiversity.

Keywords:

Geology; Earth History; Database; Visualization

Mentor(s):

James G Ogg (Science); Aaron C Ault (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1605

Presentation Time: Session 4: 1:30-2:30pm

Hostile architecture and its effects on the homeless

Humanities

Authors(s):

Zoe Michelle Beavers† (HHS)

Abstract:

Hostile architecture is seen all over bigger cities, and Lafayette is no exception. It has a significant impact on the livelihood of not only the homeless, but also disabled individuals, pregnant women, and people who use mobility aids. Hostile architecture needs to be removed, and viable resources for the homeless need to be put in place for the betterment of our society. This exploratory research project investigates the impact of hostile architecture and possible solutions for the community.

Keywords:

Homelessness; Hostile Architecture

Mentor(s):

Catherine Jean Shukle (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1606

Presentation Time: Session 4: 1:30-2:30pm

The Effect of Moderate Continuous Exercise on Plasma Free Fatty Acid Carrier Proteins in Mice. STEM

Authors(s):

Jadyn Marie Befort† (HHS|JMHC)

Abstract:

Plasma free fatty acids (FFAs) are known to be elevated with acute moderate continuous exercise (MCE). However, the effect of MCE on plasma FFA carrier proteins is unknown. Eight male C57BL/6J mice either rested (Rest) or exercised (MCE) (velocity, 15 m/min; incline, 10°; duration, 60 min) at 12 weeks of age, and plasma samples were collected immediately after the intervention. Plasma FFA carrier proteins were isolated by a fatty acid pulldown assay and detected by proteomics. Differentially abundant plasma FFA carrier proteins were selected for in silico docking simulations to identify potential binding sites for FFAs. Furthermore, plasma proteins and lipoprotein particles were separated by fast protein liquid chromatography (FPLC), and FFA levels in the FPLC fractions as well as total plasma FFA concentrations were measured. Total plasma FFA concentration was significantly higher in MCE compared to Rest group, and elevated FFAs were found in the FPLC fractions containing free proteins but not in the lipoprotein fractions. The fatty acid pulldown assay and proteomics identified 207 plasma FFA carrier proteins in total, and five proteins were found to be significantly lower in MCE, and one protein was found to be significantly higher in MCE group. These plasma proteins which were found to be lower in MCE included haptoglobin and immune system proteins. Furthermore, docking simulations identified potential FFA binding sites on the differentially abundant proteins. In conclusion, MCE can alter plasma FFA carrier proteins, and these modifications may contribute to elevated FFA transport when peripheral tissues need energy substrates.

Keywords:

Exercise; Plasma Proteins; Non-Esterified Fatty Acids; Proteomics; Docking

Mentor(s):

Keigo Tomoo (HHS); Gregory C Henderson (HHS)

Other Acknowledgement(s):

Yi Zhang (HHS)

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

Poster Presentation Abstract Number: 1607

Presentation Time: Session 4: 1:30-2:30pm

Restoring Tapawingo Park: Linking Water Filtration, Pollinator Habitat, and Public Space Creative

Authors(s):

Hailey L Benfield† (Engineering); Lawrence Lichtig† (Agriculture);

Haotian Tang† (Agriculture)

Abstract:

The Wabash River has long been one of the dirtier rivers in Indiana over the past decade, suffering from nonpoint pollution throughout the river from farming¹. Along the banks of the Wabash, West Lafayette's Tapawingo Park can act as not only a filter for the river, but also as a home for both the environment and the community. Historically, 25% of Indiana was a part of the Grand Kankakee Marsh, a marsh that held one of the most diverse ecosystems in America². Through the creation of a living machine along the bank, this area intends to act as a natural filtration system for the river, similar to the functions of a wetland. Comparable to the living water garden in Chengdu, China, this area invites people to connect with the river and its historic culture. Along with the living machine, this plan incorporates a pollinator corridor to bring a safe haven to all wildlife that depends on our pollinators. In doing so, Tapawingo Park connects local green spaces to strengthen regional biodiversity while creating visual interest for community engagement. This town square integrates ecological restoration to public spaces, allowing residents and the local college campus to observe pollinators, connect to their local ecosystem, and with each other.

Keywords:

Community; Revival; Conservation; Green Infrastructure; Nature

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1608

Presentation Time: Session 4: 1:30-2:30pm

Synthesis of Zirconia Oxide Nanostructures Enriched in Low-Coordination Lewis acid-base pairs STEM

Authors(s):

Valeria Borja Dorado† (Engineering)

Abstract:

Metal oxides such as zirconia (ZrO_2) expose surface metal–oxygen (Me–O) pairs that can function as Lewis's acid–base (LAB) sites, where the metal cation acts as the Lewis acid and the oxygen anion as the Lewis base. These LAB sites are of particular interest because they can heterolytically cleave strong C–H bonds, generating reactive intermediates that participate in dehydrogenation and related catalytic reactions. However, many of these high-energy, low-coordination sites are lost during crystal growth due to surface reconstruction and thermodynamic stabilization. The central goal of this project is to develop synthetic strategies that stabilize and enrich these high-energy, low-coordination sites by selectively controlling crystal growth. Our approach involves the use of inorganic or organic “titrants” that transiently bind to low-coordination Zr–O LAB pairs during synthesis, thereby lowering surface energy and preventing loss of those LAB pairs through growth along unfavorable crystallographic directions. Subsequent removal of these titrants by calcination or washing is expected to regenerate the active low-coordination sites for catalysis. Experimentally, zirconium oxides and oxyhydroxides will be precipitated from aqueous solutions in the presence of selected titrants, followed by calcination to remove the organic modifiers or washing to remove inorganic species. Structural characterization will rely primarily on powder X-ray diffraction (PXRD), with Rietveld refinement used to determine crystallite sizes and anisotropic growth. These studies aim to establish a direct link between synthetic control, surface structure, and catalytic reactivity in zirconia-based materials.

Keywords:

Lewis Acid-Base Sites; Zirconia Oxide; Catalysis; X-Ray Diffraction; Rietveld Refinement

Mentor(s):

Mikalai Artsiusheuski (Engineering); Enrique Iglesia (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1609

Presentation Time: Session 4: 1:30-2:30pm

Birth Control for Teens: Positive or Negative?

Humanities

Authors(s):

Sophia Elaine Breedlove† (HHS|JMHC)

Abstract:

Birth control has been used by countless individuals for decades, yet research still needs to be conducted. The pill has many uses for women, especially adolescents. Research on birth control's short and long-term links to depression in adolescents is inconclusive. According a recent study, "Almost half of the women in the sample had first used contraceptive pills as teenagers; these women were at a higher risk for being clinically depressed" (Anderl and Chen, n.p.). Most teens are not aware of the effects which is what I found in my preliminary research. I will talk about how birth control, even with potential effects such as depression, is beneficial for adolescents, but is only beneficial if the adolescents know what they are taking and of potential those effects. The information that is out there now is not enough, more needs to be completed to give correct information to teenagers to make the pill worth taking.

Keywords:

Birth Control; Adolescents

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1610

Presentation Time: Session 4: 1:30-2:30pm

Effects of Age on Rat Reproduction

STEM

Authors(s):

Megan Nicole Broecker† (Agriculture|JMHC)

Abstract:

A large proportion of biological research relies on the Long-Evans rat, a breed created by Dr. Long and Dr. Evans. Current research demonstrates strong correlations between increasing maternal age and decreasing numbers of offspring, indicating a decline in female reproduction. Male aging and its effects on time to successful copulation and litter sizes are not well-documented. Using an established breeding colony – one male paired with one female – calculations were performed to determine the length of time between pairing and copulation resulting in a litter, using the formula: Date of Parturition - 21 days - Pairing date. Litter size was recorded at post-natal day 3. Breeding pair ages were recorded at pairing. Breeding preference was given to rats that regularly produced litters, to ensure the lab had research subjects. In this retrospective analysis, no correlations between age of either sex and litter size were present, nor did age of either sex have a significant effect on the length of time between pairing and successful copulation. Contrary to standard literature, age did not contribute significantly to the reproductive trends of the Long-Evans rats in this specific lab. Further research is needed to verify these findings. Selective breeding plans such as the one implemented in this lab can contribute to the improved reproductive trends of Long-Evans rats. Understanding these trends, researchers can standardize a more efficient way of producing offspring for research. Analysis identified outside of the scope of this study has already been implemented to increase productivity in this specific lab.

Keywords:

Rat; Reproduction; Colony Breeding

Mentor(s):

Casie S Bass (Agriculture); Jimmy Dooley (Science); Jon E Ferrel (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1611

Presentation Time: Session 4: 1:30-2:30pm

Maize Aerial Root Mucilage and Microbial Activity: Is it Night and Day? STEM

Authors(s):

Samuel Thomas Burdick† (Agriculture|JMHC)

Abstract:

Maize and other grasses support microbial activity through both belowground (rhizosphere) and aboveground (aerial) roots. These root-associated microbes rely on plant-derived carbon and, in return, contribute nitrogen (N) via N-fixing activity. Recent studies of the Sierra Mixe maize landrace revealed that microbial activity in aerial root mucilage (ARM) can supply a significant portion of the plant's nitrogen budget. However, the factors regulating this process remain poorly understood. Notably, ARM production has been observed to increase at night, aligning with diurnal cycles in root elongation and environmental conditions such as humidity. This observation suggests that diurnal rhythms may influence ARM composition and, consequently, microbial N-fixation.

I propose that monophenolic acids—precursors in lignin biosynthesis that fluctuate with light and growth cycles—mediate microbial activity in ARM. These compounds are known to shape rhizosphere microbiomes by selectively promoting bacteria capable of phenolic catabolism while inhibiting others. Given that plants with altered lignin biosynthesis exhibit distinct microbial communities, diurnal changes in monophenolics may represent a key factor driving temporal variation in microbial N-fixation.

Border cells, which contribute to mucilage production and vary by genotype, may further influence the chemical composition of ARM and its microbial community. This research will investigate how diurnal variation in ARM chemistry, particularly monophenolic acid content, affects N-fixing microbial activity across maize genotypes. Identifying “hot moments” of peak N-fixation will advance understanding of plant-microbe interactions and inform breeding strategies to enhance biological nitrogen fixation in maize.

Keywords:

Maize; Aerial Root Mucilage; Diurnal Cycle; Lignin Biosynthesis; Border Cells

Mentor(s):

Roland Conrad Wilhelm (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1612

Presentation Time: Session 4: 1:30-2:30pm

Developing Realistic Environments: Improved Complex Environmental and Human Behavior Simulation STEM

Authors(s):

John Nicholas Burnst† (Engineering); Reed Ellis Bakert† (Engineering);
Noah Lee Timonera Federovitch† (Engineering); Yuan Chi Chang†
(Engineering); Akash Amalarasan‡ (Engineering)

Abstract:

Simulating environmental systems is common in design, ecology, and business fields. What has yet to be developed is a robust human behavioral model applicable to a range of social and spatial contexts. This project explores the behavior of AI-driven non-playable characters (NPCs) in response to realistic weather conditions within densely populated environments. The objective is to simulate lifelike NPC behavior by modeling how environmental factors—such as rain, wind, noise, and temperature—influence individual decision-making and social interactions in the built environment. Each NPC exhibits unique responses shaped by personalized perception models and personality traits, mirroring human variability. Using Unreal Engine's Environmental Query System (EQS), NPCs evaluate their surroundings for weather exposure, shelter availability, and crowd density. Behavior trees govern their response opportunities, which may include seeking cover, continuing despite discomfort, or altering their route in real time based on user-controlled weather inputs. To enhance realism, this team has refined existing environmental effects and introduced a new noise factor. These effects are integrated into an updated level featuring a redesigned layout inspired by real-world public spaces. The combination of densely occupied spaces and enriched environmental complexity significantly improves the simulation's realism and its potential for modeling human-environment interactions across a range of climates, cultures, and spatial programs.

Keywords:

AI; Pathfinding; Unreal Engine; Artificial Intelligence; GAINS

Mentor(s):

David Michael Barbarash (Agriculture)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1613

Presentation Time: Session 4: 1:30-2:30pm

Development of Feature Set for Autonomous Classification Systems for Subvisible Particles in Biotherapeutics STEM

Authors(s):

Zoe Nicole Campagna† (Engineering|JMHC); Abigail Elisabeth Gansler† (Engineering|JMHC); Sparsh Bansal† (Engineering|JMHC)

Abstract:

Subvisible particles (SVPs: 0.1-100 μm) are the result of protein aggregation in biotherapeutics due to agitation and are linked to an increased risk of immunogenicity. Current detection and identification methods heavily rely on labor-intensive and inconsistent manual review. The objective is to identify a distinct and condensed feature set for efficient and accurate classification of SVP images.

We curated a dataset of 929 SVP particles of three classes. These classes are oil, glass, and protein particulates.

We computed morphological features on the dataset of SVP particles. We then narrowed the list of relevant features through Kullback-Leibler (KL) Divergence and principal component analysis (PCA). The relevant features were processed in unsupervised k-means clustering to classify the particles. We also trained supervised models with feature inputs and compared the results to a CNN-based image input model to compare performance differences in handpicking features verses learned representations.

Through this analysis, we identified that features such as ABD diameter and volume, primary axis, roughness, sum intensity, and perimeter are most useful in distinguishing between particle classes. Supervised classifiers developed on this subset performed strongly while maintaining low computational demands.

Keywords:

[no keywords provided]

Mentor(s):

Brett A Meyers (Centers & Institutes); Reza Babakhani Galangashi (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1614

Presentation Time: Session 4: 1:30-2:30pm

Response of Human Intestinal Epithelial Cells to Exposure to Caffeine and Alcohol STEM

Authors(s):

Logan Carlsons† (Science|JMHC)

Abstract:

Caffeine is a widely accessible psychostimulant found in foods, supplements, and medications. Caffeine is consumed by approximately 80% of the world's population and is consumed by many individuals quite regularly. Many young individuals and adults also engage in the recreational consumption of alcohol. Excessive alcohol use has been shown to have several adverse effects, including an increase in gastric cancer risk. Caffeine is frequently consumed with ethanol, and while the effects of both have been well studied, the effects of simultaneous consumption of alcohol and caffeine on disease risk has not been well investigated. Series of experiments were conducted to determine how human colonic epithelial cells (CaCO2) respond to ethanol alone or in combination with caffeine. When cells were cultured with different percentages of ethanol (0, 0.5, 1, 2, 4 and 6), there was a gradual reduction in cell proliferation as ethanol percentage increased. Compared to the 0% ethanol, 4 and 6 % ethanol caused a 17 and 22% reduction in cell proliferation respectively. Ethanol at 2% also caused a significant ($P < 0.05$) reduction in the gene expression of SOD3 and CPT1 which are important antioxidant and metabolic genes. Expression of GLUT1 was significantly suppressed ($P < 0.05$) by both caffeine (1mM) and ethanol (2%) and their combination compared to untreated cells. These studies show that ethanol consumption has a deleterious effect on intestinal health through a suppression of cell proliferation and suppression of antioxidant and metabolic genes. A combination of ethanol and caffeine may also cause harm by suppressing expression of GLUT1 which may hurt cell metabolism by suppressing the uptake of glucose through this glucose transporter.

Keywords:

[no keywords provided]

Mentor(s):

Kolapo Ajuwon (Agriculture)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1615

Presentation Time: Session 4: 1:30-2:30pm

Datacenter Network Accelerator: Memory System STEM

Authors(s):

Cynthia Sarai Castaneda† (Engineering|JMHC); Yunfei Gao† (Engineering); Arnav Pravinkuma Namdev† (Engineering)

Abstract:

The Datacenter Network Accelerator team aims to design a SmartNIC (Network Interface Card) that uses remote direct memory access (RDMA) to reduce I/O, data transfer, and data movement overhead. This subteam is designing the memory controller and arbiter that manage communication between the CPU and NIC using dual-port BRAM and the CPU's SRAM controller. This work focuses on efficiently orchestrating the data transfers between the CPU and NIC while keeping the CPU free to do other work.

The memory subsystem will handle instruction decoding, memory access hazards, and managing timing between several systems. This is intended to help large datacenters process data faster by using RDMA to reduce data movement and save energy by saving CPU cycles that can be used for other operations.

Key limitations we are focusing on include BRAM latency and memory access hazards. The BRAM has a 2 cycle delay before the data is valid on its output ports and it does not support simultaneous read and write to the same address. A read and write to the same address causes the read port to stall a cycle. The memory subsystem enables access and priority control for the multiple ports divided between the CPU and the NIC and allows bidirectional instruction and data flow. We will evaluate the performance of our system through measuring the throughput of network traffic. An increased throughput will validate that our design arbitrates memory in the SmartNIC efficiently.

Keywords:

[no keywords provided]

Mentor(s):

Rishikesh Reddy Bathina (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1616

Presentation Time: Session 4: 1:30-2:30pm

Low Power Computer Vision Challenge: Forgery Detection in AI Generated Images STEM

Authors(s):

Christopher Timothy Chant† (Engineering); Aadithya Vasudevan‡ (Engineering)

Abstract:

This project investigates whether compact computer vision models can run entirely on mobile hardware to detect AI-generated images and explain their decisions. We are studying this through a new track in the Low-Powered Computer Vision (LPCV) Challenge, organized with the help of Qualcomm. For each input image, systems must output a label or score (“AI-generated” or “real”) and a concise natural-language rationale that cites visual evidence (for example, texture inconsistencies, lighting, or geometry). Participants receive a curated dataset mixing synthetic and real photographs, reference rationales, and a mobile-ready baseline. Teams will tailor models to edge constraints using quantization, pruning, operator fusion, and hardware-aware training while maintaining detection and explanation quality.

We are in the process of designing a hybrid evaluation framework to compare submissions on both task quality and efficiency. Detection quality is measured with standard classification metrics. Rationale quality uses ROUGE-L and CIDEr against reference explanations, plus an LLM-based judge that scores correctness, coherence, and specificity. Device efficiency on Qualcomm hardware includes latency, energy per inference, memory footprint, and model size. The framework is intended to enable fair, reproducible comparisons and to distill practical guidelines for balancing accuracy, interpretability, and on-device budgets.

By advancing trustworthy, private, and offline inference, this work addresses real-world settings where connectivity is limited and where data privacy is paramount. Our results aim to catalyze practical, energy-aware CV systems that run locally, bringing state-of-the-art capabilities to a wide range of mobile devices.

Keywords:

[no keywords provided]

Mentor(s):

Yung-Hsiang Lu (Engineering); Zihao Ye (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1617

Presentation Time: Session 4: 1:30-2:30pm

Optimization of Nose Cones to Mitigate Sonic Booms STEM

Authors(s):

Harshan Chandrasekar† (Engineering); Mohammad Rayan Shamsi‡ (Engineering); Javier Francisco Hurtado† (DSB)

Abstract:

The primary barrier preventing commercial supersonic travel from becoming commonplace is the shockwave generated when an aircraft exceeds the speed of sound. This shockwave is perceived on the ground as a loud, sharp boom and can be highly disruptive. This shockwave, commonly called a sonic boom, is created by the convergence of smaller shockwaves generated primarily by the nose cone, wings, and tail. For our research, we focused on optimizing the shape of the nose cone at varying supersonic speeds to minimize the far-field sonic boom generated by this part of the aircraft. We will simulate multiple nose cone shapes in supersonic flow using computational fluid dynamics (CFD) to determine which shape is optimal. Based on our results, we will manufacture a design and test it in a supersonic wind tunnel. Because a sharp change in pressure creates a sonic boom, we will use changes in pressure to determine the effectiveness of each of the nose cone designs in mitigating the sonic boom. By mitigating the shockwave generated by the nose cone of an aircraft, the perceived loudness of the shockwave generated by the aircraft as a whole could be greatly reduced, potentially reenabling routine commercial supersonic flight.

Keywords:

Aerodynamics; Supersonics; Sonic Boom; Nose Cone; Computational Fluid Dynamics

Mentor(s):

Curtis Earl Marshall (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1618

Presentation Time: Session 4: 1:30-2:30pm

Characterization of Gallium-Doped Zinc Oxide Thin Films for Tailoring Thickness-Dependent ENZ Wavelength and Loss STEM

Authors(s):

Geetika Chitturi† (Engineering|JMHC)

Abstract:

Epsilon-near-zero (ENZ) materials have attracted significant attention in recent years due to their unique light–matter interactions, enhanced nonlinearities, and potential for novel optical phenomena in the near-zero permittivity spectral range. Among them, transparent conducting oxides such as aluminum-doped zinc oxide (AZO) and gallium-doped zinc oxide (GZO), have emerged as promising candidates for ultrafast optical switching and selective nonlinear enhancement enabled by their narrow spectral ENZ region in the telecom range. While it is established that AZO film thickness can be linked to optical behavior, this relation remains less explored in GZO despite its greater electrical stability. In this work, we vary film thickness, as well as deposition parameters while growing GZO thin films with pulsed laser deposition to examine how ENZ wavelength, optical loss, and structural characteristics of GZO evolve with growth conditions. We leverage spectroscopic ellipsometry, scanning electron microscopy, and X-ray diffraction to perform physical and optical characterization of GZO thin films.

Keywords:

ENZ; Optical Switching; Ellipsometry

Mentor(s):

Miroslava Marinova (Engineering); Kyu Ri Choi (Engineering); Alexandra Boltasseva (Engineering); Vladimir M Shalaev (Engineering); Alexander V Kildishev (Engineering)

Other Acknowledgement(s):

Mustafa Goksu Ozlu (Engineering); Jae Ik Choi (Engineering)

Poster Presentation Abstract Number: 1619

Presentation Time: Session 4: 1:30-2:30pm

Seeing Stress in Stocks: Simple Network Signals from Co-Movement STEM

Authors(s):

Yohaán Chokhany† (Science|Graduate)

Abstract:

Financial markets are tightly connected, so trouble can ripple across many stocks at once. Standard risk tools often look only at pairwise correlations and can miss the bigger web that shapes how shocks grow or fade. This project builds simple “co-movement networks” from publicly available daily returns for a broad set of U.S. equities. In rolling windows, two stocks are linked when their returns move together above a chosen threshold. For each window we track a small set of network features and run basic stress tests that spread shocks along links or remove the most central stocks. We then compare these summaries to same-period market indicators like index volatility and drawdowns using straightforward plots and correlations. The goal is exploratory: to see whether these network features provide early, interpretable signals of elevated risk. If promising, the approach could support accessible dashboards and offer practical guidance for diversification choices.

Keywords:

Financial Networks; Equity Co-Movement; Systemic Risk; Market Volatility; Contagion

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1620

Presentation Time: Session 4: 1:30-2:30pm

Analyzing Pilot Stress and Fatigue

STEM

Authors(s):

Atandril Chowdhury† (Engineering)

Abstract:

This study aimed to explore how pilot stress, fatigue, and sleep quality change across multiple flight sessions, focusing on trainee pilots at Purdue University. Four healthy student pilots, ages 19–20, participated in the study. Their physiological data, including heart rate, electrodermal activity, temperature, and accelerometer readings, were continuously recorded using a wrist-worn device during each flight. Participants also rated their stress and fatigue before and after each flight using a Visual Analog Scale (VAS) and completed the Karolinska Sleep Questionnaire (KSQ) to assess sleep quality and non-restorative sleep (NRS). In addition, they were asked about flight difficulty, performance, and any unexpected events. Results showed that while stress remained mostly stable, fatigue increased consistently across flights. Higher NRS scores were linked to more fatigue, and poor sleep quality was associated with higher stress. Pilots who reported more sleep disturbances also experienced greater fatigue and lower performance. These findings suggest that fatigue and sleep quality are important factors affecting pilot performance. By addressing these factors in training programs, we can help improve pilot well-being and performance, ultimately boosting flight safety and efficiency. Promoting better sleep and managing fatigue could be key to enhancing pilot outcomes, both during training and in real-world flight operations.

Keywords:

Fatigue; Stress; Pilot; Sleep

Mentor(s):

Sudip Vhaduri (Polytechnic); Debra Henneberry (Polytechnic); Mark Wilson (HHS); Julius C Keller (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1621

Presentation Time: Session 4: 1:30-2:30pm

Nothing Fits When You Divide By Zero

Creative

Authors(s):

Thomas Zirkle Clark† (Science); Natcha Ngaosuphanvongs* (Agriculture); Andrew James Coleman* (Science)

Abstract:

The concept of dividing by zero has been thought about by academics for centuries, and it's one of the few problems that can't seem to be completely solved. Zero as a concept was relatively recently invented. Imagine having zero apples in your fridge, imagine having nothing in your fridge. However your fridge still has something in it, air or maybe a ketchup packet. Is it possible for your fridge to contain absolutely nothing? No air, no gravity, no light, this abstraction is at the heart of the problem of dividing by zero. Division is simply taking something and asking how much of something else can fit. Ten divided by five is two because 2 fives can fit into ten, but what about ten divided by zero? How many zero's can fit into ten? Currently our answer to that is, undefined. This project explores how humans have adapted to a world where division by zero is impossible, tracing the idea from its historical rejection to its modern reinterpretations in science and technology. Through a literature-based analysis of mathematical theory, computational logic, and applied sciences, this study examines how different disciplines confront and adjust to "undefined" conditions. The research highlights patterns of innovation that arise from such limitations: how medicine, computing, and mathematics each redefine frameworks to preserve coherence when formulas break down. By linking the mathematical concept of division by zero to broader human problem-solving strategies, the project argues that the undefined is not an endpoint but a catalyst for progress.

Keywords:

Mathematics; Math; Zero; Divide; Philosophy

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1622

Presentation Time: Session 4: 1:30-2:30pm

**Comparing Retention of Material When Taking Notes by
Hand Vs. Digitally**
Humanities

Authors(s):

Samantha Marie Cook† (Education)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1623

Presentation Time: Session 4: 1:30-2:30pm

Verification of the neuromelanin-forming rats to model Parkinson's Disease and their implication in HAA-induced dopaminergic neurotoxicity STEM

Authors(s):

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

Abstract:

Dopaminergic neurodegeneration is the fundamental hallmark of Parkinson's Disease (PD). Currently, there are major gaps in understanding the effects of dietary exposures on PD mechanisms and the specific cellular mechanisms leading to its onset. One of these dietary exposures, a group of chemicals known as heterocyclic aromatic amines (HAAs) [commonly found in cooked red meats], has been previously identified by our lab to target mitochondria, causing oxidative damage, protein aggregation, autophagy disruption, and DNA adduct formation within dopaminergic neurons. Neuromelanin (NM), a dark brown pigment found exclusively in the nigral dopaminergic neurons in humans and other primates, is vital to HAA intracellular accumulation and neurotoxicity. Since rodents lack NM, there is a critical need for developing NM-forming models in the study of HAAs. We aim to overcome the current animal model weaknesses by implementing NM-forming rat models. In preliminary findings, we have identified NM-forming rats and use the same methods to distinguish between homozygous vs heterozygous transgenic animals. Validating these in vivo models will serve as a foundational step in investigating HAA-mediated neurotoxicity. This includes studying the biochemical interactions between NM and mitochondrial dysfunction, which contribute to the initiation of a neurotoxic cascade. Additionally, it will also be vital to determine if NM-forming rats are sensitive to HAA-induced DAergic neurotoxicity, to identify mitochondrial structures that support HAA-induced neurotoxicity, and to better understand the connections between HAA, NM, and mitochondrial dysfunction that led to PD development. New data based on this hypothesis shows great potential for making this vital connection.

Keywords:

Parkinson; HAA; Neuromelanin; Mitochondrial Dysfunction; Neurotoxicity

Mentor(s):

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1624

Presentation Time: Session 4: 1:30-2:30pm

How Color Can Change a Life: A marketing Strategy for Colorchase

Business Case Study

Authors(s):

Kai J Dhakhwa† (DSB); William Paxton Jost† (DSB); Teck Yee Ng† (DSB); Hussain Sadiq Alsinant† (DSB); Hugh Edward Flannery‡ (DSB); Leonard Wencil‡ (DSB)

Abstract:

This research project intends to investigate a go-to marketing strategy for a digital art company: Colorchase. Colorchase is a mother-daughter art initiative that uses color and drawings as a connection tool between parents and kids, inspired by lived experience with dementia. The brand narrative highlights color as a “language” that allows connection when words cannot through digital art.

We all struggle to express how we feel; Color gives us another way to be heard. This research project aims to develop go-to market strategies for Colorchase, a digital art startup that seeks to connect individuals with Alzheimer's through the language of colors. The research focuses on identifying effective methods for positioning, and undergoing extensive market research to find our best target segment. Through our research, we will develop a phased marketing framework designed to guide Colorchase through product completion and launch, and we will also develop survey instruments to collect user feedback and establish a KPI system for ongoing evaluation. Our research will generate actionable insights on user engagement and market readiness, as we aim to bring to our target audience, a methodology of connecting to each other through the language of colors, which can make memory loss sufferers feel calm, noticed and connected. This actually matters because families often experience stress and loneliness when words fail to the real meaning of it. Colorchase provides them a simple tool for daily connection that can improve the quality of communication for the families.

Keywords:

Marketing; Positioning; User Engagement; Colorchase

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1625

Presentation Time: Session 4: 1:30-2:30pm

Beyond the Drug: Why Demographics Define Obesity Treatment Success STEM

Authors(s):

Kimberly Marely Echeverriat† (Science)

Abstract:

The growing prevalence of obesity has led to increased interest in pharmacological interventions for weight loss, with patient demographics playing a critical role in determining both efficacy and safety. Among obese patients, demographic characteristics like age, sex, BMI, race, and socioeconomic status significantly influence both the effectiveness and safety of weight loss medications. Glucagon-like peptide-1 (GLP-1) receptor agonists have become a central point due to their benefits in managing weight and improving metabolic health. GLP-1 medications, such as semaglutide, function by mimicking the natural hormone that regulates appetite and glucose metabolism, resulting in reduced food intake and delayed gastric emptying. However, their effectiveness and tolerability vary among demographic groups, limiting their use for certain populations. Other weight loss medications, such as phentermine (a stimulant that suppresses appetite) and orlistat (a fat blocker that inhibits dietary fat absorption), are alternative medications that may provide better outcomes for certain obese patients depending on their demographics. This paper highlights how patient demographics matter in the use of GLP-1 drugs and other weight loss medications, emphasizing how a more personal approach can lead to safe and more effective results. To examine these factors, a literature review was conducted of GLP-1 receptor agonists, phentermine, and orlistat to highlight how demographic differences influence efficacy and safety in long-term success in obesity treatment.

Keywords:

Obesity; Weight Loss Efficacy; Patient Demographics; Weight Loss Medications; Tolerability

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1626

Presentation Time: Session 4: 1:30-2:30pm

“Cardinal CX00: A Compiler-Guided, Area Efficient GPU Frontend Architecture”

STEM

Authors(s):

Kai Ze Ee† (Engineering); Zach Anthony Barna‡ (Engineering); Daniel EnYi Yang† (Engineering); Yash Singh† (Engineering)

Abstract:

Modern open source GPU implementations demonstrate strong performance but incur high area costs. This work presents a custom hardware frontend for a GPU architecture designed to minimize area while maintaining high throughput. Our design enables end to end execution initiated by a CPU launched kernel, after which the GPU performs a boot like process to accept and dispatch workloads. Relying on compiler guarantees, we remove the traditional SIMT stack, scoreboard, and Register File crossbars, using packetized independent instructions and a Predicate Register File encoded branch resolution mechanism. A custom warp scheduling and issue policy ensures high utilization of critical components, namely the I-Buffer, Register File, and Operand Collector, keeping functional units saturated in steady state operation. Specifically, the Register File is split into two banks, each tied to its own Operand Collector, allowing a single crossbar connection to all functional units and significantly reducing area; meeting constraints of the 90 nm MITLL process node. Verification begins with an emulator supporting the graphics workload and compiler sub-teams, followed by cycle accurate functional simulation to validate architectural choices. Next steps include rendering a spinning cube via emulation, functional simulation, and RTL simulation, scaling to multi core SM clusters, and exploring tensor core extensions for machine learning acceleration.

Keywords:

GPU; Graphics; Computer Architecture

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering); Fan Jing Hoon (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1627

Presentation Time: Session 4: 1:30-2:30pm

Self-Pumping Membranes

STEM

Authors(s):

Lily Dawn Farmert† (Engineering)

Abstract:

The mechanisms underlying nanofiltration leave a notable gap in current research. This project seeks to investigate and characterize membranes that utilize photocatalytic surface reactions, which may enable their integration into larger chemical and environmental processes. The initial phase of the study focused on examining the relationship between membrane surface zeta potential and the surrounding solution conditions. Zeta potential measurements were obtained using the Anton Paar SURPASS 3 system, which applies the Smoluchowski equation and multiple probe readings to determine surface potentials. To analyze the effects of ionic strength, experiments were conducted repeatedly with varying salt concentrations. Preliminary results indicate that the zeta potential becomes more positive at lower pH levels and in solutions with reduced salt concentrations. Going forward, similar experiments must be run on the TiO₂ and Au plated membranes for their characterization. Overall, nanofiltration performance is highly sensitive to environmental and physicochemical parameters. Continued investigation into these membrane systems is necessary to improve the broader understanding and practical application of nanofiltration processes.

Keywords:

Membrane; Photocatalysis; Self-Pumping

Mentor(s):

Sudharshan Anandan (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1628

Presentation Time: Session 4: 1:30-2:30pm

Reviving The Country Mansion: A Consumer Behavior Approach

Business Case Study

Authors(s):

Addison M Filipovich† (DSB); Trisha Raman† (DSB); Kassidy L Trent† (DSB); Laura Sofia Samaniego† (DSB)

Abstract:

This project develops a marketing strategy for The Country Mansion, a historic venue in Dwight, Illinois, currently undergoing a multimillion-dollar restoration to transform it from a traditional local event space into an upscale, all-inclusive destination for weddings, corporate retreats, and special occasions by 2030. The purpose of this study is to examine how consumer behavior principles can guide the rebranding of a heritage property to appeal to modern audiences seeking experiential, authentic, and immersive stays.

Drawing on theories of perception, identity, and decision-making, our team conducted interviews with event planners, analyzed comparable Midwest venues, and explored digital marketing trends to identify key factors influencing consumer choice in destination weddings. Findings indicate that the target market consists primarily of women aged 25–35 who value venues that blend historical character with modern amenities, emphasizing personalization, convenience, and authenticity.

Based on these insights, the proposed strategy positions The Country Mansion around the theme “modern luxury meets timeless charm.” It emphasizes behind-the-scenes storytelling, immersive branding, and experiential marketing to build awareness and emotional connection prior to reopening. By leveraging consumer behavior insights, the project demonstrates how heritage properties can be revitalized for today’s market without sacrificing authenticity. Ultimately, The Country Mansion’s transformation is not just about restoring a building, it’s about creating an emotional destination that connects with couples, planners, and guests, offering a model for other historic venues seeking relevance in a changing industry.

Keywords:

Case Study; Hotel; Event Space

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1629

Presentation Time: Session 4: 1:30-2:30pm

VIP Independent Motor Control- Dynamics & Controls Sub-team STEM

Authors(s):

Matthew Douglas Frago† (Engineering); Sumit Suditya Biswas† (Engineering); Suraj Ketan Patel† (DSB); Benjamin Tianming Sun† (Engineering)

Abstract:

Autonomous Motorsports Purdue's (AMP) racing kart, developed to participate in the Autonomous Karting Series (AKS), uses a live rear axle that compromises its performance in cornering due to the mechanical coupling of the rear wheels. This project looks at the vehicle dynamics and control mechanism of converting a go-kart from a traditional internal combustion engine with a live axle to an electric drivetrain featuring independent motors and a split rear axle. The research focuses on quantifying changes in mass distribution, load transfer characteristics, frame rigidity, and torque vectoring resulting from the new component architecture. We will also make sure that our changes comply with AKS competition rules so that our changes will be applicable to improving the kart. Our team will be using comparative modeling and finite element analysis (FEA) conducted through ANSYS to investigate the differences in the baseline vehicle's performance compared with the altered dynamics of the independent motor control (IMC) configuration to identify potential handling imbalances and structural stresses. Furthermore, our work will outline the design of physical chassis modifications needed to mitigate the adverse effects and harness the full performance potential of torque vectoring. This project will provide a foundational framework for optimizing the chassis and suspension of the AMP kart to successfully integrate an IMC system.

Keywords:

Vehicle Dynamics; Controls; Kart; Motorsports Engineering; Electric Integration

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Reed Joseph Freer (Engineering); Richard Osita Ajagu (Engineering); Samuel Labi (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1630

Presentation Time: Session 4: 1:30-2:30pm

Skiing Toward Sustainability: Examining Snowmaking and Climate Adaptation Practices Humanities

Authors(s):

Rohan Mihir Gandhi† (Engineering)

Abstract:

This exploratory research project examines snowmaking practices in North American ski resorts as a response to climate change, focusing on whether these adaptations represent sustainable solutions or maladaptive consequences. Snowmaking is widely used to extend ski seasons amid warming winters, but evidence suggests it may exacerbate environmental issues by consuming large amounts of water and energy, increasing greenhouse gas emissions, and causing ecological harm (Scott et al.; Cognard et al.). To investigate this, I conducted a detailed literature review of peer-reviewed studies assessing water use, energy consumption, and regional case studies in Wisconsin and Canada, considering how energy sources and economic diversification affect sustainability outcomes. This research highlights the importance of transitioning to renewable energy, implementing stricter water regulations, and diversifying resort activities beyond winter sports to avoid maladaptive cycles. The findings contribute insights for ski industry stakeholders and policymakers about the need for transformative strategies ensuring long-term ecological and economic resilience in the face of climate change. Without such measures, snowmaking risks becoming an unsustainable practice that threatens both the environment and the future viability of ski resorts.

Keywords:

Snowmaking; Skiing; Sustainability; Climate Change; Climate Change Adaptation

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1631

Presentation Time: Session 4: 1:30-2:30pm

Wee Beasties: 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:

Evolution; Kinases; Chance; Contingency; Necessity

Mentor(s):

Brian Patrick Ha Metzger (Science)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1632

Presentation Time: Session 4: 1:30-2:30pm

Atalla AI Accelerator - Vector Core STEM

Authors(s):

Joseph Alan Ghanem† (Engineering); Chase Yungmin Johnson† (Engineering); Jacob Thomas Walter† (Engineering|JMHC); Vedant Sharma‡ (Engineering)

Abstract:

Existing AI Hardware accelerators are specially designed to support fast matrix multiplication processes, the current accelerator is meant for efficient, large-scale computing via the implementation of a Scalar Core and Systolic Array. The systolic array is hyper specialized for GEMM (mx+b) operations and the scalar core is inefficient for data level parallelism (DLP), which is common for AI/ML workloads such as activations. With the underutilization of DLP there lies an opportunity to utilize single instruction multiple data (SIMD) operations to greatly increase performance. To accomplish this we have designed a Vector Core to integrate into the Atalla Accelerator, with this approach we have added custom architecture optimized for vector-wise operations. This design enables parallel execution of identical operations across multiple execution lanes. With the Vector Core and VLIW methodologies in place we can leverage parallel processing to exploit instruction level parallelism (ILP) and DLP. The Vector Core will synthesize on MITLL 90 nm technology to fit within 3.5mm², have a clock frequency of 600MHz, contribute to a speedup from the previous implementation, and meet the IEEE-754 floating point standard. Since the Vector Core requires duplicating hardware across multiple lanes, maintaining high hardware utilization and balancing power with area will pose a constraint. The inclusion of a Vector Core in the updated Atalla Accelerator enhances its ability to efficiently support both training and inference across diverse AI and ML applications.

Keywords:

AI Hardware; Vector Processor; Single Instruction Multiple Data; Instruction-Level and Data-Level Parallelism

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering); Fan Jing Hoon (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1633

Presentation Time: Session 4: 1:30-2:30pm

Random Direct Memory Access (RDMA) Accelerator implementation on the HAPS-100 4F system STEM

Authors(s):

Omkar Ghodke† (Engineering); Peter Alexei Kaya Gretchikha† (Engineering); Joshua Angel Villasol† (Engineering); Evan Runzhao Liut (Engineering)

Abstract:

In order to test and verify the functionality of hardware, pre-silicon verification is done on FPGAs, using systems like the HAPS-100 4F by Synopsys. However, at Purdue the HAPS-100 system is underused for verification, due to lack of documentation and know-how. The key idea of our team is to tackle this very issue and use the HAPS-100 4F system to implement a two server setup to test the RDMA accelerator being designed by the rest of the Datacenter Network Accelerator team in SoCET. An RDMA accelerator is a specialized hardware that speeds up Remote Direct Memory Access operations in a network, so that CPUs can spend clock cycles on other tasks. By the end of this academic year, we aim to create thorough documentation and build a local LLM model for future users to learn the HAPS-100 4F system. On top of that, our goal is to implement a two server setup and verify the functionality of the RDMA Accelerator. Since only two servers are being simulated, the performance of this accelerator in a multi-server environment, which mimics the real-world application more closely, will not be measured, but this is still an important proof-of-concept for the real-world environment. We have goals of interconnecting more software simulated servers with switches to allow us to mimic multi-server setup in the future. As SoC gets more complicated and systems become larger, pre-silicon verification using FPGA systems, like the HAPS-100, will become vital. Therefore making these systems simpler to understand will undeniably lead to better and faster digital designs.

Keywords:

FPGA Implementation; System-on-Chip Design; Pre-Silicon Verification

Mentor(s):

Mark Johnson (Engineering)

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 Role of Insurance Companies in Health Care

Humanities

Authors(s):

Stefanie Anne Giurcanu† (Engineering)

Abstract:

We call the right to life a human and constitutional right in the United States. Yet, life-saving treatments are sometimes stalled - or even denied - by nothing more than an insurance clerk's signature. Which message resonates more with American values: having access to state-of-the-art treatment, or subjecting cases to a cost-benefit analysis to determine the profit margin for a health insurance company? Across the country, patients wait when time is of utmost importance. It is not because doctors do not know the next steps in treatment - they do. It is also not because the hospital is not ready for the procedure - it is. But because insurance companies have not "approved" of said treatments. There is no denying the role these companies play. The reality is, without insurance, most patients would be unable to afford any treatment. Still, families who have paid premiums for decades often discover that when cancer inevitably infiltrates the body, the better treatment is suddenly deemed too expensive, too new, or too "unreliable." This topic ultimately raises the question on who should decide one's medical option: the doctor who's trained to help the patients, or the insurance company that looks to make a profit from illness? If insurance companies must play a role, how much power should they have over determining which personalized cancer treatment they cover. Any delay - whether just a few days or even weeks - can mean the difference between a complete recovery and irreversible decline, between life and death itself.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1635

Presentation Time: Session 4: 1:30-2:30pm

Quantum Reinforcement Learning: A Survey and Comparative Study with Classical Methods STEM

Authors(s):

Keshav Gollamudi† (Science); Honghai Gong‡ (Polytechnic); Soham Roy† (Engineering)

Abstract:

Reinforcement learning is a powerful machine learning framework where agents learn to make decisions through interaction with their environments. With the rapid development of quantum computing, researchers have begun exploring how quantum methods can enhance RL, giving rise to quantum reinforcement learning. This project surveys existing work on QRL, focusing on how advances in quantum neural networks have made it possible to adapt established machine learning techniques to the quantum domain. We compare classical RL and QRL, highlighting their key differences and discussing the potential performance benefits of quantum approaches. To illustrate these concepts, we implement a toy RL problem using both classical and quantum RL algorithms, with the quantum simulations carried out in PennyLane.

Keywords:

Quantum Reinforcement Learning; Quantum Computing; Quantum Neural Networks; Reinforcement Learning; Classical vs Quantum Learning

Mentor(s):

Noah Charles Singer (Science); Andy Jung (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1636

Presentation Time: Session 4: 1:30-2:30pm

Adult Immunization Needs and Perceptions Among Patients at a Free Medical Clinic in Indianapolis

Social Science

Authors(s):

Hannah Cole Hampson† (HHS|JMHC)

Abstract:

Declining immunization rates and widening vaccine disparities are causing great concern among public health and healthcare professionals. While these issues are multifactorial, healthcare access and vaccine hesitancy are significant contributors. This study aimed to understand vaccination status, eligibility, and vaccine perceptions among adult patients at a free medical clinic within a food pantry in Indianapolis. A survey was administered to assess vaccine eligibility for flu, COVID-19, shingles, hepatitis A, hepatitis B, human papillomavirus (HPV), pneumococcal, and respiratory syncytial virus (RSV). Vaccine eligibility was determined using the 2024 Centers for Disease Control and Prevention (CDC) Adult Immunization Schedule. Descriptive statistics were used to characterize data. A total of 18 patients were recruited with a median age of 52 years. All patients were eligible for at least 1 vaccine and 72% (n=13) were open to receiving at least 1 vaccine. The most common vaccines patients were eligible for were COVID-19 vaccine (78%, n=14), shingles vaccine (78%, n=14), hepatitis B vaccine (78%, n=14), and pneumococcal vaccine (72%, n=13). Reported barriers to receiving eligible vaccines included not knowing the vaccine was needed, (56%, n=10), transportation (33%, n=6), and costs (33%, n=6). Questions assessing vaccine hesitancy demonstrated that most participants believe vaccines are effective and important; however, concerns about risks associated with new vaccines were present. Overall, this study demonstrates that most adult patients at a free clinic have unmet immunization needs. Findings highlight the opportunity to address vaccine gaps through immunization initiatives at food pantries.

Keywords:

[no keywords provided]

Mentor(s):

Adriana May Gardner (Pharmacy); Kalesia Renae Smith (HHS); Ashley H Meredith (Pharmacy)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1637

Presentation Time: Session 4: 1:30-2:30pm

Title: Power, Performance, and Area Optimization of SoCET's AFTx07++ Semiconductor Chip STEM

Authors(s):

Amogh Shivanand Havanagitt (Engineering); Ammar M Mukadam† (Engineering); Jayaditya Borah† (Engineering); Juneseok Kwont (Engineering)

Abstract:

Semiconductor chips serve as the foundation of today's most pressing technological developments. Artificial intelligence, quantum computing, bioengineering, and various other fields are increasingly dependent on these tiny silicon dies, millimeters in size. However, meeting the demands of these emerging technologies requires chips that are faster, smaller, and consume less power. To address this, our project focuses on power, performance, and area (PPA) optimization of the newest System-on-Chip Extension Technologies (SoCET) AFTx07++ semiconductor chip.

Our approach follows a series of steps. Firstly, the AFTx07++ chip was benchmarked to generate reliable PPA metrics, utilizing a new TSMC process design kit and Synopsys EDA tools. PPA will then be optimized by analyzing the chip's electromigration, which contributes to the unwanted displacement of atoms, and IR drop, which is the voltage loss due to non-negligible wire resistance. These results will guide careful rerouting and the precise addition of decoupling capacitors, making the chip more reliable and power efficient. Alongside this, congestion and heat maps of the chip will be extracted from the physical silicon layout, enabling modifications to the floorplanning and cell density. As chips get smaller, thermal issues become increasingly relevant, making careful temperature planning crucial for long-term performance.

Ultimately, semiconductor chips are vital for cutting-edge technologies. This project applies industry-standard methods to benchmark and optimize PPA for the AFTx07++, preparing it to be a building block for future innovation.

Keywords:

System on Chip; PPA; EDA

Mentor(s):

Mark Johnson (Engineering); Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1638

Presentation Time: Session 4: 1:30-2:30pm

Psychiatric Service Dog Trained Tasks for Sexual Assault Survivors: Comparing Veterans and Civilians

Social Science

Authors(s):

maya holguin† (Science|JMHC); Rachel Catherine Parker‡ (HHS|JMHC)

Abstract:

Posttraumatic stress disorder (PTSD) is prevalent among sexual assault populations, with rates of 58-60% at one year after assault. Service dogs are a complementary intervention that has been found to significantly relieve PTSD symptoms through tasks such as interrupt anxiety, alert to anxiety, and guard. While PTSD has been studied in the context of combat-related trauma, limited research has examined how service dog tasks support survivors of sexual assault and military sexual trauma.

This pilot study sought to examine which trained tasks survivors of sexual assault used most frequently and how veterans and non-veterans differed in their task use. Twenty-one participants who were over 18 years old, survivors of sexual assault, and currently paired with a service dog completed an online survey which collected demographic information and self-reported task use. Data was analyzed descriptively in RStudio.

Civilians (n=9) most often used comfort anxiety (100% of civilian participants), alert to anxiety (88%), and nightmare interruption (75%), while veterans (n=12) used alert to anxiety (100% of veteran participants), comfort anxiety (92%), and create space (83%). Collectively, participants (n=21) reported using alert to anxiety (95% of all participants), comfort anxiety (90%), and create space (75%) most; in contrast, participants used guard least (25%).

Both veterans and civilians most often used service dogs for anxiety-related tasks, reflecting the central role of these interventions in PTSD support. Differences in task use between veterans and civilians highlight the importance of tailoring service dog programs to specific survivor needs, which trainers and clinicians should consider when providing care.

Keywords:

Post-Traumatic Stress Disorder (PTSD); Sexual Assault Survivors; Service Dogs; Human Animal Bond; Veteran and Civilian

Mentor(s):

Leanne Nieforth (Vet Med); Sarah Jean Reega (Vet Med); Emilie Mae MacInnis (Vet Med)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1639

Presentation Time: Session 4: 1:30-2:30pm

**Gelding behavioral response to estrual mare urine.
STEM**

Authors(s):

Jenna N Honnert† (Agriculture); Elizabeth Ann Habeeb†
(Agriculture|JMHC); Kolton N Logsdon† (Agriculture); Kaylie Danielle
Spata‡ (Agriculture); Reilly Cole Wennemar‡ (Agriculture|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Gelding; Estrus; Behavior; Mare

Mentor(s):

Casie S Bass (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1640

Presentation Time: Session 4: 1:30-2:30pm

The Effect of Lunar Regolith Simulant on Crop Development and Response to Microbes STEM

Authors(s):

Emma M Horn† (Agriculture)

Abstract:

With the upcoming Artemis missions, NASA aims to establish a long-term lunar base. Plants will be essential in supporting a closed-loop system by providing food and oxygen. Instead of relying solely on hydroponics, researchers are exploring the possibility of growing plants in lunar regolith, the dusty substrate that covers the Moon's surface. A major challenge could arise if pathogens enter this closed-loop system. This project's goal is to investigate the effects of simulated lunar regolith on the colonization of *Ralstonia Solanacearum* in tomato plants (*Solanum lycopersicum*). *Ralstonia* is a bacterial pathogen that causes bacterial wilt in tomato plants. The results from this project will allow us to understand how lunar regolith affects pathogen colonization and plant health in extraterrestrial environments. They will allow us to better understand how they function here on Earth.

Keywords:

Lunar Regolith; Pathogens; Tomato Development; *Ralstonia solanacearum*

Mentor(s):

Anjali Iyer-Pascuzzi (Agriculture); Denise L Caldwell (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1641

Presentation Time: Session 4: 1:30-2:30pm

Purdue Theater External Audience Engagement Strategies
Business Case Study

Authors(s):

Connor Bryn Hoy† (DSB); Jonathan Huang† (DSB); Taotianchen Want† (DSB); Ishank Shekhar† (DSB)

Abstract:

[Abstract Redacted]

Keywords:

Case Study; Marketing; Theater; Marketing Research

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1642

Presentation Time: Session 4: 1:30-2:30pm

Compiler from Graphical Workloads to Custom Instruction Set Architecture with Resource Maximizing Optimizations STEM

Authors(s):

Zay Linn Htet† (Engineering); Pranav Bantval† (Engineering); Jia-He Zhou† (Engineering); Justin Yasuumi‡ (Engineering)

Abstract:

GPUs are throughput processors that aim to run multiple processes simultaneously, especially in the application of graphics. These programs should be compiled to maximize the utilization of all available hardware. Prior designs have complex hardware that manage allocations for the register file cache (a smaller low-power storage for frequently used registers); to reduce such complexity, the compiler will instead make static RFC assignments during compile time. We also designed a custom, graphics-oriented instruction set architecture (ISA) for these workloads with a corresponding compiler that will produce executable binaries. Our compiler's key innovation is to maximize the usage of the GPU's hardware by having the compiler identify and issue independent instruction packets without the need for dependency checking, while minimizing the area of the hardware by lifting their RFC assignment responsibility. Predication will also be utilized in the produced executables to ensure optimal control flow and functional correctness across instructional branches, where each thread consults a specific bit within a predication entry to determine whether its instruction should execute. We will validate our compiler against an instruction emulator to ensure functionality. We will further benchmark the performance using a cycle accurate simulator model of the hardware. Though the algorithms we develop for RFC allocation, packetization, and predication may not produce the most optimal results on certain complex code patterns, ensuring functionality on foundational and crucial algorithms is a sufficient point to mark the start of the development of an end-to-end ecosystem that a graphics library can be built around.

Keywords:

GpGPU; Compilers; ISA; Optimization

Mentor(s):

Sooraj Chetput Venkataraghavan (Engineering); Fan Jing Hoon (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1643

Presentation Time: Session 4: 1:30-2:30pm

A High-Selectivity Workflow Using Al₂O₃ Mask in Bosch Etching for 3D Advanced Packaging STEM

Authors(s):

Chun-Kang Huang† (Engineering); Uyen Do† (Engineering); Bobby Gu† (Engineering|JMHC); PO-Tsung Hsu† (Engineering); Eric Younghoon Song† (Engineering); Luke Michael Satchell‡

Abstract:

This project develops a highly-selective lithography and etching process to fabricate ultra-high aspect-ratio Through-Silicon Vias (TSVs). TSVs are critical micron-scale structures that provides high-speed and reliable electrical interconnections between stacked chips in 3D advanced packaging. This technology enables efficient vertical integration of memory and logic layers, significantly enhancing computing density and energy efficiency while reducing overall chip footprint.

The proposed process integrates the Bosch etching mechanism (alternating C₄F₈ passivation and SF₆ etching) with an aluminum oxide (Al₂O₃) hard mask to achieve exceptional selectivity. Unlike conventional masking materials, Al₂O₃ reacts with fluorine ions in the SF₆ plasma to form a stable aluminum fluoride layer that resists further etching. Meanwhile, the C₄F₈ passivation controls ion bombardment, enabling precise removal of silicon in unmasked regions. By tuning the passivation and etch times, this method achieves superior selectivity, allowing the use of thin-film masks for deep silicon etching.

This approach directly addresses lithographic depth-of-field limitations and other challenges traditionally found in thick photoresist masks. Through systematic process development and optimization, the project provides both a robust TSV fabrication workflow for the Purdue packaging community and hands-on semiconductor process experience for participating students.

Keywords:

Advanced Packaging; Semiconductor Fabrication; 3D Integration; Through Silicon Vias; 3D Fabrication

Mentor(s):

Peter Bermel (Engineering); Saeed Mohammadi (Engineering)

Other Acknowledgement(s):
Huan wen Mao (Engineering)

Poster Presentation Abstract Number: 1644

Presentation Time: Session 4: 1:30-2:30pm

Using Statistical Analysis to Measure the Effects of Metal Exposure and Metal Mixtures on Welders STEM

Authors(s):

Breanna Lee Hutter†

Abstract:

Welders are continuously exposed to the toxic fumes of metals, which can have detrimental effects on their health. Consistent inhalation of these fumes causes decline in the welders' cognitive and motor functions, as well as increased mood symptoms. These cognitive, motor, and mood responses are collectively referred to as CMM variables. It is important to know what levels of metal exposure and which combinations of metals affect the health of welders most significantly. An analysis of the effects of exposure to metal mixtures is done on observations of 46 welders, all with 19 CMM variables and lifetime exposure to five different metals. The Bayesian Network conditional probabilities are calculated for different bi-stratifications of exposure to metal mixtures on the CMM variables using bootstrapping. The results of this analysis are expected to determine the relationships between the condition of a CMM variable and the level of exposure to different metal mixtures, as well as assess whether increasing the number of metals in the mixture has a significant effect. Identifying these trends is crucial to the safety and awareness of welders, as exposure to metals is a risk they constantly face.

Keywords:

Welders; Metal Exposure; Metal Mixtures; Bayesian Networks; Bootstrapping

Mentor(s):

Jonathan R Kuhn (Purdue Northwest); Ulrike Dydak (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1645

Presentation Time: Session 4: 1:30-2:30pm

Why Purdue Should Implement More Single-room Study Spaces

Social Science

Authors(s):

Jungmin Im† (HHS)

Abstract:

The purpose of this research project is to explore whether or not Purdue students would benefit from having private, single-room study spaces on campus. Exploratory research will include a literature review on the mental health benefits and drawbacks of solitary studying, as well as the psychological importance of social interactions among college students. Primary research will also be conducted through a survey of Purdue students to assess their studying habits, perceived productivity, and emotional well-being when using private study rooms versus public spaces. The findings will be used to determine whether implementing more private study areas would enhance student mental health without significantly reducing social engagement. Suggestions will also be made on how Purdue can balance both privacy and community interaction within its campus facilities.

Keywords:

[no keywords provided]

Mentor(s):

Catherine Jean Shukle (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1646

Presentation Time: Session 4: 1:30-2:30pm

3D Design Comprehension Enhancement using AR/VR for Engineering Education STEM

Authors(s):

Hiya Jha† (Science); Kian Shiju Kallarackal‡ (Science)

Abstract:

Understanding 3D geometry and spatial connections is an essential skill in engineering education, however, traditional 2D geometry often limits students' ability to visualize complex structures. This research project explores how virtual and augmented reality technology can enhance the comprehension of 3D geometry and design principles among engineering students. In this project, our aim is to use SketchUp for 3D modelling and the Meta Quest Pro headset to develop an interactive learning environment where students can design and manipulate geometric models.

The main objective of the research is to evaluate how VR-based learning compares to conventional modelling in terms of spatial understanding and knowledge retention. Participants complete geometry-based design tasks in both environments and their performance can be measured by pre and post assessment scores as well as task completion time and accuracy. Lastly, our research will also analyze eye-tracking and hand-tracking features of the Meta Quest Pro to study user interaction patterns and identify the cognitive benefits of immersive learning through AR/VR interfaces. The expected outcome would be quantifiable improvement in students' spatial reasoning and conceptual understanding when working in virtual 3D spaces.

Therefore, this research project will help us demonstrate the importance of integration of augmented and virtual reality technologies in future STEM education.

Keywords:

[no keywords provided]

Mentor(s):

Steven R Dunlop (DSB); Saanvi Singh (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1647

Presentation Time: Session 4: 1:30-2:30pm

Workflow for the Agricultural Production Systems Simulator (APSIM) Model for Assessing Corn Yield Response to Different Fertilizer Nitrogen Rates STEM

Authors(s):

Jorge Andres Jola Hernandez† (Agriculture)

Abstract:

Nitrogen (N) is an essential nutrient for corn growth and development. Applying optimal fertilizer N rates for this crop can reduce nutrient losses and increase farmer profitability. One challenge in developing N guidelines for corn in the U.S. Midwest is the limited availability of long-term data. To assess long-term corn yield response to N fertilization, simulations have been conducted using the Agricultural Production Systems Simulator (APSIM) model. This study aimed to develop a workflow to run simulations and collect data from several thousand farming scenarios across Indiana. To carry out this, a Python module was created to automate tasks, including sampling farm polygons across the area of interest and extracting weather and soil data for each field. Over 4,000 simulated field trials evaluating different N rates under various conditions (e.g., crop rotation and planting date) were run. The workflow developed in this study allows for the automation of the APSIM simulation process, which would otherwise require extensive manual effort and time. The created dataset will support research and education related to nutrient management, leaching processes, and environmental policy evaluation.

Keywords:

Crop Modeling; Simulation; Field Trials

Mentor(s):

German Mandrini (Agriculture); Ignacio Antonio Ciampitti (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1648

Presentation Time: Session 4: 1:30-2:30pm

Environmental Equine Airway Dust STEM

Authors(s):

Pranav Teja Kalakota† (Science); Carmen Aurora Infante Garnert (Engineering); Maxim Ryan Nepochatov† (Engineering); Trey Vu† (Engineering); Katia Marie Bo-Hua Olmstead‡ (Engineering); Gabriela E Aparcana Contreras‡ (Engineering); Pravar Koundinya‡ (DSB|JMHC)

Abstract:

Equine asthma represents a significant respiratory health challenge, manifesting as Inflammatory Airway Disease in younger horses and the more severe Recurrent Airway Obstruction in mature animals. Environmental particulate matter and allergens from stable environments serve as primary triggers for these debilitating conditions. Our research project focuses on three-dimensional reconstructions of equine lower airways to advance understanding of airflow dynamics and particle deposition patterns. The approach that we found to be appropriate consists of combining computational fluid dynamics modeling using ANSYS Fluent with physical anatomical reconstruction through negative molding techniques. These reconstructions will serve the broader equine research community by providing both virtual simulation environments and adaptable physical models. We are building upon established methodologies from veterinary research professors and institutions. Project deliverables will equip researchers with validated models for investigating respiratory mechanics under controlled simulation parameters and realistic environmental conditions. This foundational work establishes infrastructure for future studies examining intervention strategies and therapeutic approaches for managing equine respiratory disease.

Keywords:

Equine Asthma; IAD; RAO; Reconstructions; Particle Deposition

Mentor(s):

Curtis Earl Marshall (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1649

Presentation Time: Session 4: 1:30-2:30pm

Sound Sensor Networks and Sub/Urban Health: A Transdisciplinary Approach Using the Purdue Campuses as a Living Lab STEM

Authors(s):

Kurt Andrew Khaustov† (Science); Harshitha Pathania† (Liberal Arts); Sophia Victoria Pimentel† (DSB); Irem Ucar† (Engineering); Linda Ronglin Xu‡ (Science); Santosh Ramesh‡ (Science); Zhengyi Jiang‡ (Science); Elian Inigo Turcal Rieza‡ (Engineering); Nathan Sing Lee‡ (Engineering|JMHC); Ryce Pi‡ (Science); Atandril Chowdhury‡ (Engineering); Felipe Saavedra Cardona‡

Abstract:

Our project investigates environmental soundscapes in West Lafayette and on the Purdue campus—including the Purdue Airport with its newly reopened commercial terminal—treating these sites as a living laboratory. Conducted under the Discovery Undergraduate Interdisciplinary Research Internship (DUIRI) with mentorship from Dr. Tae Hong Park and his Citygram research, the study integrates engineering, data science, and acoustic ecology. Building on the Soundscaper system, we are developing an interactive sound-mapping interface that allows users to hear synthetic soundscapes representing real-world conditions. Additionally, we use the Citygram and GetNoisy sound-sensor network systems to track airplane noise data, which are analyzed through signal processing, automatic classification, and sonification techniques.

We examine the spatial, temporal, and perceptual dynamics of environmental sound, emphasizing implications for environmental sustainability, community engagement, and public well-being. Noise from the Purdue Airport and other urban sources is interpreted as a living trace of community activity, informing scalable tools for interactive sound mapping, environmental monitoring, and civic engagement. By combining humanistic listening with computational analysis, this project treats cities as resonant systems in which every sound reveals stories of technology, ecology, and collective experience. The project advances soundscape-based approaches to understanding the environment while developing new tools for monitoring and engaging with the sonic life of communities.

Keywords:

Noise Pollution; Sensor Networks; Urban Health; Acoustic Ecology;
Object-Oriented Sound Synthesis

Mentor(s):

Tae Hong Park (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1650

Presentation Time: Session 4: 1:30-2:30pm

Predicting Fourth Down Risk

Business Case Study

Authors(s):

Kabeer Singh Khubbar† (DSB); Samuel Anthony Fiore† (DSB); Bruno Andres Knize Simon† (DSB); Aditya Venugopal Nair† (DSB)

Abstract:

Motivated by our passion for sports and data analytics, we have an opportunity to combine the two worlds and estimate the probability of converting on fourth-down passing plays based on the current situation, player, team, and score. Our data contains snapshots of thousands of real NFL plays, which we've reduced to just fourth-down passing plays. Additionally, we've added features such as ScoreDiff to make our predictions more robust. Our exploratory analysis has shown us some interesting details, such as which formation has led to the most and least success: singleback with a 77% success rate and empty with a 28% success rate. Formations can be incorporated into the model by calculating which routes wide receivers are running based on their field locations, and then assessing whether formations are affecting routes, which would affect fourth-down success.

For our model, we will start with Logistic Regression to set a baseline for which features are impacting prediction success. We would also pull the odds ratios, which are easily interpretable for audiences and can help us understand correlations. After Logistic Regression, we will try a Random Forest model to capture non-linear relationships. We will compare the accuracy and AUC of both models using k-fold cross-validation and proceed with the model that performs better.

Keywords:

Football; Prediction; Risk; Analytics; Modeling

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1651

Presentation Time: Session 4: 1:30-2:30pm

2.4 GHz Radio Transmitter

STEM

Authors(s):

Tyler Ken Kikuno† (Engineering); Joseph Alexander Schelb† (Engineering); Brandon B Velasquez Hernandez† (Engineering); Jihong Min† (Engineering); Zhuoyu Yang‡ (Engineering); Yu-Chen Tseng‡ (Engineering)

Abstract:

Radio transmission is a cornerstone of modern wireless devices, and microcontrollers offer a programmable and cost-effective method for controlling these systems. For high-frequency applications like 2.4 GHz radio, integrating the microcontroller with sensitive analog and radio frequency (RF) peripherals on a custom Printed Circuit Board (PCB) is critical for achieving the performance and reliability that prototyping methods like breadboards cannot provide. This project develops a custom, open-source 2.4 GHz audio transmitter on a PCB, demonstrating a flexible, customizable design platform adaptable to a wide range of wireless applications.

Designing such RF applications presents significant challenges. High-frequency signals are susceptible to parasitic capacitance and inductance, requiring meticulous impedance control and layout strategies to maintain signal integrity. Integrating digital, analog, and RF components on a single board also introduces a high risk of unrecoverable design flaws. To mitigate these risks, a modular design approach is employed, separating the system into three functional blocks: analog baseband, RF front-end, and frequency synthesis. Each is developed on a separate, verifiable board, enabling isolated testing and iterative development before final integration. Layout challenges are addressed by designing controlled-impedance transmission lines with carefully calculated trace geometries adjacent to ground planes and strategic grounding to minimize noise.

Completed schematics and routed PCB designs for each module are finalized, passing all electrical and design rule checks. Fabricated boards are assembled and verified using an oscilloscope to confirm expected waveforms at key nodes. The final demonstration will be successful reception of the transmitted signal with a commercial off-the-shelf receiver.

Keywords:

[no keywords provided]

Mentor(s):

Weijing Sebastian Chen (Engineering); Matthew A Swabey (Engineering); Conor James Green (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1652

Presentation Time: Session 4: 1:30-2:30pm

Physical and Logical Verification of the AFTx08 Chip through LEC, DRC and LVS STEM

Authors(s):

Seokjae Kim† (Engineering); Evanjaline Sherl Sahaya Rajesh Durait‡ (Engineering|JMHC); Hsin-Yu Tsern† (Engineering)

Abstract:

This project presents the physical and logical verification process of the AFTx08 dual-core microcontroller tape-out as part of the SoCET Design Flow program, where tapeout marks the final stage of the integrated circuit (IC) design cycle before fabrication. This semester, our team will apply Design Rule Check (DRC), Layout versus Schematic (LVS), and Logic Equivalence Checking (LEC) to ensure the chip's correctness and manufacturability. DRC will verify compliance with foundry design rules, LVS will confirm alignment between the layout and schematic, and LEC will ensure functional equivalence between the synthesized netlist and the original RTL. Using industry-standard tools like Siemens Calibre for DRC and LVS and Synopsys Formality for LEC, violations related to metal spacing, via enclosure, and power-ground connections will be identified and resolved. The verification flow will conclude with clean DRC and LVS signoff, confirming that the layout is fully compliant and ready for manufacturing. Through close collaboration with synthesis, floorplanning, optimization, and verification teams, this project will provide hands-on experience with tapeout-level verification and strengthen our understanding of design integrity in the semiconductor fabrication process.

Keywords:

LEC; DRC; LVS; Verification; Tapeout

Mentor(s):

Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1653

Presentation Time: Session 4: 1:30-2:30pm

The effect of mastitis on milk production across lactation phases in dairy cattle STEM

Authors(s):

Elyse Priscilla Kim† (Agriculture)

Abstract:

Data was collected from 197,705 mastitis events that occurred from December 2020 to October 2025 in lactating Holstein cows from one commercial dairy farm. Mastitis is the most economically costly disease that impacts dairy cattle, reducing milk production with negative implications for animal welfare. The incidence of the disease creates additional costs associated with management, medicine and treatment, and quality of life, emphasizing the importance of preventing mastitis. The objective of this study is to quantify the extent to which stage of lactation and milk production level influence the magnitude of production losses associated with individual mastitis incidents. Information from two management software programs utilized by the dairy farm, Afimilk and DairyComp 305, were combined using a Jupyter Notebook with python coding language. Variables analyzed from the Afimilk file include animal ID, date, days in milk, age in days, and daily milk yield. From the DairyComp305 file, the variables were animal ID, mastitis event, event date, days in milk, treatment remark, and treatment protocol. To examine deviations of milk production several days before and after the occurrence of mastitis, which correlates to a specific lactation phase, impacted cows are filtered by their ID. We will compare deviations from predicted lactation curves to determine the effects of mastitis in early, mid and late lactation. We anticipate that the effects of reduced milk production will be different depending on the stage of lactation and level of milk production.

Keywords:

Mastitis; Lactation; Production; Deviation

Mentor(s):

Jacquelyn P Boerman (Agriculture); Isabela Garcia Mendes de Araujo Santos (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1654

Presentation Time: Session 4: 1:30-2:30pm

Firmware Tests and Integration for Multicore RISC-V SoC STEM

Authors(s):

Eileen Koh† (Science); Amber Kuoiwa Khauv‡ (Science)

Abstract:

A multicore SoC contains two or more independent processing units, or cores, on the same chip, a feature that provides improved multitasking efficiency over single-core processors. One of the primary objectives of the upcoming AFTx08 microcontroller tapeout, scheduled for Spring 2026, is to introduce multicore processing to the current AFTx07++. Existing firmware and software must be adjusted to accommodate this update.

The Firmware team is rewriting startup firmware to ensure multicore compatibility, as well as architecting a suite of multicore software tests to debug and diagnose multicore capabilities and issues. Recent accomplishments include enabling dynamic firmware loading capabilities within the AFTx08 RTL simulation, easing the process of iterative firmware development. Testing has also uncovered a critical bug in multicore cache coherence, which resulted in each processor seeing a slightly different version of computer memory, as well as an additional bug in which hardware errors were not getting detected by the processors.

Next steps involve expanding the suite of software tests, continual debugging of the current RTL by running software programs in full-system tests, and updating startup firmware for multicore integration. The ultimate goal is to deliver a reliable and rigorously tested RTL in preparation for the multicore AFTx08's tapeout, ensuring correct system integration of the dual core chip.

Keywords:

SoC; RISC-V; Multicore Processor; Firmware; RTL

Mentor(s):

Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1655

Presentation Time: Session 4: 1:30-2:30pm

Reconstructing the Higgs Boson through the Big Data Analysis STEM

Authors(s):

Arushi Kolluru† (Science|JMHC); Misty Chen† (Engineering); August William Mauer† (Science)

Abstract:

The purpose of this study is to find the Higgs Boson signal in Run-2 data collected from proton-proton collisions in the Large Hadron Collider. The data is gathered with the CMS detector, using manual data cuts in analysis. The data cuts are used to select candidates of events that fit within expected values for the Higgs Boson. This is accomplished by restricting the range of parameters, such as transverse momentum or lepton count, to the range where Higgs bosons have previously been observed as virtual products of the collision. The cuts will be applied to events within the data that show the decay of two Z-bosons into combinations of four leptons. The specific dataset has parameters of $\sqrt{s} = 8$ TeV and integrated luminosity 11.6 fb^{-1} . The Python libraries Uproot, Numpy, and Matplotlib are used to analyze the datasets, make the cuts, create histograms, and differentiate decay products of the Higgs boson from background products. Through this, events that allow for reconstruction into two Z bosons, which are further reconstructed into a Higgs boson, can be selected. The projected results of the study are that events containing a Higgs Boson will indicate a mass range of 120-130 GeV/c^2 and will be statistically significant from the background. The cuts will validate the existence of the Standard Model Higgs Boson, a particle that is the mediator of the Higgs field, which is integral to understanding how fundamental particles have mass and interact with each other.

Keywords:

Higgs Boson; Higgs Field; Particle Physics; Big Data; Large Hadron Collider

Mentor(s):

Heather Nicole Martin (Science); Andy Jung (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1656

Presentation Time: Session 4: 1:30-2:30pm

Formula 1 Race Performance: An Analytical Dive into Pit Stop Strategy

Business Case Study

Authors(s):

Rishita Korapati† (DSB); Mia Bell Foulk† (DSB); Chih-Yu Lee† (DSB);
Varsha Devisetty† (DSB)

Abstract:

In Formula 1, pit-stop timing is one of the most decisive yet uncertain elements of race strategy, where a single-lap misjudgment can determine whether a driver finishes on the podium. To address this challenge, this project applies predictive analytics to estimate how pit-stop timing decisions made during the race influence a driver's final position percentile at the finish line. Crucially, the model uses only information available before each pit decision, ensuring that predictions respect real-time race conditions and remain temporally valid.

Lap-by-lap telemetry data from the FastF1 API were collected across multiple circuits, seasons, and weather conditions. Each record represents a unique driver-lap, capturing lap time, tire compound, stint number, position, and track temperature. The dataset was refined by merging telemetry tables, excluding formation and Safety Car laps, and resolving missing values. Exploratory analysis revealed that top drivers typically pit within a ± 2 -lap window around the median stint transition, while those stopping under Safety Car conditions improved their finishing percentile by 6–8%, demonstrating the advantage of adaptive timing.

Building on these insights, a staged modeling framework was implemented, progressing from Ridge and Lasso regression to ensemble methods such as Gradient Boosting and XGBoost to predict finishing percentile as a function of pit timing and contextual features. Results show that in wet or Safety Car-affected races, optimal pit windows shift earlier and become less predictable, whereas in dry conditions, mid-stint stops yield stronger outcomes. These findings highlight how analytics can enhance strategic precision in one of the most data-driven sports.

Keywords:

Predictive Analytics; Pit Stop Strategy; Telemetry Data; Race Performance; Machine Learning

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1657

Presentation Time: Session 4: 1:30-2:30pm

Correlation of White Genes with Deafness in Horses

STEM

Authors(s):

Dakota Dawn Kovanda† (Agriculture); Leea Marie Persinger† (Agriculture); Aidan Mitchell Conley† (Agriculture); Ella Marie Horrall† (Agriculture)

Abstract:

The U.S. horse industry, composed of over 6.6 million horses, contributes approximately

\$177 billion annually to the national economy and supports around 1.7 million full time jobs.

Although deafness in the equine industry is rare, affecting an estimated less than 1% of the U.S.

horse population, it can present significant safety concerns for both horses and handlers. As a

prey species that has evolved over 55 million years, horses have developed a heightened flight

response, and they heavily rely on auditory cues to be aware of their surroundings and potential predators. Deafness compromises this awareness, increasing the risk of startle-related injuries to both horses and handlers. This study investigates potential genetic associations between white coat color patterns and congenital deafness in horses. Hair samples were collected from five senior geldings of various breeds and colors by twisting and pulling approximately 30 mane hairs per horse. A full color/pattern genetic panel was performed at the University of California-Davis to assess the presence of alleles associated with pigmentation linked deafness. Although all subjects were geldings (castrated males) and not breeding animals, identifying heritable deafness remains critical to preventing its transmission through breeding stallions and mares. Our team examined the relationship between coat color genetics and congenital deafness to contribute to safer equine management practices and promote informed breeding decisions within the industry.

Keywords:

Deafness; Horses; Genetic Testing

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

Mentor(s):

Casie S Bass (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1658

Presentation Time: Session 4: 1:30-2:30pm

Fabrication and Process Control of Metal-Insulator-Metal Capacitors Using Ion Milling | VIP SPC MIM Team 3 STEM

Authors(s):

Matyas Kubon† (Engineering); Anas Ziad Abughali† (Engineering);
Dipali Rebecca Abraham† (Engineering); Ananya Anand Nadkarni†
(Engineering); Zixuan Fei† (Engineering)|JMHC)

Abstract:

This research focuses on fabricating metal-insulator-metal (MIM) capacitors using advanced nanofabrication techniques and statistical process control (SPC) to optimize process stability, yield, and device quality. An MIM capacitor consists of a dielectric layer sandwiched between two metal electrodes. The VIP SPC MIM team has designed a capacitor structure that enables same-side probing by providing top-side access to both electrodes. The device includes a 5 nm titanium (Ti) / 20 nm nickel (Ni) bottom electrode, a 20 nm hafnium(IV) oxide (HfO₂) dielectric, and a 5 nm Ti / 150 nm aluminum (Al) top electrode. During capacitor fabrication, a hole 300 microns in diameter is etched through the dielectric to expose the bottom Ni electrode for electrical contact. In earlier stages of the SPC MIM project, inductively coupled plasma reactive ion etching (ICP RIE) with chlorine (Cl₂) and boron trichloride (BCl₃) gases was used to etch the hole. However, this process leads to undesired chemical reactions with Ni, forming insulating residues that degrade electrode contact quality. The current phase of the research investigates Ion Milling as an alternative etching mechanism. Ion Milling uses physical sputtering with argon (Ar) atoms, avoiding chemical reactions and minimizing residue accumulation on Ni. The project focuses on evaluating Ion Milling in terms of dielectric etch uniformity, residue reduction, and process control using endpoint detection. Evaluation metrics include etch parameters (surface roughness and etch rate), visual mask damage analysis, and endpoint detection consistency. The goal is to integrate Ion Milling into the MIM process and assess its impact on bottom-electrode access and overall capacitor quality.

Keywords:

SPC; MIM; Ion Milling; Reactive Ion Etching

Mentor(s):

Zhihong Chen (Engineering); Joerg Appenzeller (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1659

Presentation Time: Session 4: 1:30-2:30pm

Asbestos Exposure and Policy: A Comparative Study of Health Risks and Regulations in the US and Vietnam STEM

Authors(s):

Sophia Rochelle Lehnert† (HHS); Laura Helen Greent‡ (HHS|JMHC); Kathryn Lynn McCloskey† (HHS); Klaudia Julia Czerwinski† (HHS)

Abstract:

Asbestos is a global health hazard that has yet to be fully banned in some countries, including Vietnam. It has been known to cause mesothelioma, a type of lung cancer, and asbestosis. Asbestos is still widely used in Vietnam and was only banned in the United States in 2024. However, in June 2025, the EPA launched a 30-month review of the ban, questioning whether restrictions on chlorine production and asbestos-containing gaskets were beyond what is necessary. Review pause may prompt rollback, raising exposure risk concerns. Our research seeks to look at Asbestos exposure in three categories: museum-related environments, construction and building materials, as well as naturally occurring asbestos/man-made environmental exposures in the US and Vietnam. We will dive into the exposures in museums from the building to the artifacts that it collects. In terms of constructional exposure to asbestos, we will highlight the differences in exposure in the United States and Vietnam to see the contrary points. As well as comparing regulatory policies and asbestos-related health impacts to make changes to policy and come up with some solutions to prevent exposure. We will examine public health data, work safety regulations, trade trends, and other annual reports to look at exposures in the United States and Vietnam. This will help us determine if the United States policy is effective, if gaps in innovation exist, and if we can improve PPE and other controls to help prevent asbestos exposure, and help to create a more consistent global standard for regulatory enforcement.

Keywords:

Environmental Protection Agency; Mesothelioma; Asbestosis; Asbestos-Containing-Materials; Asbestos Ban

Mentor(s):

Mark Wilson (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1660

Presentation Time: Session 4: 1:30-2:30pm

How Students Can Utilize Context-Dependent Memory

Social Science

Authors(s):

Reilly Siobhan Lustina† (HHS)

Abstract:

The purpose of this research project is to examine context-dependent memory and its academic application while determining whether or not Purdue students would benefit from a university mandate requiring all exams to be proctored in the same room that the course is taught in. I will gather my research by performing a literature review of experimental research articles surrounding college students' studying and learning methods, unconscious and conscious encoding, and fluctuating exam scores. My findings will be used to evaluate the potential positive effects of testing in the same room that initial learning takes place.

Keywords:

Context-Dependent Memory; Context; Exam; Memory

Mentor(s):

Catherine Jean Shukle (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1661

Presentation Time: Session 4: 1:30-2:30pm

Understanding Product Returns in E-Commerce: A Predictive Analysis Using Synthetic Data Business Case Study

Authors(s):

Vitoria Machado Machado Didone† (DSB); Jack Dorsey Feehan† (DSB)JMHC; Ashton Anthony Price† (DSB); Owen Thomas Edwards† (DSB)

Abstract:

What determines if a product purchased online will be returned? To answer this question, this project utilizes predictive models to identify the transactions with a higher risk of product returns based on the transaction history and consumers' demographics. Product returns are a costly challenge for e-commerce companies. By anticipating the purchases that are more likely to have product returns, the company can reduce operational costs and make data-driven decisions to increase consumer satisfaction and product fit.

The synthetic dataset used in this analysis includes 250,000 transaction records and 13 aspects related to consumer demographics, product details, and payment amount. Preliminary findings of the analysis indicate that approximately 41% of the transactions ended up in product returns. This is a relatively high number considering the extra costs associated with returns. The predictive analysis first introduces the exploratory data analysis (EDA) to identify potential relationships between product returns and transaction history. To validate our EDA, we will use a predictive modeling process with multiple stages. The first stage being a polynomial regression, the second being a spline model, and the final stage being a selection based on the lowest test error after K-fold cross-validation.

This project will give companies the ability to make data-driven decisions by identifying high-return customers, which would enable better inventory management by predicting returns, which will help to minimize shipping and restocking costs. More broadly, this project illustrates how predictive analytics models can be relevant for organizations to improve their operations and decision-making in the digital marketplace.

Keywords:

E-Commerce; Product Returns; Predictive Analytics; Consumer Behavior; Logistic Regressions

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

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1662

Presentation Time: Session 4: 1:30-2:30pm

Sustainable Thermal Solutions for Historic Campus Buildings: An Analysis of Smith Hall Humanities

Authors(s):

Alyssa Marie Viray Magsino† (Liberal Arts); Meg Catherine Schemanske† (Liberal Arts); Avni Jade Dutta† (Liberal Arts)

Abstract:

This project explores how outdated heating and cooling systems in historic campus buildings can guide designers toward sustainable, energy-efficient solutions that preserve architectural integrity. Focusing on Smith Hall at Purdue University, a century-old building that houses the Department of Entomology, our research examines how limited user control and inefficient thermal systems impact both energy performance and occupant well-being. Using a combination of site visits, user interviews, and research review, we analyze how sustainable design frameworks such as LEED and WELL apply to historic structures without full demolition.

The project emphasizes cost-effective strategies that enhance thermal comfort, occupant health, and energy efficiency while maintaining the building's historic character. By engaging directly with students and faculty who occupy Smith Hall, we assess how comfort limitations affect productivity and satisfaction, translating these insights into practical design recommendations. Through occupant surveys, we evaluate how user experiences correspond to WELL and LEED standards and determine areas for improvement to meet these standards. Our findings propose low-cost, high-impact interventions that balance preservation with sustainability, such as adaptive HVAC retrofits, improved ventilation, and passive thermal design methods.

Ultimately, this research contributes to a broader understanding of how designers can ethically and sustainably modernize historic academic buildings. It demonstrates that preservation and performance are not opposing goals, offering a model for universities seeking to improve environmental quality and reduce energy use in historical structures. On campus, this study highlights how designers can positively impact the user experience within existing spaces while considering budget, waste production, and sustainability efforts.

Keywords:

[no keywords provided]

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1663

Presentation Time: Session 4: 1:30-2:30pm

Predicting Long-Term Brand Loyalty from Influencer Exposure: A Multi-Model Segment-Aware Approach Business Case Study

Authors(s):

Ashish Krishna Mallur† (DSB); Annika Anders Nelson† (DSB); Brandon J Moss† (DSB)

Abstract:

This project aims to analyze how influencer marketing shapes long-term brand loyalty, a key driver of lifetime value, retention, and acquisition efficiency. Using a synthetic dataset of 5,000 consumers, we track variables such as engagement, demographics, purchase behavior, and interaction patterns, comparing those exposed to influencers with those who were not. After cleaning and preparing the data (imputation, deduplication, and standardization), exploratory analysis will examine loyalty outcomes and influencer engagement. Feature engineering will include engagement rates, time-based behaviors, and interaction terms to support predictive modeling, such as logistic regression.

Initial findings show an average loyalty score of 25.2 (SD = 11.6), with membership (25.6% of users) emerging as the strongest predictor, boosting loyalty by 10–12 points. Influencer exposure (17.6%) increases purchase frequency (4.6 ? 5.9) and repeat visits (4.1 ? 5.0), while trust (mean = 6.18/10) strongly correlates with loyalty ($r = +0.41$). Review and tutorial campaigns outperform giveaways (28–30 vs. 22), and high-engagement audiences—especially in college-town and urban markets—show 20–25% greater responsiveness. Frequent influencer touchpoints (2–3) maximize impact, and recent purchases (<90 days) correlate with loyalty gains of 6–8 points.

Overall, loyalty is influenced more by behavioral and relational factors than demographics. Strategies focusing on membership incentives, influencer credibility, consistent engagement, and trust-building content are most effective for increasing retention and lifetime value.

Keywords:

Influencer Marketing; Brand Loyalty; Customer Engagement; Predictive Analytics; Retention Strategies

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1664

Presentation Time: Session 4: 1:30-2:30pm

Comparing eDNA Results to Camera Trap Data to Determine Biodiversity STEM

Authors(s):

Abigail Rose Malott† (Agriculture|JMHC); Alexandra Grace Early† (Agriculture); Katerina Murkes‡ (Science|JMHC)

Abstract:

Remote sensing throughout the world has allowed us to gain knowledge on biodiversity and habitat suitability in a variety of biomes. Currently, a common method of remote sensing is through the use of camera traps, which capture images and videos of animals in the area using motion sensing and infrared technology. However, cryptic, fossorial, arboreal, and small species may be difficult to detect using this technology. Emerging genetic analysis techniques (such as soil, fecal, and water analyses) may allow us to better detect these wildlife species. By identifying a larger index of mammal families in specific study areas, we can better understand the biodiversity of specific ecosystems.

We will utilize historical camera trap observations (n=2431) over a sampling period of 944 days across 16 deployments in a local river basin. The observations represent a wide range of species, including the presence of cryptic species such as bobcats (*Lynx rufus*). We will conduct an analysis of the eDNA soil analysis with observed mammal occupancy over the camera sampling days. Theoretically, the camera detected species will be a subset of the representation in the eDNA analysis. We predict that the eDNA analysis of soil will give more insight into the mammalian biodiversity of select sites in the Wabash River Basin than camera traps and detections via computer-analyzed mammal vocalizations.

Keywords:

eDNA; Biodiversity; Camera Trap; Ecology; Mammals

Mentor(s):

Kristen Marie Bellisario (JMHC); Abhinav Tyagi (Purdue University)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1665

Presentation Time: Session 4: 1:30-2:30pm

3D Gaussian Splatting for Autonomous Racing Localization and Simulation STEM

Authors(s):

Shay Joseph Manor† (Science); Millan Shah Kumar‡ (Science|JMHC)

Abstract:

Autonomous racing presents challenges distinct from traditional autonomous driving. Many race tracks are flat with low grass and sparse features. Traditional SLAM and LiDAR struggle as limited texture variation and dynamic lighting cause SLAM failures, while low grass leads to insufficient geometric features for LiDAR. This shows a critical flaw in current autonomous racing capabilities.

3D Gaussian Splatting (3DGS) offers a novel solution by representing environments as collections of Gaussians. While existing 3DGS implementations focus on small-scale scene rendering, we extend this to large-scale outdoor racing and develop a custom monocular localization pipeline. Our approach leverages a pre-built 3DGS map constructed from track data, then performs real-time pose estimation by minimizing photometric error between rendered and observed views.

Reinforcement learning (RL) in traditional simulators often fail during real-world deployment due to discrepancies in appearance, lighting, and physics modeling. Our 3DGS reconstruction enables training directly on photorealistic renderings of the track. This approach significantly reduces the sim-to-real gap, allowing RL controllers to learn racing lines, account for vehicles, and learn reactive behaviors that transfer reliably to the physical kart without extensive real-world fine-tuning.

The key technical contributions include: (1) efficient large-scale 3DGS map construction, (2) a lightweight localization algorithm, and (3) robust feature matching despite sparse landmarks. By rendering novel views from the 3DGS representation and comparing them against the live camera feed, our system achieves sub-meter localization accuracy suitable for high-speed racing applications.

This work demonstrates that 3DGS-based localization provides a viable alternative to conventional methods for autonomous racing.

Keywords:

3D Gaussian Splatting; Autonomous Racing; Reinforcement Learning; Simulation; Computer Vision

Mentor(s):

Francisco J Montalvo (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1666

Presentation Time: Session 4: 1:30-2:30pm

Factually Grounded and Human-Aligned RAG Systems for AI Governance and Policy STEM

Authors(s):

Saahil Mathur† (Science); Ruth Tanjung Sugiarto* (Engineering|JMHC);
vedant Thakur* (Liberal Arts); Seunghyun Yoo* (Science)

Abstract:

The purpose of this project is to improve retrieval-augmented generation (RAG) systems for analyzing and summarizing artificial intelligence (AI) policy documents by developing a pipeline that produces factually grounded and contextually relevant responses through enhanced retrieval and human-aligned generation. While recent RAG systems have explored aligning generation outputs with human preferences, there remains a gap in applying these approaches to technical, legal-style AI policy texts and ensuring that responses remain faithful across jurisdictions and legislative formulations. To address this, the system combines a ColBERT-based retriever that enables precise evidence retrieval through semantically rich representations of policy texts, and a language model fine-tuned via Direct Preference Optimization (DPO) to align responses with human judgments of correctness and clarity. Preliminary evaluation suggests that combining ColBERT retrieval with DPO-tuned generation improves factual consistency and reduces hallucinations in policy question-answering tasks. This work contributes to ongoing efforts to align large language models with human expectations and demonstrates how preference fine-tuning and advanced retrieval can improve reliability of RAG systems for complex, knowledge-intensive domains such as AI governance and policy analysis.

Keywords:

[no keywords provided]

Mentor(s):

Tunazzina Islam (Science)

Other Acknowledgement(s):

Ryan David Rittner (Office of the Provost)

Poster Presentation Abstract Number: 1667

Presentation Time: Session 4: 1:30-2:30pm

Autopilot Integration and High-Fidelity Simulation for Lightweight Unmanned Fixed-Wing Aircraft STEM

Authors(s):

Dominic Henry Mazurek† (Engineering); William Falk Wahlberg‡ (Engineering); Braden Thomas Callaway† (Engineering)

Abstract:

This research details the creation of a high-fidelity simulation environment for lightweight fixed-wing Unmanned Aerial Vehicles (UAVs), developed and validated within the Purdue UAS Research and Test (PURT) facility. The project utilizes a simple, off-the-shelf airframe, modeled after the Windracers aircraft and equipped with an active LED marker board for multi-vehicle tracking, to gather essential empirical data. The core contribution is a dynamic digital model developed in ROS 2 and Gazebo, which is directly parameterized and validated using flight data from the PURT facility to ensure it accurately replicates real-world flight physics and vehicle dynamics.

This rigorously validated simulation provides a foundational tool for a wide spectrum of aerospace research, enabling the virtual testing of aerodynamics, guidance and control algorithms, and multi-UAV behaviors in a risk-free environment. By providing a scalable and high-fidelity platform grounded in real-world data, this work establishes a robust methodology for the digital development and testing of autonomous systems, with broad applications in vehicle design, flight control, and operational planning for UAVs.

Keywords:

Wind Racers; Unmanned Fixed-Wing Aircraft; Simulation; UAS; Motion Capture

Mentor(s):

James Michael Goppert (Engineering); Worawis Sribunma (Centers & Institutes)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1668

Presentation Time: Session 4: 1:30-2:30pm

Exploring Adversarial Robustness Through Landseer and DAD Integration STEM

Authors(s):

Soham Mehta† (Science)

Abstract:

Machine learning models are vulnerable to a wide range of adversarial attacks, including backdoor, evasion, extraction, and inference attacks.

Although many defense mechanisms exist, they are often evaluated in isolation and target narrow threat models. Landseer is a modular framework

designed to systematically explore, compose, and evaluate machine learning defenses across the entire ML pipeline. Its flexible Docker-based architecture allows pre-, during-, and post-training defenses to be integrated,

enabling automated testing of defense combinations against diverse attack scenarios.

This work contributes an implementation of the Distributional-discrepancy-based Adversarial Defense (DAD) method into the Landseer ecosystem.

DAD is a two-pronged defense that uses statistical measures—specifically

optimized Maximum Mean Discrepancy (MMD)—to both detect and de-noise adversarial inputs, improving robustness without discarding data.

By incorporating DAD as a Landseer defense tool, we enable reproducible,

automated evaluation of its performance across multiple datasets, models,

and attack types. This integration facilitates direct comparison between DAD and other defenses, providing a standardized platform for adversarial robustness benchmarking and future research on defense composition.

Keywords:

Adversarial Defense; Distributional Discrepancy; Modular Framework; Landseer; ML Robustness

Mentor(s):

Zahra Ghodsi (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1669

Presentation Time: Session 4: 1:30-2:30pm

Environmental Impact of CryptoMining

Humanities

Authors(s):

Haari Muthukumar† (Engineering)

Abstract:

As cryptocurrency gains more and more traction in society, it becomes imperative to look at the potential downside and impacts that it has. Cryptomining, a common form of obtaining Proof of Work cryptocurrency such as Bitcoin, is one of the major players to environmental degradation. The electrical usage is sky high, with many of these crypto operations resulting in thermal pollution, carbon pollution, and electronic pollution. In this exploratory research, I consider potential solutions such as taxing carbon emissions and enacting cryptotransaction fees. Overall this work tries to establish an understanding of the problems created through cryptomining and the solutions for it.

Keywords:

Cryptocurrency; Environment

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1670

Presentation Time: Session 4: 1:30-2:30pm

Clock Domains for SoCET Design Flow STEM

Authors(s):

Moe Wai Yan Myint† (Engineering); Blake Alexander Andrews† (Engineering); Tei Okamoto† (Engineering); Niels van Ritbergen† (Engineering); Raunak Dani‡ (Engineering)

Abstract:

In modern VLSI design, connecting multiple domains operating at different clock frequencies is critical to achieving optimal power and performance for a System-on-Chip (SoC). This requires partitioning designs into different clock domains and connecting them using Clock Domain Crossing (CDC) techniques. SoCET's current SoC design uses a single ungated clock, resulting in unnecessary dynamic power consumption. We propose a multi-domain clocking architecture with systemic clock gating and verified CDCs to decouple high-speed core logic from lower-speed I/O. Our approach will utilize asynchronous FIFOs with gray code pointers for safe data transactions across domains. As a proof of concept, we developed a send-and-receive prototype to demonstrate compatibility with our design and verification tooling. For SoCET's next SoC iteration, core and I/O clocks will be separated, with idle subsystems gated to save power. The project's second phase will extend clock domain separation to SoCET's new dual-core design and the on chip SRAM. Success will be measured by reduced dynamic power, measurable differences between core to I/O clock frequencies, and functional data transfers in silicon. This work will also establish a reusable and verified physical design flow template for future SoCET projects using clock domain crossings.

Keywords:

Clock Domain Crossings; VLSI; System-on-Chip; SoCET

Mentor(s):

Timothy Francis Hein (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1671

Presentation Time: Session 4: 1:30-2:30pm

Design and synthesis of selective Delta Opioid Receptor agonists STEM

Authors(s):

Felicia Jesutofunmi Onawola† (Pharmacy|JMHC)

Abstract:

Chronic pain, a prevalent ailment among adults, is often treated with opioid analgesics, but the effectiveness of these opioids is limited by adverse effects such as tolerance, addiction, and respiratory depression. Opioid receptors (ORs) are a subset of G-Protein Coupled Receptors (GPCRs) found throughout the nervous system. There are three main ORs: mu-OR, kappa-OR, and the delta-OR each having different physiological effects. The only approved therapeutics target the mu-OR which is notorious for triggering these side effects. The delta-OR signaling pathways bifurcate into two distinct cascades: a G-protein-dependent pathway that releases second messengers to produce analgesia, and a beta-arrestin 2 (beta-arr 2) pathway that inhibits G-protein signaling and promotes receptor internalization, blocking analgesia.

Ligands that act on the delta-OR display distinct profiles of potency, selectivity, and beta-arr 2 recruitment. The ($\pm$)-TAN-67 agonist exhibited markedly lower beta-arr 2 recruitment relative to other scaffolds and was therefore selected as the project's lead compound. Reported syntheses of ($\pm$)-TAN-67 are not enantioselective, and analysis of the isolated enantiomers showed (+)-TAN-67 induces seizures, whereas (–)-TAN-67 produces analgesia. An enantioselective synthetic route produced the enantiopure ligand (–)-TAN-67 but its pharmacodynamic (PD) and pharmacokinetic (PK) activities indicated activation of the beta-arr 2 pathway and suboptimal metabolism. To improve the pharmacological activity and reduce beta-arr 2 recruitment, a computational approach was modeled for the identification of the key recognition sites: salt-bridge formation with the N-methyl (message site) and pi-stacking with the quinoline ring (address site). Consequently, analogs have been derived to enhance these ligand-receptor interactions.

Keywords:

Chronic Pain; Opioid; Analgesic; Opioid Receptor; Opioid Receptor Agonist

Mentor(s):

Ryan Alan Altman (Pharmacy); Abdulrahman Arafat Mohammed Moursy (Pharmacy)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1672

Presentation Time: Session 4: 1:30-2:30pm

High-Speed Low-Power SAR-Assisted 2-Stage 8-Bit Pipeline ADC STEM

Authors(s):

Eain Drae Oot† (Engineering|JMHC); Safa Islam‡ (Engineering)

Abstract:

This project presents the design and construction of a SAR-Assisted 2-Stage 8-Bit Pipeline ADC. This specific ADC architecture is selected for its ability to deliver fast, high-resolution data conversion, while minimizing power consumption compared to other ADC architectures. The development process is divided into four main stages: research, digital logic design, simulation, and fabrication. The design process is strongly supported by existing PhD research papers on this particular ADC architecture. Drawing from these studies, the project utilizes Cadence tools to design key components, including a comparator, a 5-bit mDAC, a digital correction block, and a 4-bit SAR ADC. The specifications and component values have been adjusted to be more suitable for an undergraduate-level delivery. An ADC capable of converting AC signals to DC outputs at high speed and low power is highly desirable in industry applications such as digital cameras, ultrasonic medical devices, and high-speed oscilloscopes. In its preliminary stage, this ADC is expected to achieve 8-bit resolution at 50 Ms/s with a power consumption of 5 mW. The successful realization of the ADC can enable the development of high-performance devices that require fast, efficient, and easy-to-debug signal conversion.

Keywords:

8-Bit Pipeline ADC; Analog to Digital Converter; Electrical Engineering; IC Design; System on Chips

Mentor(s):

Seyedehmarzieh Rouhani (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1673

Presentation Time: Session 4: 1:30-2:30pm

Screens Causing Autism: Another Hoax or No?

Social Science

Authors(s):

Jaser Ahmed Pallikonda Latheef† (HHS)

Abstract:

Autism, formerly Asperger's, formerly Savant Syndrome, formerly Childhood Schizophrenia, is a turbulent label with an ever-changing set of criteria. As of 2025, Autism continues to be an actively researched and hotly discussed phenomenon. A newly emerging view on the origins of Autism is that it is caused by exposure to electronic screens during early developmental stages. Unlike a previous (now debunked) claim that Autism was caused by the MMR vaccine, a positive correlation can be observed between increased device usage and Autism diagnosis. Virtual Autism is an informal label given to children who begin displaying apparent Autistic traits after prolonged screen usage every day. Is Virtual Autism something that should be considered part of the Autism umbrella, or is it a transient issue? Virtual Autism is most certainly a transient issue, a product of its time due to child neglect and need not be made a formal diagnosis, but it is still important to prevent it from occurring through healthy interpersonal interactions with developing children and restricting screen use.

Keywords:

Autism; Screens; Virtual Autism; Psychology; Mental Health

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1674

Presentation Time: Session 4: 1:30-2:30pm

Quantum Annealing for Feature Selection: A Comparative Study on the MiniBooNE Dataset STEM

Authors(s):

Abhinav Vijay Pandet† (Science); Adarsh Narayanan† (Science); Rahul Nagisetty† (Engineering); Vivan Nagrath† (Engineering)

Abstract:

Feature selection is an important technique used in machine learning pipelines as a way to determine the most optimal features in a dataset for further processing. In practice, classical methods such as Recursive Feature Elimination (RFE) and Principal Component Analysis (PCA) are used to perform feature selection. However, these methods are often computationally expensive for high dimensional data and prone to overfitting training data. Quantum annealing offers a promising alternative by encoding the feature space onto a quantum system, enabling faster convergence toward the optimal feature subset. For this study we use the MiniBooNE particle identification dataset to explore the efficiency of quantum annealing as an alternative paradigm for feature selection and compare its performance against classical algorithms.

Keywords:

Quantum Annealing; Feature Selection; QUBO Optimization

Mentor(s):

Andy Jung (Science); Noah Charles Singer (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1675

Presentation Time: Session 4: 1:30-2:30pm

ChainVisor - Investigating IoT STEM

Authors(s):

Jayla Kennedy Parks† (Liberal Arts); Tarek Ibrahim Salamat† (Engineering); Omar Ahmed Abdelrady Ismaiel† (Engineering); Daniel Kailin Wu† (Engineering); Samuel D Guber* (Engineering); Evan Robert English* (Science); Sebastian Emin Toro* (Engineering)

Abstract:

Smart devices are more present in the everyday home, now more than ever. IoT devices have a wide range of features like controlling other smart devices and universal remote usage, but how secure are they really? We aim to determine potential vulnerabilities of an IoT device, looking at internal components and its manufacturers to test the security of said device. With the intent to gather information to protect other users from threats, we can carry out a case study to identify existing mitigations in consumer-grade IoT to avoid supply chain attacks, the supply chain vulnerability, and reverse engineering the device. We will analyze our results using controlled trials to determine how effective our proposed attack methods are and the possibility of an attack.

Keywords:

[no keywords provided]

Mentor(s):

Santiago Torres Arias (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1676

Presentation Time: Session 4: 1:30-2:30pm

Impact of Pre-Gestational Acute Kidney Injury on Pregnancy Outcomes and Offspring Development in Mice STEM

Authors(s):

Julie Thu Anh Phung† (Engineering)

Abstract:

Acute kidney injury (AKI) can result in long-term sequelae and increase long-term risks of chronic kidney and heart disease. However, the impact of prior maternal kidney injury on future pregnancy and offspring health is not yet well understood. This project investigates how a prior, recovered episode of AKI influences pregnancy outcomes and offspring development using a murine model.

Female C57BL/6J mice underwent either AKI via bilateral renal ischemia-reperfusion or a sham procedure. After a two-week recovery, they were bred with healthy males. Maternal weight, litter size, and pup growth were measured through 12 weeks of age. At 12 weeks, offspring kidney function was evaluated through transdermal glomerular filtration rate (tGFR), and ultrasound arterial resistive indices were measured to examine vascular health.

Dams with a history of AKI tended to have a smaller litter, though this difference was not statistically significant. Their offspring were born at slightly lower weights compared to shams (1.306 g vs. 1.343 g, $p=0.03$) but caught up in growth by the second week of life. Preliminary kidney function testing showed no major differences between groups. Arterial resistivity indices were slightly lower in AKI offspring compared to sham and control offspring; however, these results were not statistically significant.

These findings suggest that a history of pre-gestational maternal AKI may temporarily affect fetal growth but does not cause early-life kidney dysfunction. Ongoing studies will explore how maternal injury influences blood vessel health, metabolism, and kidney function later in life to better understand risks for future cardiovascular and kidney disease.

Keywords:

Acute Kidney Injury; Transdermal Glomerular Filtration Rate; Maternal Injury

Mentor(s):

Danielle E Soranno (Engineering)

Other Acknowledgement(s):

Alleé Shaw (Indiana University); Emilia Jean Adolay (Engineering);
Jennifer Anderson (Indiana University); Sayeh Gholampoor (Indiana
University)

Poster Presentation Abstract Number: 1677

Presentation Time: Session 4: 1:30-2:30pm

Arsenic Exposure and Health Outcomes Across Contexts in Vietnam and the United States STEM

Authors(s):

Hurshal Pol† (HHS|JMHC); Kapil Ramswamy Chandramouli† (HHS);
Andrew Patrick Folkers† (HHS); Sidharth Reddy† (HHS)

Abstract:

Arsenic contamination remains a persistent global health crisis, revealing stark contrasts in exposure sources and health outcomes between industrialized and developing nations. This study examines the biological and environmental consequences of arsenic exposure in the United States and Vietnam, highlighting how socioeconomic, occupational, and regulatory contexts shape public health outcomes. In the U.S., arsenic exposure mainly arises from contaminated groundwater and industrial waste, contributing to increased risks of cardiovascular disease, diabetes, and various cancers. In contrast, Vietnam experiences widespread exposure through naturally contaminated drinking water, agricultural runoff, rice, food, and poorly regulated occupational environments, disproportionately affecting rural and low-income populations.

This research aims to compare biomarker and metabolic profiles associated with arsenic exposure across these two populations, using publicly available datasets and community health surveys. By identifying both shared and population-specific pathways of toxicity, the study seeks to inform culturally and contextually relevant mitigation strategies. Proposed interventions include improved water filtration systems, occupational safety training, and targeted nutritional programs to enhance arsenic detoxification.

Ultimately, this comparative analysis underscores the urgency of developing interdisciplinary solutions that integrate environmental health science, policy innovation, and global health equity to reduce arsenic-related disease burdens worldwide.

Keywords:

Arsenic; Biomarkers; Toxicity; Global Health; Health Outcomes

Mentor(s):

Mark Wilson (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1678

Presentation Time: Session 4: 1:30-2:30pm

Cell-State Changes in Non-Small Cell Lung Cancer with the Suppression of CIP2A STEM

Authors(s):

Elisabeth Porter† (HHS)

Abstract:

Lung cancer is leading cause of cancer-related deaths in the United States. As the third most common cancer, almost 30% of patients present with an epidermal growth factor receptor (EGFR) mutation that drives their cancer. When EGFR is mutated, it is constantly active, which allows for the continuous signaling to downstream pathways and ultimately leads to tumor growth. PP2A is a major ser/thr phosphatase in the cell and is a major tumor suppressor that negatively regulates many pathways, including the EGFR signaling pathway. Lung cancer patients present with an increased amount of Cancerous Inhibitor of PP2A (CIP2A). CIP2A is the endogenous inhibitor of PP2A and allows for continuous EGFR signaling, tumor growth, and cancer progression. Previous work in the lab has shown that a decrease in PP2A leads to a cell state change known as epithelial-to-mesenchymal transition (EMT), making the tumors more aggressive. In my project, via shRNA mediated knockdown of CIP2A, I will be analyzing the changes of the cancer cell state using qRT-PCR, western blot, and immunofluorescent analysis in addition to phenotypic assays. Our results suggest that cells with knockdown of CIP2A may be shifting their cell state to a more epithelial, less aggressive cell state.

Keywords:

[no keywords provided]

Mentor(s):

Brittany Nicole Heil (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1679

Presentation Time: Session 4: 1:30-2:30pm

Thin film optimization for BaZrS₃ chalcogenide perovskite STEM

Authors(s):

Myriam Julieth Rangel Miranda† (Engineering)

Abstract:

As global fossil fuel reserves continue to deplete, there is growing recognition of the vast potential of solar energy, due to the abundance of sunlight reaching the Earth. This makes solar energy a leading renewable energy source through the use of solar panels or photovoltaics. Therefore, there is a need to focus on improving the efficiency of existing solar cell technologies. In the search for new alternatives, materials that are non-toxic, earth-abundant, and stable, while exhibiting promising optoelectronic properties, are increasingly needed, qualities that are found in chalcogenide perovskites.

BaZrS₃ is one of the most studied chalcogenide perovskites due to its lower synthesis temperatures, thermodynamic favorability, and favorable bandgap for the top layer in a tandem device. Using a solution-deposited process, BaZrS₃ thin films were successfully obtained at a moderate temperature of 575°C in just 2 hours. This is significantly lower in both temperature and processing time compared to traditional synthesis methods, which typically require 800–1200°C and extended durations ranging from several hours to days.

However, the resulting films exhibited holes in its structure, emphasizing the challenge of non-continuous growth and an uneven distribution of the material. For this reason, this work focuses on optimizing the existing process by introducing liquid fluxing agents trying to reduce the kinetic barriers and facilitating the nucleation of and growth of BaZrS₃ and enhancing film uniformity. This approach supports the prospective application of these materials in optoelectronic devices, due to its potential for continuous, high throughput, roll-to-roll processing over large areas.

Keywords:

Chalcogenide Perovskites; BaZrS₃; Solution-Processing; Solar Cells; Thin Films

Mentor(s):

Kiruba Catherine Vincent (Engineering); Rakesh Agrawal (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1680

Presentation Time: Session 4: 1:30-2:30pm

Deep Learning for Enhanced Analysis of Depot Formation and Diffusion in Auto-Injector Devices STEM

Authors(s):

Disha Ransingh† (HHS); Sai Aiswarya Sadagopan† (Science); Rishika Ramakrishnan† (Science); Jonas Villabroza† (Engineering); Jane Zhao‡ (Pharmacy|JMHC)

Abstract:

The pharmaceutical industry adheres to strict regulatory standards for the safe manufacturing of drugs. One standard involves optimizing drug delivery performance and consistency to minimize any unintended responses upon administration. The rising prevalence of chronic diseases like diabetes requires frequent injections and self-administration through auto-injectors which are particularly convenient as they reduce hospital visits. Existing works exploring depot morphology and diffusion often lack sufficient experimental validation and oversimplify drug depot geometry, limiting predictive accuracy. This study explores the application of a U-Net Model to output autosegmented images that can be analyzed to improve autoinjector administration methods, ensuring safety and proper dosing. Leveraging the model, we aim to detect trends in plume aspect ratio, waterfront growth, apparent diffusion, and the geometric metrics of the plume during and post-injection. Overall, our study aims to broaden our knowledge regarding drug delivery using autoinjectors, and we strive to offer an automatic model that is able to autosegment images and uses observable trends in depot formation to optimize safe drug delivery.

Keywords:

Depot Formation and Diffusion; Machine Learning; U-Net Model; Autosegmentation; Plume Metrics

Mentor(s):

Brett A Meyers (Centers & Institutes); Reza Babakhani Galangashi (Engineering); Sourav Das (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1681

Presentation Time: Session 4: 1:30-2:30pm

Color and Coverage: A study into Autism Spectrum Disorder Diagnosis Disparities for Children of Color Humanities

Authors(s):

David Alexander Ransom† (HHS)

Abstract:

Autism Spectrum Disorder(ASD) is a neurological condition that primarily impacts development. These developmental differences often manifest in certain behavioral patterns, struggles with communication, and restrictive needs. Historically, ASD was a disorder primarily diagnosed and studied in white, upper-middle-class children, leaving people of color who faced ASD understudied and underdiagnosed (Onovbiona et al. 1438). These diagnosis disparities persist to this day, leading to the delayed diagnosis via long waiting lists or misdiagnosis of children with ASD who are people of color. In this exploratory research project, I focus on the reasons these diagnosis disparities persist due to race, as well as negative short and long-term impacts caused by such delays and misdiagnoses. To pursue this issue, I conducted a literature review of multiple peer reviewed and popular primary and secondary sources. I hope to use these sources not only to gauge current public knowledge and research on the topic but to utilize first-hand experiences from the caretakers of children of color with ASD. This research exemplifies the scale and stakes of this issue and the specific underlying issues causing these disparities, delays due to long waiting lists, and rampant misdiagnoses. Such research is vital for public health advancements in diagnosis accessibility and understanding ways to best tackle these disparities in diagnosis.

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1682

Presentation Time: Session 4: 1:30-2:30pm

Hardware-Aware PTMPicker: A Pragmatic Approach to Pre-trained Model Selection STEM

Authors(s):

Soham Rattant† (Engineering); Charles Chen‡ (Science)

Abstract:

The rapidly increasing use of Pre-Trained Models

(PTMs) in various fields to eliminate the need for the resource-intensive training traditionally associated with artificial neural network implementations has led to a surge of new PTMs into model repositories. Despite the astonishing volume of PTMs available, only a few are particularly suitable for each unique task, making the problem PTM selection key to unlocking the full potential PTMs. Additionally, accuracy is not the only concern, as there are usually hardware limitations that need to be accounted for in real-world applications. Specifically, we need to output a ranking of the top k PTMs given a specific task, dataset, hardware constraints, and corresponding importance ratings. After exploring a myriad of current PTM selection methods, we propose a pipeline involving the frameworks PTMPicker, Fennec, and NeuSight. Each of these frameworks addresses at least one of the current issues with PTM selection and allows for hardware-aware selection, something existing approaches struggle to integrate. Our approach will be evaluated on task-specific benchmarks with a variety of hardware specifications to simulate real-world hardware constraints.

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

Keywords:

[no keywords provided]

Mentor(s):

James C Davis (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1683

Presentation Time: Session 4: 1:30-2:30pm

Molding of Hybrid Continuous and Discontinuous Fiber Systems to Improve Strength and Reduce Variability STEM

Authors(s):

Luis Andre Romero Alvarez† (Engineering)

Abstract:

Composite materials shine due to their exceptional strength-to-weight ratio but face a considerable challenge in manufacturing of complex shapes with continuous fibers. Long discontinuous fiber composites allow the fabrication of complex part geometries, however, there is substantial variability in the strength characteristics of the molded parts. Hence, this project investigates a hybrid molding concept, integrating tailored continuous fiber printed preforms with long discontinuous fibers in compression molding with the goal of enhancing strength and reducing variability. An exploration of different continuous fiber preform architectures was carried out in this project guided through structural analysis and topology optimization tools. For this purpose, finite element analysis is used to analyze the response of a bracket geometry towards external forces, identifying stress-heavy regions that serve as key indicators of where continuous fiber preform reinforcements should be placed. This way, the discontinuous composite is used to conform the complex geometry, while the continuous fiber reinforcements help the structure achieve enhanced mechanical performance. The concept was demonstrated for overhead pin brackets manufactured with carbon fiber reinforced Polyphenylene Sulfide (PPS). The brackets were mechanically tested to evaluate the improvement in strength and the reduction in variability. The results show substantial improvements gained through the addition of continuous fibers, demonstrating that integrating strategically placed reinforcements with complex geometries using compression molding is successful, achieving good manufacturability and mechanical performance effectively. Therefore, this is a viable methodology for manufacturing hybrid composite structures that are both lightweight and exhibit high endurance, suitable for the aerospace industry.

Keywords:

Hybrid Composites; Compression Molding; Additive Manufacturing; Discontinuous Fiber; Continuous Fiber

Mentor(s):

Eduardo Barocio Vaca (Engineering); Jordan James Wess Kalman (Engineering); Garam Kim (Polytechnic)

Other Acknowledgement(s):

Raju Ahammad (Engineering)

Poster Presentation Abstract Number: 1684

Presentation Time: Session 4: 1:30-2:30pm

An Overview: Sodium Acid Pyrophosphate and its uses in potato processing STEM

Authors(s):

Nicolas Raymond Rosy† (Agriculture)

Abstract:

Sodium Acid Pyrophosphate (SAPP) is a common food additive used in a variety of food products such as canned seafood, cured meats, hashbrowns and many more to adjust the pH, or acidity of a food, maintain color, or even found in baking powders to be used as a leavening agent. Particularly in potato processing, SAPP is used to prevent darkening after cooking, a common undesirable trait that occurs in cooked potatoes. A study was done to evaluate the effectiveness of various types of treatments used to prevent darkening by comparing a 3% concentration of SAPP along with other chemicals that reduce the browning in potatoes, and researchers found that SAPP showed a brighter color as compared to an untreated potato. This is measured using a calorimeter which measures the color of various types of food. In addition, when asking consumers to take a sensory test on potato samples, consumers were able to notice a slightly brighter color in a sample containing SAPP in comparison to an untreated potato. This was measured using a Hedonic scale or asking consumers to rate on a scale of 1-9. When looking at the health risks of SAPP, it can be seen that SAPP does have the ability to weaken one's immune system making them at higher risk for disease and sickness. Many more health risks regarding the use of SAPP are still being continued to be explored by scientists.

Keywords:

SAPP; Potato; Color; Health; Food

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1685

Presentation Time: Session 4: 1:30-2:30pm

Design of Hyaluronic Acid-Based Hydrogels for Brain Tissue Mimicry and Nanoparticle Transport Studies STEM

Authors(s):

Eliana Saavedra† (Engineering)

Abstract:

Understanding nanoparticle transport within brain-mimetic environments is critical for developing effective neurotherapeutic delivery systems. Existing hydrogel models insufficiently replicate the mechanical, chemical, and degradative characteristics of native brain extracellular matrix, limiting their predictive capacity for nanoparticle behavior. To address this limitation, hyaluronic acid-based hydrogels were synthesized using distinct crosslinkers—poly(ethylene glycol) diacrylate (PEGDA), maleimide and divinyl sulfone (DVS), and ferric ethylenediaminetetraacetic acid (Fe-EDTA)—to tune network architecture, redox sensitivity, and mechanical stability. Systematic titrations were conducted across different pH conditions to identify the optimal environment for hydrogel formation and stability. Preliminary observations indicate that pH 7.4 yields the most stable and homogeneous gels, aligning with physiological conditions. Comparative evaluation of the crosslinkers is ongoing to assess their effects on stiffness, degradability, and suitability for nanoparticle diffusion studies. This work establishes the foundation for a tunable, biocompatible hydrogel platform that closely mimics brain tissue properties, enabling quantitative investigation of nanoparticle transport and informing the rational design of delivery systems for neurological applications.

Keywords:

Hyaluronic Acid Hydrogels; Brain Tissue Mimic; Crosslinkers; Tissue Engineering; Nanoparticle Transport

Mentor(s):

Marisa Ann Egan (Engineering); Julie C Liu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1686

Presentation Time: Session 4: 1:30-2:30pm

Modeling DNMT1-associated neurodegeneration using human stem cell–derived cortical organoids. STEM

Authors(s):

Karen Vanessa Salazar Salazar†; Evangelina Sarah Kalathoti* (Science); Katherine Margaret Stockhausen* (Science|JMHC)

Abstract:

DNA methylation is a key epigenetic mechanism that regulates gene expression, maintains cellular homeostasis, and guides cell fate decisions. Alterations in DNA methylation–related proteins can disrupt these processes and contribute to disease. Among DNA methyltransferases, DNMT1 is the main enzyme responsible for maintaining methylation patterns during cell division. DNMT1 mutations are linked to hereditary sensory neuropathy with dementia and autosomal dominant cerebellar ataxia, disorders featuring narcolepsy and progressive neurodegeneration.

This study aims to elucidate the cellular and molecular consequences of DNMT1 mutation, identify cellular phenotypes, and explore potential CRISPR-based therapeutic strategies for individuals with rare DNMT1 variants. Induced pluripotent stem cells (iPSCs) carrying the DNMT1 mutations were differentiated into three-dimensional cortical organoids to model human brain development. CRISPR prime editing is being applied to correct the mutation in iPSCs, followed by editing in organoids, enabling direct comparison between mutant and corrected models. Editing efficiency and unintended DNA damage (indels) will be assessed, along with neuronal differentiation markers and electrophysiological recordings to evaluate molecular and functional changes.

We hypothesize that the DNMT1 mutation disrupts DNA methylation maintenance, leading to aberrant gene expression, impaired neuronal differentiation, and altered electrophysiological activity that contribute to neurodegeneration. Correction of the mutation by prime editing is expected to rescue these alterations, providing mechanistic insights into DNMT1-associated neurodegeneration. This work establishes a human stem cell–based platform to investigate DNMT1-related pathogenesis and explore potential gene editing therapies for rare neurodegenerative disorders.

Keywords:

DNMT1; Neurodegeneration; iPSCs; Gene Therapy; Organoids

Mentor(s):

Morgan Jefferies Robinson (Engineering); Yang Yang (Pharmacy)

Other Acknowledgement(s):

Manasi Suchit Halurkar (Pharmacy); Kyle William Wettschurack (Pharmacy)

Poster Presentation Abstract Number: 1687

Presentation Time: Session 4: 1:30-2:30pm

How Does Car Design Affect Our Interpretation of Cars?

STEM

Authors(s):

Emily Grace Marie Saldivar† (Engineering)

Abstract:

This research takes a deep dive into how humans are affected by vehicle design by analyzing personal accounts from consumers on what is sought out most in a vehicle. Input was gathered from car designers and engineers on the steps involved in the process to create a car that consumers will want. The research also draws on credible sources that elaborate on how the human brain reacts to interacting with objects. In addition, it includes an analysis of automotive design and how it has changed since the start of the automotive industry. The answer to how car design can affect humans is somewhat complex. The main idea is that humans are affected by the frequency of their interaction with cars, as the majority of people use cars daily to complete a wide variety of tasks. Due to this constant dependency on vehicles, humans develop emotional connections that influence their experience. These findings emphasize the importance of choosing the right vehicle and speaking up about what truly would make them feel the most positive in a car. This information can also underscore for car designers the need to listen to consumers, challenge existing designs, and create something bold and exciting that will resonate with current and later generations.

Keywords:

Automotive; Design; Society

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1688

Presentation Time: Session 4: 1:30-2:30pm

Exploring Interactive Robotic Music Therapy Systems for Rehabilitation: A Survey STEM

Authors(s):

Hector Armando Salinas Gordillo† (Engineering)

Abstract:

Interactive robotic music therapy introduces an innovative opportunity, where human-guided musical interaction with robotic systems can create adaptive and engaging therapeutic experiences. This survey explores the current state of research at the intersection of robotics, music, and rehabilitation, focusing on emerging technologies such as human-robot interaction methods and system designs that help enable real-time, interactive music therapy.

Potential patient groups include individuals undergoing motor or cognitive rehabilitation, such as those recovering from stroke, living with Parkinson's disease, cerebral palsy, or age-related motor impairments, as well as individuals with developmental disorders or limited mobility. Traditional rehabilitation exercises may be monotonous, which can reduce patient motivation and adherence. By integrating robotics with music, patients can guide robotic instruments through gestures, biofeedback, or motion tracking, enabling interactive, personalized therapy and providing more accurate and comprehensive data on patient activity and progress.

This project reviews existing robotic platforms, sensor and control mechanisms, and interfaces that allow patients to guide desired outputs, showing advances in interactivity, adaptability, and user engagement. These systems may facilitate greater patient involvement and positively influence rehabilitation outcomes.

Challenges such as usability, accessibility, and integration into existing therapeutic systems are discussed, along with opportunities for future research. This survey identifies gaps in the literature and outlines directions for advancing interactive robotic music therapy systems, providing a framework for researchers and developers interested in the design and application of music-guided robotic interventions in rehabilitation contexts.

Keywords:

Music Therapy; Robot Therapy; Interactive Therapy; Assistive Technologies; Biofeedback Systems

Mentor(s):

Yung-Hsiang Lu (Engineering); Yeon Ji Yun (Liberal Arts); Nan Kong (Engineering); Samantha Sudhoff (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1689

Presentation Time: Session 4: 1:30-2:30pm

The Economics of Happiness

Social Science

Authors(s):

Isaiah William Schaefer† (HHS)

Abstract:

This investigation explores the complex relationship between money and happiness, with the goal of clarifying how financial resources influence well-being. While money provides utility and security, its role in generating lasting happiness appears limited. A wealthy individual may find satisfaction in the ability to provide for family, yet a poorer individual can experience similar happiness through the same act of provision. Thus, money is present in both cases, but happiness is not strictly dependent on it. To explore this dynamic, research was drawn from scientific journals, university archives, and empirical studies, creating a broad conversation around the economic and psychological dimensions of happiness. Findings suggest that although money can improve quality of life up to a certain threshold, its influence diminishes once basic needs and security are met. Beyond that point, purpose, relationships, and meaningful pursuits emerge as stronger determinants of happiness. This study concludes that money should be viewed as a tool that enables flourishing rather than as the root of happiness itself.

Keywords:

Happiness; Money; Purpose; Psychology; Subjective Well-Being

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1690

Presentation Time: Session 4: 1:30-2:30pm

Optimizing Deep Learning Models for Enhanced Detection of Subvisible Particles in Pharmaceutical Development STEM

Authors(s):

Bella Irma Schaetzle† (Agriculture|Engineering); George Panagost (Engineering); Myra Rawar Khare† (Engineering|JMHC); Anas Eyad Rafeit (Engineering)

Abstract:

Accurate classification of flow imaging microscopy (FIM) images is essential for evaluating protein therapeutic products. Pharmaceutical production of protein-based therapeutics introduces stress (e.g., thermal, shear, etc.) that can cause proteins to aggregate, increasing the risk of adverse reactions. To monitor this, samples from production are assessed using FIM, an optical microscopy technique where images are evaluated for aggregates and other particulate matter, collectively known as subvisible particles (SVPs). The integration of convolutional neural networks (CNN) to detect spatial features with existing FIM databases has demonstrated accurate automated classifications of SVPs. However, different CNN architectures yield varying outcomes with advantages that have yet to be distinguished for optimizing SVP assessment. This project aims to optimize CNN architectures for classifying multiple SVP types from FIM data. Our dataset includes normalized and processed images of protein aggregates, oil droplets, and glass particles. Our current model, built in Python using TensorFlow and Keras, has three convolutional dropout layers followed by a fully connected output layer. Our ongoing work investigates the impact of the layer arrangements for feature identification purposes and will provide further insight into enhancing the CNN for applications with various SVPs. It focuses on reproducing the published results and testing variations in layer depth, filter size, learning rate, pooling strategy, and dropout rate to improve accuracy and generalization. The outcomes of this project will guide the design of optimized CNNs for automated detection of SVPs, supporting faster and more reliable image-based analysis in pharmaceutical and experimental research settings.

Keywords:

Flow Imaging Microscopy (FIM); Convolutional Neural Networks (CNN); Subvisible Particles (SVPs); Image Analysis; Deep Learning

Mentor(s):

Brett A Meyers (Centers & Institutes); Sourav Das (Engineering); Reza Babakhani Galangashi (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1691

Presentation Time: Session 4: 1:30-2:30pm

Investigating the Role of Paraoxonase 1 Genotype in Modulating Chlorpyrifos-Induced Mitochondrial Dysfunction Relevant to Parkinson's Disease STEM

Authors(s):

Sofia Schumann† (HHS); Kishan Kumar Namburi‡ (Science)

Abstract:

Chlorpyrifos (CPF), a widely used organophosphate pesticide has been epidemiologically linked to increased Parkinson's disease (PD) risk, with exposed individuals showing elevated odds ratios (OR = 1.87; 95% CI, 1.05-3.31) for developing PD. Polymorphisms in paraoxonase 1 (PON1), a critical detoxification enzyme, further modify this risk through gene-environment interactions. Recent evidence demonstrates that CPF induces mitochondrial dysfunction, a key pathogenic feature of PD. However, there remains a gap in knowledge about how CPF modulated mitochondrial dysfunction in PON1 knockout rats.

This study investigates whether PON1 deficiency exacerbates CPF-induced mitochondrial dysfunction in liver and brain tissues of rats. We hypothesize that PON1 knockout (KO) liver and brain will exhibit greater vulnerability to mitochondrial dysfunction than wild-type (WT) tissues following CPF exposure, due to impaired detoxification capacity and increased accumulation of the toxic CPF-oxon metabolite.

Previous work from our lab, demonstrated that CPF exposure disrupts liver mitochondrial function, with dose-dependent inhibition of complexes II, II?+?III, and V. CPF reduced mitochondrial content and enzyme activity, highlighting a possible connection between liver mitochondrial dysfunction and dopaminergic neurotoxicity.

To extend these findings, we assessed mitochondrial function in liver tissue from PON1 knockout models using the same complex activity assays. Given PON1's role in organophosphate detoxification, and our prior observations of CPF-induced vulnerability in liver mitochondria, we hypothesize that PON1 deficiency may intensify mitochondrial impairment and contribute to broader neurotoxic outcomes.

Keywords:

Neuroscience; Toxicology; Neurotoxicology; KO Rat Model; Chlorpyrifos

Mentor(s):

Jason R Cannon (HHS); Reeya Tanwar (HHS); Fatema Mustafa Currim (HHS)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1692

Presentation Time: Session 4: 1:30-2:30pm

Marketing Research for Mulhaupts

Business Case Study

Authors(s):

Dominic Joseph Sciacca† (DSB); Zachary Andrew Lovell† (DSB); Tyler Arthur Verhaalen† (DSB); Deep G Patel† (DSB)

Abstract:

This project explores the marketing management issues, opportunities, and challenges facing Mulhaupts, a security and access control company based in Lafayette, Indiana. Our team identified the Mulhaupts sales floor as an area with strong potential for improvement. While the company excels in its business-to-business operations, there is an opportunity to strengthen the business-to-consumer side of the organization.

The project focuses on the customer journey from the moment a customer identifies a security need to the point of purchase to better understand how Mulhaupts can improve engagement and conversion. Research will include exploring strategies to attract new customers while retaining existing ones through an enhanced in-store experience.

By identifying key areas for improvement in customer experience, this project aims to develop strategies that increase in-store engagement, strengthen brand loyalty, and position Mulhaupts for continued growth in the consumer security market.

Keywords:

Case Study; Marketing; Strategic Management

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1693

Presentation Time: Session 4: 1:30-2:30pm

Timescale Creator Online STEM

Authors(s):

Ellis Reuben Selznick† (Engineering); Congtian Wu† (Science);
Samyukta Balaji† (Engineering); Yuanfei Song† (Science)

Abstract:

The goal of this project is to make TimeScale Creator more accessible to researchers and the public by moving it to an online environment. TimeScale Creator allows geologists to visualize and analyze data across stratigraphic, paleontologic, climatic, and geophysical frameworks. Migrating to a web-based platform removes the need for software installations or manual updates, giving users access to geophysical plotting tools directly through their browsers. While the original Java program offered extensive functionality, its technical setup and maintenance requirements created barriers for many users. The new online version, developed with TypeScript and React, preserves the core capabilities of the original software while introducing an intuitive, user-friendly interface for chart creation. It also provides a smoother online experience, allowing users to easily explore data, customize charts, and share their work across devices. Users can import regional data packages or access more than 20,000 global and regional geologic events, to build custom charts with ease. TimeScale Creator Online includes initial integrations with an MCP server that enhances data access and chart generation. Features such as GeoGPT-assisted chart creation will streamline visualization and analysis. Together, these capabilities make TimeScale Creator Online a modern, accessible platform that supports research, education, and public exploration of Earth's dynamic geologic history.

Keywords:

Geology; Visualization; User Interface; Earth History

Mentor(s):

James G Ogg (Science); Aaron C Ault (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1694

Presentation Time: Session 4: 1:30-2:30pm

Towards a 3D Finite Element Method Harmonic Balance Simulator for Superconducting Traveling-Wave Parametric Amplifiers STEM

Authors(s):

Franklin Shang† (Science); Jack Thomas Willard† (Engineering|JMHC); Ekam Bhullar† (Engineering); Tanvi Chukka† (Engineering); Xinyu Liu‡ (Engineering); Eric H Chang‡ (Engineering); Nurdaulet Aba‡ (Engineering)

Abstract:

In superconducting quantum computing, qubit states are measured by applying specially designed microwave fields. Due to the low power of these microwave signals, amplification without the addition of noise becomes a crucial step in measurement fidelity. Superconducting parametric amplifiers are often used to provide this amplification of the signals in the beginning stages since they add close to the quantum limit of noise to the signal. More recently, traveling-wave parametric amplifiers have become an active research topic for this because of their directionality and high gain-bandwidth performance. In order to design one of these, the interactions of the electromagnetic fields with the nonlinearity of device need to be modeled. To accomplish the first goal, the team is designing a finite element method solver for complex geometries to model the electromagnetic fields. To accomplish the second goal, the team is also designing a harmonic balance simulation tool that will interface with the finite element method solver. In the future these tools will be used to design a traveling-wave parametric amplifier and other complex electromagnetic structures.

Keywords:

Quantum; Microwave; Finite Element Method; Harmonic Balance

Mentor(s):

Thomas Edgar Roth (Engineering); Samuel Theodore Elkin (Engineering); Sean Sebastian Ramirez (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1695

Presentation Time: Session 4: 1:30-2:30pm

Simulating Senses: Modelling Personality-Based Perception and Decision Making in NPCs STEM

Authors(s):

Mihika Sharma† (Science); Prisha Sunil Bangera† (Science); Richard Lin† (Engineering); Monish Jonnadula† (Science|JMHC); Shrey Parikh‡ (Engineering); Chun-Yu She‡ (Engineering)

Abstract:

This project explores the concept of non-player characters (NPCs) expressing lifelike behaviors by simulating human perception and sensory processing in real-time. While traditional NPCs follow a rigid pre-scripted behavior tree, this project leverages a dynamic perception system and personality-driven decision framework to create NPCs that emulate human behavior. Using Unreal Engine, a platform for interactive 3D environments, we equip NPCs with vision and hearing systems that reference their individual preferences to interpret environmental stimuli such as auditory cues, interactable objects (Smart Objects), and other agents using Unreal Engine's Environmental Query System (EQS). Each NPC can possess a combination of user-defined and randomly generated personality traits that influence their interpretation of the world.

These traits interact with environmental conditions, allowing NPCs to respond and adapt to their surroundings. For instance, an NPC with sensitive hearing would navigate away from loud sounds. Objects such as trash cans, fountains, and seating serve as interactive focal points, giving NPCs opportunities to display dynamic decision-making patterns based on their traits and the actions of other NPCs.

Personality-based perception models can emulate behavioral realism to provide insight in interior design, urban planning, and crowd modeling. For the game design, simulation, and animation industries, this project provides a framework for generating realistic digital agents that respond in a human-like manner to their surroundings. Ultimately, our work aims to bridge the gap between current-gen NPCs—those with pre-scripted behavior—and AI-managed NPCs that behave as perceptive, personality-driven individuals in a virtual world.

Keywords:

[no keywords provided]

Mentor(s):

David Michael Barbarash (Agriculture)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1696

Presentation Time: Session 4: 1:30-2:30pm

**System on Chip Extension Technologies: Printed Circuit
Board Team LCD Interface Design for the AFTx05
STEM**

Authors(s):

Deeya J Sharma† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Weijing Sebastian Chen (Engineering); Conor James Green
(Engineering); Matthew A Swabey (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1697

Presentation Time: Session 4: 1:30-2:30pm

Data-Driven Prediction of Residual Stress in Laser-Based Additive Manufacturing Using XGBoost STEM

Authors(s):

Shlok Ashish Sheth† (Science); Anisha Bhargava† (Science); Ishan D Junnarkar† (DSB); Youngeun Kwon† (Engineering)

Abstract:

The purpose of this study is to develop a predictive data-driven framework to analyze and minimize residual stress in laser-based additive manufacturing (AM). Residual stresses formed during fabrication significantly affect part quality and dimensional accuracy, reducing the reliability of AM processes. This work employs 150 simulated thermal datasets generated through physics-based thermal modeling, each representing variations in key process parameters such as laser power, scan speed, and hatch spacing. Using XGBoost, a gradient boosting algorithm, the model learns nonlinear relationships between thermal distributions and residual stress outcomes. Regression analysis and feature importance evaluation are used to identify dominant parameters influencing stress formation. Preliminary results show that temperature gradients and scan speed have the greatest impact on residual stress prediction, with the model achieving high accuracy and low error metrics across cross-validation tests. These findings confirm the effectiveness of combining simulation data with machine learning to capture process–structure–property relationships. The developed framework will be integrated into a Streamlit-based dashboard that allows interactive visualization of predicted results and parameter optimization. Overall, this study demonstrates how data-driven modeling can enhance process control, improve reproducibility, and support intelligent decision-making for more sustainable and reliable additive manufacturing.

Keywords:

XGBoost; Regression Analysis; Cross-Validation Tests; Additive Manufacturing

Mentor(s):

Hazim Atef El Mounayri (Purdue University)

Other Acknowledgement(s):

Farshad Samadpour Samarin (Engineering)

Poster Presentation Abstract Number: 1698

Presentation Time: Session 4: 1:30-2:30pm

NanoHub sim2ls

STEM

Authors(s):

Tony Shi† (Engineering|JMHC)

Abstract:

Simulations are a very important part of the nanoHUB scientific platform. All simulations rely on the Sim2LS framework, which helps identify inputs, outputs, and the cache system used by the simulations. Our project aims to refactor this framework to make it independent of the nanoHUB platform, allowing it to be used on other systems. The project also includes improving the caching system and adding support for new input types.

Keywords:

nanoHUB; Sim2LS

Mentor(s):

Juan Carlos Verduzco Gastelum (Centers & Institutes)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1699

Presentation Time: Session 4: 1:30-2:30pm

Effects of artificial light at night and traffic noise on tadpole development and physiology STEM

Authors(s):

Jabez Soongeui Shint† (Science); Stiwar Albeiro Catano Cardeno‡

Abstract:

Urbanization transforms landscapes, exposing species to artificial light at night (ALAN) and traffic noise. These pollutants can disrupt adult morphology and physiology, yet their effects on development are less understood. Research on their combined effects remains limited, despite their frequent co-occurrence. We examined the independent effects of ALAN and the combined effects of ALAN and traffic noise on American toad (*Anaxyrus americanus*) tadpoles. Glucocorticoid (GC), measured as corticosterone (CORT), regulates immunity, inflammation, and stress resistance making it important to assess how GCs change. To simulate sensory pollution, we used playbacks of traffic noise and white light, creating a “phantom road”. To examine the effects of two common sources of light pollution, we tested two spectra of light for ALAN: “white” and “yellow”. We hypothesized that these stressors differentially disrupt development resulting in changes in tadpole morphology and physiology. Tadpoles exposed to the white light exhibited higher body weights, whereas yellow light reduced body and tail length, indicating impaired growth. Tadpoles under combined effects were comparable to those under natural conditions. Tadpoles in the control showed strong coping capacity with a stress response and recovery unlike other treatments that had reduced CORT release rates and didn't show recovery. Yellow light alone impairs tadpole growth, while white light can increase body mass without amplifying stress responses. This study provides insights for mitigation strategies in urban environments.

Keywords:

Urbanization; Artificial Light at Night (ALAN); Traffic Noise; Physiology; Morphology

Mentor(s):

Ana Maria Ospina Larrea (Science); Jonathan Lopez (Science); Caitlin Gabor (Texas State University); Ximena Bernal (Science)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1700

Presentation Time: Session 4: 1:30-2:30pm

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

Authors(s):

Diya Singh† (Science)

Abstract:

Urban environments present significant ongoing barriers to physical activity and public health, including motivational challenges, environmental constraints, uniformity of existing fitness apps, and limited opportunities for social engagement. This project proposes an AI-powered Walkability Assistant designed to promote healthier, more active lifestyles through personalized, adaptive, and community-driven solutions.

This study advances past efforts by introducing a novel wellbeing framework that encompasses four dimensions: physical, social, environmental, and psychological wellbeing. To identify user-driven strengths and areas for improvement, we conducted sentiment analysis (positive/negative) and Latent Dirichlet Allocation (LDA) topic modeling on large-scale user-generated data from walking and fitness app reviews, leveraging a custom wellbeing taxonomy to categorize users' perceptions and preferences. This layered approach revealed distinct needs and improvement areas across the four wellbeing dimensions, supporting more targeted recommendations and adaptive interventions. Ongoing open-ended survey results, informed by our framework, continue to provide rich qualitative perspectives that complement large-scale findings.

Building on these findings, the proposed prototype incorporates personalized route recommendations, real-time adaptation to environmental conditions, and gamified incentives to sustain user engagement. The Walkability Assistant is designed to decrease sedentary behavior, enhance holistic wellbeing, and foster inclusive urban communities through AI-driven, dynamically adaptive features. By synthesizing user-centered design and scalable data science, this project makes a substantive contribution to public health and sustainable urban communities.

Keywords:

Artificial Intelligence; Walkability; Public Health; Urban Mobility; User-Centered Design

Mentor(s):

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1701

Presentation Time: Session 4: 1:30-2:30pm

Nest: A custom GPU software library and benchmark for the in-development Cardinal gpGPU STEM

Authors(s):

Tushar Singh† (Engineering|JMHC); Aiden Hughes Sexton† (Engineering); Erhao Chen† (Engineering); Aidan Michael McDonough† (Engineering)

Abstract:

Existing general-purpose Graphics Processor Unit (gpGPU) benchmarks are all written using popular frameworks, namely OpenGL and CUDA; However, these frameworks assume a complex compiler for the GPU and do not work on in-development hardware such as the Cardinal—a gpGPU being developed by our SoCET subteam—that will not be able to run prior benchmarks such as Rodinia. To solve the lack of a compatible benchmark, we are implementing a custom computer graphics library and standard benchmark programs including a rotating cube with textures on each face which will allow the hardware developers to analyze performance on a real workload without the need for any existing graphics' tool support. Upon completion, the runtime, hardware utilization, memory bandwidth, and other performance metrics will be measured and used to inform decisions to improve the hardware capability to perform a real graphics workload. The library and benchmark will only be compatible with the new compiler developed for the Cardinal, meaning the new library will not provide valid comparisons with other existing gpGPUs that cannot run our custom library. Future plans include determining the viability of porting OpenCL to the Cardinal and determining what additional hardware and software requirements are required to do this, including hardware functional units and a redesign of the code compiler using LLVM. This will enable existing benchmark suites to be run, and comparisons against other architectures to be performed.

Keywords:

GPU; Software; Graphics Library; Benchmark

Mentor(s):

William Rowan Cunningham (Engineering); Mark Johnson (Engineering); Fan Jing Hoon (Engineering); Sooraj Chetput Venkataraghavan (Engineering)

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

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1702

Presentation Time: Session 4: 1:30-2:30pm

Influence of QLCS Merger Types on the Frequency and Timing of Tornado Production STEM

Authors(s):

Maliyah Ann Smith† (Science)

Abstract:

Accurate and timely forecasting of a tornado in a quasi-linear convective system (QLCS) is a known forecasting challenge. Many studies aim to find identifiable precursors to tornadogenesis by discerning specific characteristics of a QLCS prior to tornado production. The objective of this study is to determine the type of merger interactions in a QLCS and ascertain if there is any association with the timing of tornadogenesis across its lifespan.

The lifespan of each system is defined by 3 hours before (after) the first (last) storm merger in which one of the storms exhibits greater than 50 dBZ (denoted t_{-0} and t_{-1} respectively). Storm tracks from 2010 - 2023 were obtained from the GridRad-Severe dataset. Storm merger pairs and systems were identified and assigned based on their relative spatial and temporal locations. Tornado counts for each system were found and added using the Storm Prediction Center database archives. Results showed systems with single cell - MCS mergers had a median t_{-tor} of $t_{-0.43}$. Systems with MCS - MCS mergers had a median t_{-tor} of $t_{-0.379}$. In contrast, systems with multicell - MCS mergers had a median t_{-tor} of $t_{-0.37}$. Lastly, systems with mixed mergers had a median t_{-tor} of $t_{-0.47}$.

Using the Kruskal-Wallis test, a statistically significant difference in tornado timing was found for at least one of the four system types. The implications of these results may aid in forecasting when an ongoing system could produce a tornado, and in turn, lead to increased tornado warning times for QLCS tornadoes.

Keywords:

Meteorology; Atmospheric Science; EAPS; Severe Storms; Tornado

Mentor(s):

Robin L Tanamachi (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1703

Presentation Time: Session 4: 1:30-2:30pm

**The Impact of Greek Life Involvement on Student Mental
Health**

Humanities

Authors(s):

Brooke Mia Spindler† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Michael Douglas Johnson (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1704

Presentation Time: Session 4: 1:30-2:30pm

Datacenter Network Accelerator : NIC - Transport Header Processing STEM

Authors(s):

Maxwell Christophe Sprague† (Engineering); Branden Woojin Cho† (Engineering); David Kim† (Engineering); Wilson Wong* (Engineering|Graduate)

Abstract:

Data centers derive significant overhead from data operations between servers in the forms of data transfers, copying, and more. Currently, data center servers handle remote data operations using their own CPUs, causing bottlenecks due to limited resources. Specifically, datacenter servers do not have a way to transfer data between servers while still utilizing their CPUs to do useful work. Our subteam aims to bypass interaction from a remote CPU by offloading data operations to a Smart NIC (Network Interface Card). Our team handles parsing and generating the BTH (Base Transport Header), RETH (RDMA Extended Transport Header), and AETH (Acknowledgement Extended Transport Header) layers of the network packets that communicate with other Smart NICs across the network. This will be accomplished using several hardware modules that aim to accomplish two tasks: stripping the network packets to obtain metadata before sending formulated requests to the StRoM (Smart Remote Memory) kernels, and generating/packaging data requests through the RoCEv2 (RDMA over Converged Ethernet) protocol. We emphasize reliability to ensure that the kernels receive accurate requests with reliable data and that outgoing requests similarly have the requisite parameters for proper processing. A limitation we expect to encounter is generalizability, because our first priority is achieving functionality within a controlled environment before expanding to work in any datacenter. This technology has potential to improve the performance of infrastructure that currently supports many trending technological focuses, such as AI, which uses datacenters to send and receive great quantities of training data.

Keywords:

[no keywords provided]

Mentor(s):

Rishikesh Reddy Bathina (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1705

Presentation Time: Session 4: 1:30-2:30pm

Dual-Acting Small Molecules Targeting Alpha-Synuclein Aggregation and Soluble Epoxide Hydrolase for Parkinson's Disease STEM

Authors(s):

Lydia Jane Stoner† (Science|JMHC); Natalie Grace Horgan* (Pharmacy|JMHC)

Abstract:

Neurodegenerative diseases such as Parkinson's disease (PD) are thought to be driven by two key pathological processes: protein misfolding and neuroinflammation. PD cases are projected to double by 2040, with an estimated 1.1 million current cases in the US. Although PD is multifactorial in origin, intracellular and post-synaptic accumulation of misfolded proteins such as alpha-synuclein (α -syn) contribute to nerve function disruption. Therefore, inhibition of alpha-synuclein aggregation via small molecule disruptors of oligomer and fibril formation is a promising method of treating PD. Previous research by our group has laid foundation for aggregation-only scaffolds by similarly synthesizing amide, triazine, triazole or urea derivatives that reduced alpha-synuclein and tau fibrils while exhibiting physicochemical properties consistent with Central Nervous System (CNS) drugs.

This project aims to identify and characterize small molecules with dual activity against both mechanisms by inhibition of alpha-syn aggregation and soluble epoxide hydrolase (sEH), an important enzyme involved in neuroinflammation. Sixteen compounds featuring triazole scaffolds were synthesized and evaluated using fluorescence assays: Thioflavin T assays quantified fibril formation, and sEH inhibitor screening assays assessed anti-inflammatory activity. Top performing molecular candidates demonstrated <20% alpha-synuclein fibril formation alongside >85% sEH inhibition, indicating strong dual activity.

The anti-aggregation activity of six best compounds was confirmed with transmission electron microscopy and advanced cell-based assays. One compound inhibited both alpha-syn aggregation and sEH enzymatic activity. This work highlights the therapeutic promise of triazole-based small molecule scaffolds and aims to discover therapeutically relevant molecules capable of mitigating neurodegenerative progression by targeting both aggregation and inflammation pathways.

Keywords:

Alpha-Synuclein Aggregation; Soluble Epoxide Hydrolase (sEH); Dual-Acting Inhibitors; Neurodegenerative Disease; Small Molecule Synthesis

Mentor(s):

Jessica Sonia Fortin (Vet Med)

Other Acknowledgement(s):

Taiwo Ademola Ademoye (Interdisciplinary & Special Programs)

Poster Presentation Abstract Number: 1706

Presentation Time: Session 4: 1:30-2:30pm

Pokémon AI Adventure
STEM

Authors(s):

Evan Michael Stonestreet† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Zihan Li (ETH Zürich)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1707

Presentation Time: Session 4: 1:30-2:30pm

Rebranding of the Country Mansion Case Study

Business Case Study

Authors(s):

Elle Miriah Stowers† (DSB); Sydney Jo Muller† (DSB); Emma Grace Day† (DSB); Emma Grace Dodson† (DSB); Alexandra Mae Hildreth† (DSB); Aubrey Janell Kennelly‡ (DSB)

Abstract:

Our team collaborated with The Country Mansion, a historic event venue managed by Carson Woods, to analyze consumer behavior challenges and identify strategies for rebranding. Although the property offers a beautiful and versatile space for weddings, corporate events, and celebrations, it currently lacks a strong digital presence. In today's market, consumers rely heavily on websites, social media, and online reviews when selecting event venues. Without a cohesive online strategy, The Country Mansion risks being overlooked by potential clients.

Through our research, we aim to provide actionable insights that will strengthen the Mansion's brand identity and align it with modern consumer expectations. Our objectives include assessing online engagement trends, evaluating competitor branding, and developing recommendations for a website redesign and social media strategy. The final deliverables will include a research report, rebranding recommendations, and sample digital marketing materials.

By bridging immediate marketing needs with the owner's long-term vision of transforming the Country Mansion into an all-inclusive destination, our project seeks to enhance consumer perception, attract new clientele, and position the property for sustainable growth within the regional event space market.

Keywords:

Case Study; Country Mansion; Carson Woods; Marketing; Rebranding

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1708

Presentation Time: Session 4: 1:30-2:30pm

Higgs Boson vs Background Signal Machine Learning STEM

Authors(s):

Jonathan Maxwell Sutjandra† (Science); Andrew Christopher Nilsson† (Science); Asrar UI Haq Asrar UI Haq† (Engineering)

Abstract:

The discovery of the Higgs boson using the Compact Muon Solenoid (CMS) at the Large Hadron Collider (LHC) was a revolutionary step in the field of high energy particle physics. Our project applies machine learning methods using PyTorch to identify Higgs boson events within particle collision data that is provided by the CMS. This project is expected to be built on foundational exercises in modeling and gradient descent. We then extend these concepts to train a neural network capable of distinguishing Higgs boson signals from background noise. The model is expected to be trained on kinematic variables that describe particle interactions and is optimized by PyTorch's automatic differentiation and loss modules. We emphasize proper data handling, reproducibility, and model evaluation as part of our responsible data stewardship. By applying these techniques, we aim to improve accuracy of classification in high-energy physics datasets. We expect to separate the Higgs Boson signal from background noise. We present progress toward isolating the Higgs boson signal and a hypothesized outcome for if we had been successful.

Keywords:

[no keywords provided]

Mentor(s):

Andy Jung (Science); Heather Nicole Martin (Science); Santosh Bhandari (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1709

Presentation Time: Session 4: 1:30-2:30pm

Thermotolerance Testing for *N. Fowleri* Amoeba (Nf69)

STEM

Authors(s):

Jeeya Vijay Thukral† (Pharmacy)

Abstract:

Naegleria fowleri is a free-living amoeba that causes Primary Amoebic Meningoencephalitis (PAM). Transmission occurs through contaminated water entering the nasal passage, where amoeba migrates up the olfactory nerve, across the cribriform plate and into the brain. Due to the rapid progression of infection and poor efficacy and penetration of drugs into the central nervous system (CNS), this disease has a fatality rate of >98%. Current treatments are not effective and high dosages of antifungals/antiparasitics/antibacterials leads to toxic side effects in the patient. The purpose of this study is to discover if *Naegleria fowleri* is thermotolerant, capable of surviving across a wide range of temperatures, rather than strictly thermophilic as current studies claim. *N. fowleri* (Nf69) trophozoites were exposed to a temperature range (40–65 °C) over different time intervals (30 seconds to 120 minutes) to determine survivability. Results show that as time and temperature increases, there is increased growth inhibition, indicating the Nf69 is thermotolerant at the tested temperature range of (40–65 °C). A subsequent experiment examined longer exposure periods (24–72 hours) at lower temperatures (30–40°C) to evaluate whether *N. fowleri* maintains thermotolerance under extended conditions. As time and temperature increases, it is hypothesized that there is increased growth inhibition, indicating Nf69 is thermotolerant at the temperature range of (30–40°C). Understanding thermotolerance and persistence can assist with predicting and modeling growth patterns of these pathogens. This allows for selective and targeted warnings of not swimming to specific populations or locations, potentially avoiding more deaths from PAM.

Keywords:

Amoeba; Thermotolerance; PAM; Persistence; Time

Mentor(s):

Christopher Aaron Rice (Vet Med); Chayan Sharma (Vet Med);
Chenyang Lu (Vet Med)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1710

Presentation Time: Session 4: 1:30-2:30pm

Facilitating space exploration through the creation of a humanoid robot able to perform complex tasks under the harsh conditions of space and other planets.

STEM

Authors(s):

Quinn Robert Traast† (Engineering); Gabriel Duarte Rengifo† (Engineering); Elvin Xuyang Li† (Engineering); Arya Bhangalet† (Engineering); Pranjal Bhatia‡ (Engineering); Charlotte Eva Regnier‡ (Engineering); Lavanya Sridhar‡ (Engineering); Henry David Pham‡ (Engineering); Madhav Amit Arora‡ (Polytechnic); Drish Jaykishan Shah‡ (Polytechnic)

Abstract:

This research focuses on developing precise hand and arm mechanisms for a humanoid robot capable of performing complex tasks, aiding astronauts in space exploration. The goal is to design an arm that allows for the attachment of various customizable end effectors or hands. Our current process includes a prototype of a complete arm with 6 degrees of freedom (DOF) from the shoulder to the forearm, along with a 3-DOF wrist that allows the attachment of numerous customizable end effectors. Currently, we are prototyping various types of end effectors for collecting samples, gripping, cutting, drilling, and other applications. The next phase of our project is to create and manufacture an aluminum version of the entire arm, wrist, and hand system. This will enable us to test our design in real-world scenarios that would simulate low and zero gravity environments, as well as rough and rocky terrain, and begin to gather data for programming and operation. Our findings aim to contribute to the understanding of how humanoid robots can aid in space exploration through performing complex tasks that support astronauts' research and the aerospace industry.

Keywords:

Degrees of Freedom (DOF); End Effectors

Mentor(s):

Jaeeun Kim (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1711

Presentation Time: Session 4: 1:30-2:30pm

**Effective Methodology for Great Pacific Garbage Patch Clean
Up**
Humanities

Authors(s):

Miles Alexander Travist† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1712

Presentation Time: Session 4: 1:30-2:30pm

**Matching Methods for On-demand Transportation Services
STEM**

Authors(s):

Shou-Fu Tseng† (Science)

Abstract:

This study aims to review matching algorithms utilized in on-demand transportation platforms (e.g., ride-hailing, food/grocery/parcel delivery services, microtransit, etc). It will conduct a comparative analysis of various methods, evaluating their respective advantages and disadvantages. Based on this analysis, the study will propose a framework to guide the application of these algorithms, specifying the optimal contexts and conditions for their use.

Keywords:

Matching Method; Machine Learning; Optimization; On-Demand Transportation

Mentor(s):

Tho Le (Polytechnic)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1713

Presentation Time: Session 4: 1:30-2:30pm

Algorithm Optimaztion for Anaysing Star Clusters using Color-Magnitude Diagrams STEM

Authors(s):

devyani tyagi† (Science)

Abstract:

The project focuses on optimizing an algorithm used to generate color–magnitude diagrams (CMDs) for optical data of various star clusters and categorize them based on their stellar properties. The CMDs serve as essential tools for estimating the relative ages of clusters. Originally developed as an educational initiative, this project aims to make astrophysics more accessible to high school and early college students. The optimization effort expands the algorithm’s capability to handle not only open clusters but also globular clusters. In the study, the globular clusters M5 and M13 are analyzed using CMDs produced by the improved algorithm. Based on the CMD analysis, M5 is determined to be older than M13.

Keywords:

Star Clusters; Algorithm Optimization; Globular Clusters; Stellar Evolution; Astrophysics Education

Mentor(s):

Andy Jung (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1714

Presentation Time: Session 4: 1:30-2:30pm

Development and Preliminary Characterization of a Robotic WAAM Platform for Metal Additive Manufacturing STEM

Authors(s):

Bruno Marcelo Uribe Velazquez† (Engineering)

Abstract:

Wire Arc Additive Manufacturing (WAAM) offers a cost-effective approach for manufacturing large and complex metallic components with high deposition rates. However, achieving consistent bead shape, uniformity and quality microstructure remains a major challenge when using a commercial welding power source, due to the interaction between welding parameters, robot motion, and thermal effects, as well as the limited customization of welding settings. This project focuses on the development of a WAAM platform using a Fanuc Arc Mate 120iC robot integrated with a Lincoln Power Wave i400 power source and a Lincoln AutoDrive 4R220 wire feeder to control metal deposition. A preliminary Design of Experiments (DOE) has been formulated to characterize bead geometry under varying process parameters, including voltage, wire feed speed, travel speed, and contact-tip-to-work distance. Preliminary single-bead tests are being conducted to validate system functionality and to characterize the influence of parameter changes on bead shape and uniformity. Future work will extend these studies to multilayer printing and non-planar deposition strategies aimed at improving structural quality and geometric accuracy in WAAM-manufactured components. In addition, a physics-based simulation framework will be developed to predict residual stresses and deformation resulting from the highly transient non-isothermal manufacturing process.

Keywords:

WAAM; Metal Additive Manufacturing; 3D Printing; Robot

Mentor(s):

Eduardo Barocio Vaca (Engineering); Garam Kim (Polytechnic); Raul Hector Fuentes Hernandez (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1715

Presentation Time: Session 4: 1:30-2:30pm

Augmented Reality Display System for Go-Karts STEM

Authors(s):

Shreya Veerredhi† (Engineering); Caleb Michael Diekmann‡
(Engineering)

Abstract:

This project develops an integrated augmented reality (AR) heads-up display system for electric go-karts using Meta Quest Pro devices. The system provides real-time vehicle telemetry to drivers without compromising visibility or situational awareness during operation, addressing the challenge of monitoring vehicle performance while maintaining focus on the track.

The technical implementation comprises three interconnected subsystems: a Controller Area Network (CAN) bus interface for data acquisition from the motor controller, a Bluetooth wireless communication layer for telemetry transmission, and an AR visualization environment for intuitive information presentation. Critical technical challenges include ensuring reliable wireless data transmission in dynamic racing environments, managing bandwidth and latency constraints for real-time streaming, and establishing compatibility between sensor data formats and AR rendering pipelines.

Keywords:

[no keywords provided]

Mentor(s):

Steven R Dunlop (DSB); Saanvi Singh (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1716

Presentation Time: Session 4: 1:30-2:30pm

Purdue VIP: Windracers Autopilot Integration and High-Fidelity Simulation for Lightweight Unmanned Fixed-Wing Aircraft STEM

Authors(s):

William Falk Wahlberg† (Engineering); Dominic Henry Mazurek† (Engineering); Lillian Ji† (Engineering); Braden Thomas Callaway† (Engineering)

Abstract:

This research focuses on the development and testing of autopilot systems for lightweight unmanned fixed-wing aircraft within a controlled environment, utilizing the Purdue University PURT motion capture facility. The broader project involves the creation of a simple, off-the-shelf airframe, replicating the characteristics of the Windracers fixed-wing aircraft and featuring an active LED marker board for the identification of multiple units. Within this framework, the core contribution of this work is the development of a high-fidelity simulation environment to serve as the primary platform for autopilot development and testing.

The simulation sub team's work centers on utilizing ROS 2 and Gazebo to create a dynamic and accurate digital model of the aircraft. A critical innovation of this approach is the direct integration of empirical data gathered from physical flight tests within the PURT facility. The precise motion capture data from PURT is used to parameterize and validate the simulation's flight dynamics, ensuring the model faithfully replicates the real-world aircraft's behavior and response to control inputs.

This correlated simulation-testing pipeline enables the comprehensive evaluation of navigation and control algorithms under a vast range of simulated conditions. By leveraging the validated simulation, our team can rapidly prototype and de-risk autopilot software with a high degree of confidence before proceeding to physical flight tests. This method significantly accelerates the development cycle and enhances overall system robustness.

The integration of this high-fidelity simulation, grounded directly in real-world flight data, provides a powerful and scalable platform for advancing

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

autonomous capabilities. The results of this research contribute not only to the specific aircraft platform but also to the broader methodology of developing unmanned aerial systems, with potential applications in surveillance, monitoring, and data collection in challenging environments.

Keywords:

[no keywords provided]

Mentor(s):

James Michael Goppert (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1717

Presentation Time: Session 4: 1:30-2:30pm

Fish Oil Increases Plasma Eicosapentaenoic, Docosapentaenoic, and Docosahexaenoic Fatty Acid Concentration in Thoroughbreds STEM

Authors(s):

Emory Lane Ciula Walkert† (Science); Tara Kathleen Kester* (Science)

Abstract:

The goal of this study was to evaluate the effect that omega-3 polyunsaturated fatty acid supplementation with fish oil has on a variety of fatty acid lipid levels in the plasma of Thoroughbred racehorses. Blood samples were collected from horses at four racetracks across the United States: Santa Anita Park in California; Gulf Stream Park in Florida; Ruidoso Downs in New Mexico; and Horseshoe Indianapolis in Indiana. At each site, horses were randomly divided into two cohorts. Using a double-blind experimental design, one cohort received fish oil supplements daily for 4 weeks, while the control group received corn oil as a placebo. Blood samples were collected from each horse at baseline and after 4 weeks of supplementation. Plasma was stored at -80°C until analysis. Fatty acid levels were quantified using liquid chromatography-mass spectrometry. Results indicated a significant increase in Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA) in the fish oil-supplemented group. Although not statistically significant, an increase in Docosapentaenoic acid (DPA) levels was observed for the group taking fish oil. These findings suggest that the racing industry may wish to consider the use of fish oil supplementation to elevate DHA, DPA, and EPA fatty acid levels in horses. Because these compounds play a key role in regulating immune function and inflammatory responses, supplementation could present a practical and cost-effective strategy to support respiratory health and enhance overall performance in racehorses.

Keywords:

Racehorses; Fish Oil; Fatty Acids; Respiratory Inflammation; Immune System

Mentor(s):

Kathleen M Ivester (Vet Med); Laurent L Couetil (Vet Med)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1718

Presentation Time: Session 4: 1:30-2:30pm

Predicting Student Academic Stress for Early Intervention Business Case Study

Authors(s):

Jari L Warnert† (DSB); Arush Sowreddy Medam† (DSB); Ansh Pahwa† (DSB); Destinee Walker† (DSB|JMHC)

Abstract:

What factors most accurately predict individual students' academic stress levels? We aim to predict individual students' academic stress so universities can intervene early and effectively, while identifying which factors explain the most variation in students' stress levels and how accurately a student's stress index can be predicted from these factors.

We will use the Student Academic Stress — Real World Dataset (Kaggle, by poushal02). Each row represents a student's responses on predictors such as peer pressure, study environment, and academic stage. The observed stress index is concentrated in the moderate-to-high range (levels 3–5), with level 4 most common, indicating that stress is widespread in this sample. The cohort is undergraduate-heavy, so results will generalize most strongly to that population. Study environments are nearly evenly split between peaceful and non-peaceful settings, suggesting that environment may play a central role in stress differences. Coping strategies are dominated by problem-focused approaches, with fewer students reporting emotional breakdowns or social support; peer-pressure ratings cluster around the middle, peaking at level 3.

We will start with multiple linear regression as the baseline to quantify main effects. Depending on diagnostics, we will expand carefully to more flexible options as needed, adding interaction or nonlinear terms and considering a tree-based model to capture complex relationships. Model quality will be judged with k-fold cross-validated RMSE, MAE, and R^2 to balance accuracy and interpretability.

We will deliver a validated, interpretable stress-score predictor; a ranked set of influential factors showing how pressure, environment, and habits relate to stress; and a compact, reproducible feature set that guides proactive student support.

Keywords:

Prevention; Stress; Intervention; Students; Well-Being

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

Mentor(s):

Davi Cordeiro Moreira (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1719

Presentation Time: Session 4: 1:30-2:30pm

Seeing Green: Targeted Sports Advertisements affecting college students

Humanities

Authors(s):

Katherine Mae Wengert† (HHS)

Abstract:

Online sports betting used to be illegal seven years ago. Now, you can place a bet anytime, anywhere, and on any sport. With skyrocketing popularity, advertisements have become more prevalent, especially targeting college-aged individuals. Many colleges have embraced online betting platforms, which have enabled promotion to college students “on campus, in athletic venues and, in some cases, directly in students’ email inboxes” (Claybourn). College campuses are an attractive source of advertising because college students are riskier with their money and view betting as a leisure and social activity (Dannemiller). In this exploratory research project, I use a literature review and primary sources to showcase why Sportsbooks should limit their advertising during games and diminish targeted advertising. This research highlights the importance of restricting advertisements to make betting safer for students. Advertisements should be restricted to protect students from developing habits that can lead to addiction. When students see betting commercials, it reminds them to place another bet, which can lead to risky behavior. People who do not participate in sports betting should be aware of the addictive qualities of sports betting because they most likely know someone who is being affected. Live betting raises financial concerns, and without a limit imposed on targeted advertisements, we may see an increase in depression, anxiety and other issues.

Claybourn, Cole. “Sports Betting on College Campuses: What to Know | Best Colleges | U.S. News.” Sports Betting on College Campuses: What to Know, 18 Apr. 2023, www.usnews.com/education/best-colleges/articles/sports-betting-on-college-campuses-what-to-know.

Dannemiller, Steve, et al. "Sports Betting on College Campuses in America". Sage Business Cases. London: SAGE Publications, Inc., 2025. 30 Oct 2025, doi: <https://doi.org/10.4135/9781071986813>.

Keywords:

[no keywords provided]

Mentor(s):

Jessica M Mercado (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1720

Presentation Time: Session 4: 1:30-2:30pm

Developing a Conductive Hydrogel Platform for Galvanic Skin Response and a Non-Enzymatic Sweat Analysis for Stress and Cognitive Workload

STEM

Authors(s):

Madelyn Erin Wurzel† (Engineering)

Abstract:

Wireless and self-powered skin-integrated sensors are transforming how physiological parameters are monitored in real time, particularly for cognitive workload modeling in high-stress environments. Cognitive workload is closely linked to autonomic nervous system activity, which regulates physiological response such as sweating, heart rate, and skin conductivity. As a result, Galvanic Skin Response (GSR) and changes in sweat metabolite concentrations serve as key indicators of cognitive workload, reflecting sympathetic nervous system activation. Current state-of-the-art wearable sensors employ enzymatic biofuel cells that use enzymes as catalysts and binding sites for electrochemical sensing of metabolites in sweat. While effective, these enzyme-based devices suffer from instability and short lifespans due to enzymatic degradation and environmental sensitivity. In this work, we propose a conductive hydrogel platform that integrates conductive polymers to enable enzyme-free electrochemical sensing. The device should demonstrate a prolonged functional lifespan compared to traditional biofuel cell-based systems. Moreover, the hydrogel's flexibility and biocompatibility support seamless skin-integration for real-time cognitive workload monitoring. By leveraging polymer-based electrochemistry, this approach advances the field of wearable bioelectronics towards more reusable and sustainable cognitive monitoring devices. Ultimately, this work contributes to the betterment of cognitive performance assessment tools with applications in healthcare, occupational safety, and many additional high-stress environments.

Keywords:

[no keywords provided]

Mentor(s):

Wenzhuo Wu (Engineering); Nachiket Vatar (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1721

Presentation Time: Session 4: 1:30-2:30pm

Embedded hardware design for wearable ultrasound electronics **STEM**

Authors(s):

Hening Xu† (Engineering)

Abstract:

Conventional ultrasound systems are not self-contained and require manual probe handling by a trained operator, so they cannot follow patients through movement or daily life. Many conditions such as hypertension, heart failure and emerging paradigms in personalized care (digital health/digital twins), need continuous, hands-free monitoring of deep tissues, which current tools rarely provide outside clinics. Wearable ultrasound aims to fill this gap by keeping a stable acoustic interface while people move, and by streaming data for automatic analysis.

This research focus on a fully integrated, wearable ultrasound platform that couples a flexible analog front-end module with a wireless data-acquisition module. The analog front-end module includes a high-voltage pulse generator, T/R switching, low-noise amplification with time-gain control, and channel multiplexing to drive and receive from miniature transducers. The wireless data-acquisition module hosts a low-power MCU/ADC chain for synchronized sampling and on-board control, a 3.3-V power subsystem, and an ESP32 Wi-Fi link for real-time data streaming. Both modules are implemented on thin fPCBs connected by a serpentine hinge, enabling conformal wear while maintaining signal integrity; the combined footprint is $\sim 3 \times 3 - 4 \times 3$ cm with an assembled thickness < 2 mm.

Keywords:

Wearable Ultrasound; Flexible Electronics; Wireless Data Acquisition; Real-Time Physiological Monitoring

Mentor(s):

Robert Jose Ccorahua santo (Engineering); Wenzhuo Wu (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1722

Presentation Time: Session 4: 1:30-2:30pm

Engineering Topological Edge Modes in One-Dimensional Split Ring Resonator Chain STEM

Authors(s):

Haoyuan Yang† (Engineering); Ireoluwatomiwa David Salako‡ (Science)

Abstract:

The purpose of this study is to analyze the engineered topological band-gap dispersion and the energy spectrum distribution via Split-Ring Resonator (SRR) setup, in a dimer construction described by the Su-Schrieffer-Heeger (SSH) model. Each unit cell comprises two SRRs with tunable intra- and inter-cell couplings, J_1 and J_2 , controlled by geometry (gap, rotation, and spacing). Using Ansys HFSS and a combination of Python libraries, we compute Bloch eigenmodes to obtain dispersion relations and band-gap evolution, and we run driven simulations of finite chains to measure S-parameters and near-field profiles. Coupling coefficients are retrieved by fitting simulated spectra to a nearest-neighbor tight-binding model, yielding a geometry-to-coupling design map. We demonstrate bulk-boundary correspondence by contrasting trivial and topological terminations and by realizing an interface state between phases. Robustness is quantified via disorder studies: off-diagonal (coupling) disorder preserves a mid-gap, edge-localized resonance with a high inverse participation ratio, while diagonal (on-site) detuning degrades localization. The deliverable for this study should reveal the topological setup difference versus the trivial setup and quantify the topological transition between coupling ratios, with clear visual evidence of engineered topological dispersion and edge localization in reciprocal SRR chains, along with practical guidelines for metamaterial design.

Keywords:

Topological Photonics; Photonics; Engineered Waveguide

Mentor(s):

Jason Dwight McKinney (Engineering); Vivek vasantrao Wankhade (Engineering); Alex Ruichao Ma (Science)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1723

Presentation Time: Session 4: 1:30-2:30pm

Transmitter

STEM

Authors(s):

Jhih-Chen Yang† (Engineering); Bo-Wei Hsieh† (Engineering)

Abstract:

As advanced chiplet systems demand higher interconnect bandwidth and signal integrity, conventional SerDes architectures face increasing challenges from timing skew, jitter, and impedance mismatch. This project presents the design and integration of a low-latency Serializer, MUX-based Retimer, and digitally calibrated Source-Series-Terminated (SST) Driver in a 45-nm CMOS process for on-package chiplet communication.

The front-end Serializer converts wide parallel data (e.g., 32 bits) into a narrower time-interleaved stream (e.g., 4 bits) using four phase-shifted clocks (0°, 90°, 180°, 270°), achieving higher throughput per I/O lane. A MUX-based Retimer follows, selecting between phase-aligned data replicas generated through a high-impedance inverter delay chain and buffer network. Its glitch-free 4:1 phase multiplexer realigns data with minimal latency, avoiding metastability typical in flip-flop retimers.

The downstream SST driver implements digitally controlled trimming resistors and current-mirror biasing to achieve fine-tunable output impedance (30–70 Ω), ensuring proper line termination and minimal reflection. Together, the modules form a robust, low-power TX subsystem capable of delivering clean, high-speed signals across on-package interconnects. Simulation results validate correct serialization, improved eye diagram quality, and impedance stability across process, voltage, and temperature corners.

This work demonstrates a fully integrated and calibration-aware TX front-end suitable for chiplet-based SerDes and future scalable die-to-die interconnect architectures.

Keywords:

Serializer; Retimer; SST Driver; Chiplet Interconnect; SerDes

Mentor(s):

Seyedehmarzieh Rouhani (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1724

Presentation Time: Session 4: 1:30-2:30pm

AI on Trials: Balancing Ethics and Technology

Humanities

Authors(s):

Rinyoung Yoo† (Education|JMHC)

Abstract:

Growing AI technology has impacted almost every corner of our lives. There are some areas where AI is definitely helpful, but there are still areas where AI usage should be questioned. The issue I focus upon is utilizing AI in legal processes, specifically in trials. Many law firms and attorneys are already using AI tools to speed up their routined tasks, and judges are referring to AI risk assessment tools to help with criminal sentencing (Angwin et al, n.p.). As the extent of AI usage increases, challenging ethical questions will arise. For instance, the problem with biased outcomes from algorithms which were learned from historically biased data. In this exploratory research project, I explored various aspects of AI usage in different legal processes, its benefits and drawbacks, and concerning ethical issues that follow. To better understand this issue, I conducted research through multiple scholarly articles and publicly available data, and examined each authors' perspectives toward the issue and their evidence. This research will provide a general overview of the current situations of AI implementation in legal fields including its technical problems and advantages. Ultimately, this research will suggest that to maximize AI's efficiency, clear regulations for transparency, data security, and human oversight should be adopted, so that AI technology can improve justice rather than endangering it.

Keywords:

AI; Artificial Intelligence; Legal Decision Making; Ethics; Technology

Mentor(s):

Carla B Rosell (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1725

Presentation Time: Session 4: 1:30-2:30pm

Global Circuit Solutions: Interconnects

STEM

Authors(s):

Mingrui Yuan† (Engineering); Mohamed Aboelyazed† (Engineering); Qi Zhang† (Engineering)

Abstract:

Modern AI and embedded chips need fast, low-power on-chip data movement. Prior work often focuses on a single topology and reports results without full physical-design constraints, leaving practical trade-offs underexplored.

We are implementing two independent interconnect designs on a TSMC180 nm process: (1) an 32×32 Benes network for high-bandwidth data paths, and (2) an AHB multi-master system bus. We are implementing an improved crossbar structure in Virtuoso and testbenching it with our self-developed random number generator as input. Our goal is to keep the area as low as possible while operating with low latency and low power. Each design is developed end-to-end in Cadence—from schematics and verification to layout with DRC/LVS—and evaluated with pre-/post-layout simulations.

The outcome by the end of our project will be the development of two validated, ready-to-integrate interconnect blocks that can be integrated into SoCET's SoC Tapeouts.

Keywords:

[no keywords provided]

Mentor(s):

Abinands Ramshanker (Engineering)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1726

Presentation Time: Session 4: 1:30-2:30pm

AMP: Independent Wheel and Motor Control Integration Sub-Team Fall 2025 STEM

Authors(s):

David Michael Yuhas† (Engineering); Griffin Xander Kanzeg† (Engineering); Ibrahim Shahid† (Engineering); Marco Alexander Wilson† (Engineering); Pedro Andres De Jesus Velez‡ (Engineering); Kyle Junzhe Wang‡ (Engineering)

Abstract:

This project explores the integration of Permanent-Magnet AC Synchronous Motors into the current Autonomous Motorsports Purdue (AMP) team's self-driving go-kart. AMP's kart utilizes a standard "sprint kart chassis" fitted with an entirely electric drivetrain and "bang-bang" controls algorithm, which are specs that adhere to the most recent 2024 rulebook of the Autonomous Karting Series (AKS). However, after reviewing the details of the physical kart, we determined there are three key areas of the current model that could possibly be changed or improved: fixed rear axle and lack of differential, chain drive propulsion, and controls algorithm. We concluded that developing and implementing an independent wheel and motor control system is a solution that would result in overall improved performance, which will be achieved by using Permanent-Magnet AC Synchronous Motors for each of the four wheels. Furthermore, research into this solution will guide our decision to integrate motors either into wheel hubs or onto the chassis, which are both present and developing technologies in the electric vehicle industry. It must be recognized that our plan does not coincide with AKS regulations, though we do believe that by researching this topic, it will allow us to expand the avenues that AMP or AKS could explore in the future, as well as grow our own knowledge of autonomous and electric vehicles.

Keywords:

Autonomous Go-Kart; Vehicle Dynamics; Controls; Electric Go-Kart; Vehicle Design

Mentor(s):

Samuel Labi (Engineering); Andres Felipe Hoyos Moreno (Engineering); Richard Osita Ajagu (Engineering)

Other Acknowledgement(s):

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

Poster Presentation Abstract Number: 1727

Presentation Time: Session 4: 1:30-2:30pm

Purdue Local Business Marketing Research Strategies Business Case Study

Authors(s):

Ashley Zachor† (DSB); Taotianchen Wan† (DSB); Erika Marie Graft (DSB); Claire Marie Campbell† (DSB)

Abstract:

This work investigates strategies to enhance customer engagement and drive sustainable growth for Wildcat Creek Winery. The primary objective is to clearly define the winery's target market and understand the key factors—such as perceived value, social experience, and exclusive access—that influence the behavior of its distinct customer segments, including local families, regulars, and travelers. The research process involves segmenting these audiences and conducting a comparative analysis of sales data, review sentiments, and partnership opportunities. This approach will uncover the unique motivations and behavioral patterns of each group, from value-seeking families attracted by affordable flights and a friendly atmosphere to experience-seeking travelers and potential Wine Club members. The project will deliver tailored engagement strategies for these core segments. For the local community and families, tactics will emphasize affordable, family-friendly programming and social events to build habitual visitation. For travelers and to revitalize the Wine Club, strategies will focus on creating exclusive benefits, member-only events, and collaborative partnerships to foster a sense of belonging and premium value. The ultimate goal is to provide a strategic framework that strengthens customer relationships, optimizes the underutilized Wine Club, and solidifies the winery's position as a key entertainment venue within the local community and regional tourism landscape

Keywords:

Case Study; Marketing; Strategic; Consumer Behavior

Mentor(s):

Erin Alkire Britton (DSB)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1728

Presentation Time: Session 4: 1:30-2:30pm

Ethical Implications of AI Chatbots in Therapeutic Settings STEM

Authors(s):

Sophia Mary Zakar† (Science|JMHC)

Abstract:

Just over 70% of individuals worldwide with mental health conditions lack proper access to adequate treatment due to anything from provider shortages to systemic barriers. [WHO] Because of this, AI chatbots have emerged as a possible solution to bridge the gaps in psychological care. While providing improved access and more efficient cost, these technologies challenge the principles of therapeutic practice, like empathy, consent, user privacy, and the integrity of therapy. I have explored perspectives from the disciplines of psychology, computer science, and bioethics to examine the ethical implications of using AI chatbots in a psychological therapy setting and how the chatbot design and usage alters therapeutic outcomes and patient agency. Therapy hinges on how well the user's sense of safety is developed. Chatbots are designed to process user input; however, their ability to respond with empathy is limited by algorithmic constraints and the data they were trained on. The user's privacy also comes into play when it comes to their consent to the chatbot's limitations and how traumatic, sensitive data is stored. I believe that without ethical frameworks, integration of AI into mental health care risks undermining patient trust and distorting the nature of psychological support. Through my research I hope to advocate for thoughtful, transparent, and accountable deployment of AI technologies in therapeutic contexts.

Keywords:

Psychology; Computer Science; Bioethics; Artificial Intelligence

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Poster Presentation Abstract Number: 1729

Presentation Time: Session 4: 1:30-2:30pm

RUDOLF: automatically checking accessibility of floorplans STEM

Authors(s):

Yanming Zhou† (Science)

Abstract:

When creating accessible floor plans for wheel chairs, designers need to follow specific rules guided by FDA. These rules include regulations on the clearway and more complex rules when turning around small objects. The goal of this research is to create an algorithm to check and verify whether or not these floor plans are accessible. This problem currently is assumed to be non polynomial, as the path planning and obstacle clearance regulations depend on the trajectory. However, the fact that this is a non polynomial problem has not prevented humans from verifying these floor plans, because humans have intuition and are able to choose only a few best paths to try to solve the problem. The project tries to replicate human path planning and generate multiple of such paths in order to check the problem. This is done using modified A star algorithm, which appropriately approximates human thought process when working for a path. The challenge is to adopt the algorithm's idea and generate a few thousand similar paths in A star fashion in order to test them. In order to guarantee minimum space, a buffer is added around the perimeter of the floor plan elements. Our current approach is to first add the buffer, run the modified A star algorithm, and then perform a final 180-degree turn check for each of the valid paths on top of the buffered floor perimeter. This is expected to help the industry quickly validate accessible floor plans.

Keywords:

[no keywords provided]

Mentor(s):

Jiansong Zhang (Polytechnic); Jingyi Lai (Polytechnic)

Other Acknowledgement(s):

RESEARCH TALKS

Only presenting authors (italicized) and mentors are listed. Contributing authors and acknowledgements are listed in the abstract book online.

RESEARCH TALK SESSION 1 | 9:00AM-10:00AM

ROOM: STEW 214B

- 9:00am
7000 Operations Research Solutions: Optimizing Pricing for EV Infrastructure
Zephan Jacob Thomas; Nakul Sreekanth; Shrish Senthilkumar; Alexander L Piet; Sivaranjani Seetharaman
- 9:20am
7001 Polyketide Specific Computationally Assisted Synthesis Planning
Molly Ann Shean; Ryan David Griffiths
- 9:40am
7002 Pencil Balancing Robot Utilizing Event Cameras
Meghana Kumar; Austin Christian Lika; Lucca Su Mo; Takashi Tanaka; Owen Lucas Bishop

ROOM: STEW 218A

- 9:00am
7003 The Costs of Closure: Precarity and Structural Violence of Humanitarian Aid in Jordan
Adrian Reid Walker; Kali Rubaii
- 9:20am
7004 Beyond the Equations: Philosophical Interpretations of Spacetime, Black Holes, and the Nature of Reality.
Andrew James Coleman; Harris J Bras
- 9:40am
7005 Ethics and Economics of Patenting Lifesaving Vaccines
Dhriti Jasti; Catherine Jean Shukle

ROOM: STEW 218B

- 9:00am
7006 Establishing an Automated Pipeline for Multiple Sequence Alignment
Rachel Marie Isaac; Brian Patrick Ha Metzger
- 9:20am
7007 Structural Analysis and Targeting of BamA in *A. baumannii* with a Stapled Peptide for Novel Therapeutic Development
Karthik Varigonda; Nicholas Noinaj
- 9:40am
7008 Synthesis and Reactivity of Lanthanides with Redox-Active Frameworks Towards Early Chalcogens?
Landon Oliver King; Kelly Lorraine Gullett

ROOM: STEW 218D

- 9:20am
7009 An Examination of Ways Normative Grading Structures are Embedded and Articulated in Engineering Syllabi
Ava Katherine Lyall; Daniel A Guberman
- 9:40am
7010 Implementation of Scaffolding in Undergraduate Engineering Project-Based Learning: Mixed-Method Analysis of Student Perceptions and Engagement
Prachet P Sowale; Lisa B Bosman

RESEARCH TALK SESSION 2 | 10:00AM-11:00AM

ROOM: STEW 214A

- 10:00am Voltage-Dependent Degradation Mechanisms in Layered Sodium-Ion Battery Cathodes
7011 *Abhaya Sundar; Pooja Ranganathan*
- 10:20am Heterogenous Multicore Extension and Benchmarking
7012 *Aishwarya Saikrupa Anand; Seongjoong Yim; Cole Aaron Nelson*
- 10:40am Nutrition Change Estimation Through Video
7013 *Donald Alexander Weintz; William Benjamin Tao; Piotr Stanislaw Nabrzyski; Benjamin Tyler Nguyen; Fengqing Zhu; Soudabeh Taghian Dinani; Carla Zoltowski; Edward J Delp*

ROOM: STEW 214B

- 10:00am Utilizing Histological Technique Approach to Tomato Species Under *Ralstonia solanacearum*
7014 *Colin Francis Kelly; Sana Anum Mohammad*
- 10:20am Unsupervised Clustering of Electrochemical Impedance Model Parameters in Ultramicroelectrode Arrays
7015 *Aidan Hirsch; Qiwei Dong; Kevin John Otto*
- 10:40am Real-Time 1-D Self-Balancing Control System on RISC-V AFTx07 Platform
7016 *Jeremy Jingrui Mao; Duc Minh Son Nguyen; Chris Jun Park; Taviish Bothra; Cole Aaron Nelson; Mark Johnson*

ROOM: STEW 218A

- 10:00am Scoping Review of Resilience Strategies to Mitigate Burnout for Social Service Providers
7017 *Jasmine Xiu Cai; Arshia Ganesh; Prisha Nitin Shethia; Yumary Ruiz; Madeline Elise Moser; Andrea M Hayes*
- 10:20am Proteomic insights into shared and unique mechanisms driving Alzheimer's and Parkinson's disease across cortical regions
7018 *Hannah Narelle Mendel; Purba Mandal*
- 10:40am Children's Perceived Socioeconomic Status and Inclusion of Peers from Different Countries
7019 *Vaishnavi Bansal; Myeong Won Kim; Laura Elenbaas*

ROOM: STEW 218B

- 10:00am Investigation of Solar Wind Compressible Fluctuations Using Inner Heliospheric In Situ Observations
7020 *Thomas Anthony Slamecka; Lingling Zhao*
- 10:20am Young or Rejuvenated? Probing the Origins of Massive Alpha-Enriched Stars
7021 *Akshith Karri; Jeffrey Miles Gerber*
- 10:40am Efficient and Cost-Effective Enzyme Deposition onto Tissues for Mass Spectrometry Imaging of N-Glycans using a Mini-Humidifier
7022 *Erik Robert Sveen; Alyssa Marie Moore; Miranda Renee Weigand; Julia Laskin*

ROOM: STEW 218C

- 10:00am Distinctive Vowel Lengths in Mayangna
7023 *Prasiddhi Shivakumaran; Elena Benedicto*
- 10:20am Designing AI Interactions That Foster Human Creativity
7024 Transferrable Beyond AI Use
saumya verma; Hyesun Choung
- 10:40am Employee Turnover in the Automotive Industry: Causes,
7025 Consequences, and Implications.
Karla Quintero Osorio; Dutt Jagdish Thakkar; Steven R Dunlop

ROOM: STEW 218D

- 10:00am Integrating Social Justice into Differential Calculus: A SoTL Study
7026 on Student Perceptions of Learning and Engagement
Nidhi Kirani; Lisa B Bosman
- 10:20am Project oCEANIC - Computing Environmental Adaptation and
7027 Navigation in Island Communities
Jacob David Dorson; Christopher Gerald Farber; Marlo Ann Weber; Katherine Jarriel
- 10:40am Researching the Purdue State Bank
7028 *Kirah Leigh Knobel; Ashima Krishna*

RESEARCH TALK SESSION 3 | 11:00AM-12:00PM

ROOM: STEW 214A

- 11:00am Modeling and Fabrication of Resistive Random Access Memory in
7029 the Back-End-of-Line for In-Memory Computing Applications
Geetika Chitturi; Jou-Ting Lai; Zeshu Wang; Haitong Li
- 11:20am Reliability of High-Temperature Pb-free Solders
7030 *Rachel Christine Quisil Ordiales; Carl Alexander Bravata; Carol A Handwerker; John E Blendell; Lijia Xie*
- 11:40am Large Language Models are Software System Optimizers
7031 *Arjun Sandeep Gupte; Stefan Teodor Maxim; Christopher Timothy Chan; Ananya Jajoo; James C Davis; Huiyun Peng*

ROOM: STEW 214B

- 11:00am Quantifying Circular Economy Progress Using NLP and Word
7032 Embedding Models: An Industry-Level Semantic Analysis
Aryav Gogia; Aparna Gupta
- 11:20am Design and Simulation of a 4 Gbit/s Receiver analog front end for
7033 Chiplet Die-to-Die Interconnects
Dong Wang; Tzu Huan Chang; Seyedehmarzieh Rouhani
- 11:40am Physical Modeling Placental Transfer of Small Molecule Drugs
7034 *Rhea Rakhra; Clayton Drook; Lourd Saba AbuHadid; Arezoo Ardekani; Ryan B Wagner*

ROOM: STEW 218A

- 11:00am
7035 Sex Differences in Internalizing and Externalizing Symptoms in Toddlers with Autism.
Rachel Marie Rieck; Brandon Keehn; Yesol Kim
- 11:20am
7036 Seeds of Suffering: How Pesticides Harm Farmers and Cause Parkinson's Disease
Greeshma Manchikanti; Beth Elly Baumgartner
- 11:40am
7037 Assessing Gait Stability at Variable Walking Speeds Using IMUs
Trevor James Fisher; *Mary Kathleen Schuh*; *Andrew Joseph Rolofson*; Jeffrey M Haddad

ROOM: STEW 218B

- 11:00am
7038 Potential of Microbial Movement as Agnostic Biosignatures
Gretchen K Minich; Ben K D Pearce
- 11:20am
7039 Predictors of Disease Features and Severity in Mycobacterium Avium Complex Lung Disease
Aadya Pandey; Patricio Escalante
- 11:40am
7040 Advances in Monte Carlo Tree Search for Multi-Step Enzymatic Synthesis Planning
Danny Andre Thornewell; Olga Costa Alves Souza; Karthik Sankaranarayanan

ROOM: STEW 218C

- 11:00am
7041 Flora Candle Company Marketing Research
Ethan James MacKinnon; *Emeline Marie Papp*; *Sydney Jo Muller*; *Andrew Thomas Gheen*; Erin Alkire Britton
- 11:20am
7042 Use of Ephemeral Messages in Online Transactions
donna Prince; Tatiana Ringenberg
- 11:40am
7043 Structural Performance Restoration of Fiber-reinforced Composite Patch Repair for Steel Bridge Girders
Caden Cole Cowles; Garam Kim

ROOM: STEW 218D

- 11:00am
7044 Researching the Caretakers' Cottage in Grand View Cemetery
Rylie Lynn Knobel; Ashima Krishna
- 11:20am
7045 Researching One-Room Schoolhouses and the Preservation of the Morris Schoolhouse
Norah Miller; Ashima Krishna
- 11:40am
7046 The Language of Stalinist High Politics
Isidore Peter White; Olga Lyanda-Geller

RESEARCH TALK SESSION 4 | 12:00PM-1:00PM

ROOM: STEW 214A

- 12:00pm
7047 Design of Electrically Small Dielectric Resonator Antennas
Jack Thomas Willard; Alex David Santiago Vargas; Ahmed Abdelraheem; Dimitrios Peroulis

- 12:20pm
7048 Trusted Tech in Motion: Building AI for Space & Maritime Domain Awareness
Lucia Aurora Morton; Eric Waltenburg
- 12:40pm
7049 Characterizing Glycogen Metabolism in Cyanobacteria During Light-Dark Cycles
Emily Lucille Richardson; John A Morgan; Isaac John Timmer

ROOM: STEW 214B

- 12:00pm
7050 I2C Integration and Validation on a RISC-V SoC
Andy Hanjun Hu; *Jash Snehal Pola*; *Anna Z Dalton*; Cole Aaron Nelson
- 12:20pm
7051 Physical Modeling Placental Transfer of Small Molecule Drugs
Aakash Sanjay; *Sanika Sudhir Bane*; Arezoo Ardekani; Ryan B Wagner

ROOM: STEW 218A

- 12:00pm
7052 Iron Nanoparticle and Radiation-Induced DNA Damage with Intracellular Calcium Quenching in Triple Negative Breast Cancer (TNBC)
Dhriti Manish Laddha; Matthew Louis Scarpelli
- 12:20pm
7053 Bridging Small Businesses and Community Health: The Case for Recovery-friendly Workplaces in the North Central Region
Sai Geethanjal Koduru; Nicole Adams; Michael D Wilcox
- 12:40pm
7054 Rooted in Wellness
Denice Arriane Guillot; Beth Elly Baumgartner

ROOM: STEW 218B

- 12:00pm
7055 Unprotected Lefts and Merges: Evaluating Classical vs. Learned Planners in Rare Traffic Interactions
Sofi Zhang Schmitt; *Siddhant Monish Tandale*; *Milica Slavkovic*; *Akul Goyal*; Samuel Labi; Reed Joseph Freer; Andres Felipe Hoyos Moreno; Richard Osita Ajagu
- 12:20pm
7056 Unprotected Lefts and Merges: Evaluating Classical vs. Learned Planners in Rare Traffic Interactions
Milica Slavkovic; *Jacob Junjie Zhang*; *Diya Meeniga*; Samuel Labi; Andres Felipe Hoyos Moreno; Reed Joseph Freer; Richard Osita Ajagu
- 12:40pm
7057 SMART Cities Audio Sentiment Analysis Model for PASER Asphalt Grading
Yaduvir Singh; *Mohit Sachin Ambe*; Nikkhil Vijaya Sankar

ROOM: STEW 218C

- 12:00pm
7058 Piano Playing Passwords
Andrew H Ngo; Linda E Haynes
- 12:20pm
7059 Thermomechanical Stress Prediction and Validation in Modular Additively Manufactured Fiber-Reinforced Composite Tooling with Adhesive Bonding
Paul Kyu-Hwan Park; Garam Kim; Eduardo Barocio Vaca

12:40pm Evaluating Community Involvement Efficacy in the Adoption of
7060 Airport Noise Mitigation Programs
*Rhea Dutta; Joao Pedro Biondo Peres; Oleksandr Sergey
Crowell; Caroline Kathure Marete*

ROOM: STEW 218D

12:00pm Chekhov's Literal and Cultural Legacy in Viet Nam
7061 *Tran Nguyet Anh An; Olga Lyanda-Geller*

12:20pm IL-21 delivery to lymph nodes via albumin complexation for
7062 vaccine applications
Rosalyn S Chu; Yanying He; yoon Yeo

12:40pm The Pink Foundation - Consumer Behavior Project
7063 *Chloe Maureen Newman; Alexis Joy Roberts; Advaitika Badruka;
Katherine Mary Kaizer; Stephen R Leitch*

RESEARCH TALK SESSION 5 | 1:00PM-2:00PM

ROOM: STEW 214A

1:00pm Discoverability for LLM Agents
7064 *Parv Kumar; Lavangi X Yadava; James C Davis*

1:20pm A Full-Stack Application and Statistical Pipeline to Streamline
7065 Proteomics Data Analysis for Enhanced Accuracy and
Interpretation
*Vatsal Sanjeevkum Dudhaiya; Jackson Drew Douvas; Isaac
Kojima Shane; Zhuojun Luo; Weiguo Andy Tao; Amirhesam
Mashaollahi*

1:40pm A Novel Fluid Metering Technology for Aerospace & Defense
7066 Applications
Aarav Zutshi; Brandon C Chynoweth

ROOM: STEW 214B

1:00pm Greener Data Centers: How Custom Chips Can Power
7067 Sustainable AI and Blockchain Systems
Sarathisamy Velmurugan; Linda E Haynes

1:20pm Acoustic Enhancement of Porous Filters in HVAC Systems for
7068 Submicron Bioaerosol Removal
Tyler James Hughes; Sudharshan Anandan

1:40pm Acoustic Bioaerosol Removal in HVAC Systems
7069 *Sohum Singh Sodhi; Sudharshan Anandan; David Warsinger*

ROOM: STEW 218A

1:00pm Associations between age and education level on the
7070 acceptability of contraceptive methods among South Africa
adolescents
Madelyn Elizabeth Ehrhardt; Jennifer Lynn Brown; Luis A Gomez

1:20pm Breaking the Cycle: Improving the US Justice System with
7071 Rehabilitation Strategies
Abigail Elizabeth Byers; Kyle Robert Alvey

1:40pm Overreliance on Artificial Intelligence and Impairment of Human
7072 Creativity and Innovation
Andrew Thomas Hanlon; Harris J Bras

ROOM: STEW 218B

1:00pm Fluorescent Lifetime Readout of Cellular Opto-Control
7073 *Ishaan Kartik Singh; Chi Zhang; Bin Dong*

1:20pm Tracing the Origins of Water: Constraining the Distribution of
7074 Heavy Water to Ordinary Water in a Planet-Forming System
Shruti Subramaniyan; Merel van 't Hoff

1:40pm Deep Neural Network to Separate the Higgs Boson Signal from
7075 Background Noise using Compact Muon Solenoid (CMS) data
Dewang Sahay; Kai James Sustersic; Jacob Antony; Andreas Jung; Heather Nicole Martin; Santosh Bhandari

ROOM: STEW 218C

1:00pm Agentic AI for Adaptive Cyber Defense
7076 *Milica Slavkovic; Brian C Zuel*

1:20pm Analyzing Purchasing Trends and Consumer Segments to
7077 Enhance Marketing Strategy for Purdue Convocations
Alexandra Mae Hildreth; Kimi Wilkinson; Ella Grace Bottonoff; Erin Alkire Britton

1:40pm Advancing Delivery Prediction Accuracy in Supply Chain
7078 Forecasting
Aditya Ghorpade; Brandon James Rodarmel; Omamah Khalud Jamil; Rachel Elizabeth Carlson; Yang Wu; Xing Wang

ROOM: STEW 218D

1:00pm The emergence of annual patterns in bobcat (*Lynx rufus*)
7079 presence in relation to seasonal flooding and species life history
Sierra Hunnicutt; Kristen Marie Bellisario

1:20pm Ecological impact of controlled deer hunting on bobcat prey
7080 activity and richness in Indiana
Antonia Christina Alexiou; Kristen Marie Bellisario

1:40pm A Sweet Spot in the Shade: Dynamics between canopy cover,
7081 herbaceous vegetation, predators, and prey
Cameron Jean Gibson; Kristen Marie Bellisario

RESEARCH TALK SESSION 6 | 2:00PM-3:00PM

ROOM: STEW 214A

2:00pm Computer Vision and Generative Models - Music Performance
7082 Video Synthesis and Verification
Bingyi Liu; Avery Fisher Noroozi; Shireen Malhotra; Qiuyang Huang; John Alexander White; Yung-Hsiang Lu

2:20pm Designing for Social Good
7083 *Pranav Ramnath; Aparajita Jaiswal*

2:40pm Online Pedestrian Annotation Tool
7084 *Dave Vishalkumar Patel; Divyansh Pramanick; Nived Ambadipudi; Anish R Devulapalli; Fengqing Zhu; Bryce Jensen Dietrich; Siddeshwar Raghavan; Soudabeh Taghian Dinani; Carla Zoltowski*

ROOM: STEW 214B

2:00pm Automated Segmentation of Aortic Wall Boundaries in patients with Thoracic Aortic Aneurysms
7085 *Joshua Paik; Shubh Parag Mehta; Craig Goergen; Benjamin Landis*

2:20pm NSWCC AIMM ICC Autonomous Boating Challenge
7086 *Alexander T Valdes; Andrew Joseph Shelley; Steven James Van Hulle; Margulan Mukhametkarim; Samuel Labi; Richard Osita Ajagu; Andres Felipe Hoyos Moreno; Reed Joseph Freer*

2:40pm Experimental Validation of Fatty Acid Synthesis Pathway to Produce Biodegradable Plastic Monomer
7087 *Madelyn Clair Watson; Karthik Sankaranarayanan; Nilanjan Samanta*

ROOM: STEW 218A

2:00pm Astrocytes and the MR1/MAIT Cell Axis in the PS19 Transgenic Model of Alzheimer
7088 *Sujal Joshi; Randy Brutkiewicz; Season Johnson*

2:20pm Simulation of Particle Deposition from Manual Metal Arc Welding Fumes in the Human Respiratory Tract Using the Multiple-Path Particle Dosimetry (MPPD) Model
7089 *Shane Kevin Limas; Jae Hong Park*

2:40pm Children with ADHD: Calling for Social and Academic Support
7090 *Gracelyn Kay Druehlinger; Beth Elly Baumgartner*

ROOM: STEW 218B

2:00pm Privacy-Preserving Machine Learning
7091 *Analysaa Deswal; Soham Mehta; Sidharth Garigipati; Nakshatra Hansika Tondepu; Zahra Ghodsi*

2:20pm Frequency dependent visual memory encoding in V1 neuronal ensembles of TRAP2 mice
7092 *Sein Kim; Sanghamitra Nareddula*

2:40pm AWARE: Affordable wearable self-powered smart pressure platform for workplace injury prevention
7093 *Dhruva Vedula; Mrigas Ajay Iyer; Aryan Jignesh Patel; Wenzhuo Wu; Pedro Henrique de Souza Barbosa*

ROOM: STEW 218C

2:00pm Forecasting Pharmaceutical Demand with Machine Learning: A U.S. Analysis with an Indiana Application
7094 *Lilian Patricia Holguin Mejia; Dutt Jagdish Thakkar; Steven R Dunlop*

2:20pm Exploring Human-AI Communication through Uses and Gratifications Theory
7095 *Yubo Sun; Hyesun Choung*

2:40pm Determining the Functional Domains of a *Ralstonia solanacearum*
7096 Type III Effector
Mateus Rocha Ripari; Anjali Iyer-Pascuzzi; Abigail Keelin Rogers

ROOM: STEW 218D

2:00pm A Multifidelity Machine Learning Approach for Airfoil Design with
7097 Transonic Buffet Constraints
Mason J Kramer; Leifur Thor Leifsson

2:20pm A Comparison of Lipid Nanoparticle Cholesterol Composition
7098 using Molecular Dynamics Simulations of Coarse-Grained Models
Isabel Estela Lusky; Samuel S Copeland; Yu Zhu; A Anshul; Jianing Li

2:40pm Immersive Virtual Reality in Undergraduate STEM Education
7099 *Ava Thant Samuel; Lisa B Bosman*

RESEARCH TALK SESSION 7 | 3:00PM-4:00PM

ROOM: STEW 214A

3:00pm Design and Development of a Multi-Modal Mechanical Testing
7100 Chamber for Cells
Miram Elag; Mehar Jetly; Grace Lincoln; Namhee Ji; Ju Na Lee; Natasha Rajendrara Gundapaneni

3:20pm Rwanda Demographic and Health Survey-Based Analysis to
7101 Identify Influence Factors on Rwanda Post-Partum Family Planning
Margaret H Prokopy; Nan Kong

3:40pm Physical Vapor Deposition (PVD) for Through-Silicon Via (TSV)
7102 Fabrication
Anusha Gambheera; Orion Kai Larson; Tim Jacques van Antwerpen; Saloni Pothireddy; Peter Bermel; Saeed Mohammadi

ROOM: STEW 214B

3:00pm Simulation of Modified Coherent Ising Machines for LLM
7103 Inference and Training
Charles Spencer Bowles; Andrew Robertson; Peter Bermel; Vidisha Singhal

3:20pm Evaluating Bone Material Properties Using Reference Point
7104 Indentation
Kaley Roe; Thomas H Siegmund

3:40pm Gaussian Bayesian Networks for Estimating Stiff Continuous-
7105 Discrete Stochastic Systems with Ill-Conditioned Measurements
Priyank Behera; Charles Robert Kenley

ROOM: STEW 218A

3:00pm The Risks of Concussion Underdiagnosis in Youth Sports and
7106 Preventive Interventions
Rakshith Srinivasan; Harris J Bras

- 3:20pm
7107 Heat and Intermittent Pneumatic Compression to Lower Extremity Result in Increased Oxygen and Deoxyhemoglobin Saturation and in Healthy and Pre-Diabetic Individuals
Luke Thomas Benner; Brhandom Jeishryel Brisueno Lopez; Bruno Tesini Roseguini
- 3:40pm
7108 Colors in Branding - Neuromarketing
Akshita Choraria; Tongxiao Zhang

ROOM: STEW 218B

- 3:00pm
7109 Automation Methods For Gamma Ray Spectroscopy and Data Analysis
Sydney Metz; James Thomas Pittard; Mason Patrick Julius Levere; Andy Jung; Ace Rounds; Jacob Edward Hartwick
- 3:20pm
7110 QUAFFLE: Quantum U -Net Assisted Federated Flood Learning and Estimation
Alan S Yi; Yirang Park; David Esteban Bernal Neira
- 3:40pm
7111 Examining Myh9a Function and Localization in Zebrafish Wound Closure Utilizing PhiC31-CRISPR-Cas9 Knock-In Line Methods
Morgan Stephens; Chang Ding; Qing Deng

ROOM: STEW 218C

- 3:00pm
7112 Examining Bias in DNA Extraction of Surface Attached Soil Bacterial Communities
Kaitlyn Marie Annunziata; Roland Conrad Wilhelm; Alex Batista Trentin
- 3:20pm
7113 Using leaf disk assays to culture and diagnose Coffee leaf rust
Robert James Lyon; Mary Aime; Terry Jarianna Torres Cruz
- 3:40pm
7114 In Ovo their heads: Can behavioral and physiological stress responses from heat stress be replicated without a parental component in Pekin ducks?
Nina Kay Wilson; Greg Fraley

ROOM: STEW 218D

- 3:00pm
7115 Researching 501 Indiana Avenue Property
Prerona Kaushik; Ashima Krishna
- 3:20pm
7116 Studying the Factors Affecting the Adoption Rate of Electric Vehicles in the U.S.
Devansh Sachin Kejriwal; Olga Rusyaeva Senicheva
- 3:40pm
7117 The New Avenue: From Black Main Street to Boiler Green
Suhani Maini; Ashima Krishna

RESEARCH TALK SESSION 8 | 4:00PM-5:00PM

ROOM: STEW 214B

- 4:00pm
7118 Process Development and Characterization of Through-Silicon-Vias (TSVs) for 3D Advanced Packaging
Tobias Mikael Cars; Aaron Fernandes; Chase John Grimm; Romy Kim; Peter Bermel; Saeed Mohammadi

- 4:20pm Habitual Refused Doses of Enoxaparin
7119 *Mia M Yates; Monica Miller; Ellen M Schellhase*
- 4:40pm VIP - Smart Cities - Data Annotation
7120 *Arunasalam Subbiah; Sanjana Chinthalap Mohan; Abhishek Subedi; Nikkhil Vijaya Sankar; Mohammad Reza Jahanshahi*

ROOM: STEW 218A

- 4:00pm Automatic Music Transcription – AI for Music
7121 *Ojas Chaturvedi; Emily Ran Li; Junyong Lee; Shreeya Vishram Sarurkar; Yung-Hsiang Lu; Yeon Ji Yun*
- 4:20pm Organometallic Cobalt(III) Complexes Supported by Pi-Acidic MePhTIM Macrocycle
7122 *Jeremy Joseph Roos; Tong Ren*
- 4:40pm Variable Emission in JWST Observations of the Supernova Remnant Cassiopeia A Reveal Light Echoes and Ejecta Flickering
7123 *Madeline G Taylor; Danny Milisavljevic*

ROOM: STEW 218B

- 4:00pm Ariadne: Discovering PBT Generator Weights with Dynamic Sampling
7124 *Francille Zhuang; Benjamin J Delaware; Patrick William LaFontaine*
- 4:20pm The Mother of all Bones: A Case Study of the Calcium-Rich Transient SN 2023xwi
7125 *Owen T Odney; Abigail Polin*
- 4:40pm Characterization of river discharge and interaction with shallow groundwater aquifers along the Wabash River using seismological methods
7126 *Jessica Marie Cyr; Xiaotao Yang; Marty D Frisbee*

ROOM: STEW 218C

- 4:00pm Comparison of Environmentally Collected Bacteriophages
7127 *Olivia Madison Krzyzanowski; Natalie George Khazal; Adriana K Sanchez; Kari L Clase; Taylor Sophia Buchowski; Anurag Rajendra Pujari; Amanda K Limiac*
- 4:20pm Developing Experiential Learning for Aviation Maintenance Technicians
7128 *Ronan Edward Lang; Manoj S Patankar*

ROOM: STEW 218D

- 4:00pm Investigating Liposomal Drug Carrier Interaction Forces with Membranes
7129 *Ella Grace Olson; Ryan B Wagner; Subham Das*
- 4:20pm Designing Inclusive Student Organizations: A Student-Led Accessibility Initiative at Purdue
7130 *Natalie Grace Horgan; Francis Willow Quinn Corvin; Rosanne Altstatt*

Talk Presentation Abstract Number: 7000

Presentation Time: STEW 214B at 9:00-9:20

Operations Research Solutions: Optimizing Pricing for EV Infrastructure STEM

Authors(s):

Zephan Jacob Thomas† (Science); Nakul Sreekanth† (Engineering);
Shrish Senthilkumar† (Engineering); Alexander L Piet† (Engineering);
Harshavi P Birla‡ (Engineering)

Abstract:

To guarantee profitability, reduce wait times, and preserve grid stability, the growing popularity of electric vehicles (EVs) has increased the demand for intelligent charging station pricing. However, conventional pricing frameworks are limited by sparse station-level demand data, which hinders adaptive responses to grid and traffic fluctuations. The Optimization team within the VIP ORSOL project uses traffic and electricity price forecasts as inputs to determine optimal retail prices for EV charging stations along California's I-210 corridor.

Our method combines constrained optimization, discrete choice modeling, and predictive queueing. CALTRANS traffic flows and station-level data are used by a stochastic queueing model to estimate expected wait times. To estimate driver demand elasticity and behavioral response to price and wait-time changes, these outputs are fed into a discrete choice model built from a synthetic dataset that includes amenities, detour times, and predicted electricity prices.

A nonlinear optimization model that maximizes operator profit while limiting grid demand and queue length is parameterized by the elasticity functions produced. Retail price, station utilization, and energy procurement costs are dynamically balanced in this framework.

Integration of OpenChargeMap and Overpass APIs for station metadata, traffic-based arrival estimation, and initial queue modeling are examples of current developments. The next step is to solve the price optimization problem under variable electricity costs predicted by the forecasting team's Transformer and LSTM models.

Predictive analytics and real-world data combine to create a basis for market-responsive EV charging strategies that enhance user experience, stabilize grid operations, and guide future infrastructure planning.

Keywords:

Dynamic Pricing Optimization; Queueing Theory; Discrete Choice Modeling; EV Charging Demand Elasticity; Traffic and Grid-Aware Scheduling

Mentor(s):

Sivaranjani Seetharaman (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7001

Presentation Time: STEW 214B at 9:20-9:40

Polyketide Specific Computationally Assisted Synthesis Planning STEM

Authors(s):

Molly Ann Shean† (Agriculture|Engineering)

Abstract:

Polyketides are a highly diverse group of natural products that are assembled from acyl-CoA building blocks. Some examples include antibiotics (erythromycin), antifungals (amphotericin B), cancer chemotherapy (epothilone), and immunosuppressants (FK506). Type I polyketide synthases (PKSs) are multifunctional enzymes composed of modules and domains whose order directly dictates the structure of the produced polyketide. PKSs catalyze stepwise decarboxylative Claisen condensation reactions of the acyl-CoA building blocks in an iterative fashion, which creates a multitude of secondary metabolites before the final product is reached. These intermediate products have been used to create polymer precursors (adipic acid), specialty chemicals, and biofuels. The final polyketide is ultimately released through a termination domain as a linear or cyclized product. The modular architecture and capacity to generate structurally diverse compounds of PKSs make them key targets for combinatorial engineering. Computer-Aided Synthesis Planning (CASP) tools can be used to predict enzymatic routes to target molecules through rule-based algorithms and machine learning. These systems perform retrosynthetic analyses by deconstructing a target compound into simpler biosynthetic intermediates and starting materials using generalized reaction chemistry. Therefore, a publicly available CASP tool can be developed to perform retrosynthesis on a new-to-nature polyketide products. This would enable the planning of synthetic routes to produce biopolymers, pharmaceutical agents, or other valuable molecules. To do this, PKS reaction chemistry data from ClusterCAD, a computational resource for Type I modular PKS design, will be used to propose engineered PKS constructs to create the new-to-nature targets.

Keywords:

[no keywords provided]

Mentor(s):

Ryan David Griffiths (Interdisciplinary & Special Programs)

Other Acknowledgement(s):
Karthik Sankaranarayanan (Engineering)

Talk Presentation Abstract Number: 7002

Presentation Time: STEW 214B at 9:40-10:00

Pencil Balancing Robot Utilizing Event Cameras STEM

Authors(s):

Meghana Kumar† (Engineering|JMHC); Austin Christian Lika† (Engineering|JMHC); Lucca Su Mo† (Engineering|JMHC); Geronimo Marin Hurtado‡ (Engineering)

Abstract:

Maintaining the balance of a pencil on its tip involves precise and high-speed control, due to the instability of the system. The task of keeping a pencil upright is an exemplary case of an unstable system, whose behavior can be modeled and stabilized through feedback control. The instability and design of the system makes it an applicable and testable prototype of a high-speed, vision-based control concept. This project aims to recreate a pencil-balancing robot that uses event cameras, modeled after ETH Zurich's design. Using a pair of event camera sensors, this setup will enable future projects to experiment with various data processing methods and tracking algorithms. Utilizing event cameras allows the systems to capture the pencil's unstable state accurately when compared to traditional frame-based cameras. The project combines physical reconstruction with computational modeling to achieve stable control. The equations of motion (EOMs) governing the pencil's dynamics are derived and simulated using MATLAB Simulink and Simscape to evaluate the system's stability and response. These simulations inform the design and tuning of proportional-derivative (PD) and proportional-integral-derivative (PID) controllers, which actuate a servo-driven table to maintain the pencil in a vertical position. Real-time event data from the cameras is processed and integrated into the feedback loop to continuously estimate the pencil's position and orientation. By merging the physical representation of the system with the software processing side, this project aims to create a responsive, functional, and efficient balancing platform system. The system not only demonstrates the potential of vision in feedback control but also serves as a foundation for future research in event-based perception, control optimization, and real-time robotic stability systems.

Keywords:

Event-Based Vision; Feedback Control; Unstable Systems; Controls; PD/PID Controller

Mentor(s):

Takashi Tanaka (Engineering); Owen Lucas Bishop (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7003

Presentation Time: STEW 218A at 9:00-9:20

The Costs of Closure: Precarity and Structural Violence of Humanitarian Aid in Jordan

Social Science

Authors(s):

Adrian Reid Walkert† (HHS)

Abstract:

The abrupt closure of United States Agency for International Development (USAID) programs exposed the deep instability of the global humanitarian system and has led to compounded crises in refugee communities. Based on ethnographic research in Jordan, inside Azraq refugee camp and an international non-governmental organization (INGO), this paper details the immediate consequences due to the closure of USAID in the context of the institution's decades long role in the region. Current discussions about the political economy of humanitarian aid frame this closure as a catastrophic failure. This project, however, challenges such framing by arguing that the precarity and dependency produced by USAID's closure was not an accidental vulnerability, but rather an inevitable structural function of foreign aid, which has long suppressed and displaced alternative regional support systems.

Keywords:

Humanitarian Aid; Precarity; Dependency; Structural Violence; Jordan

Mentor(s):

Kali Rubaai (Liberal Arts)

Other Acknowledgement(s):

Harold Kory Cooper (Liberal Arts)

Talk Presentation Abstract Number: 7004

Presentation Time: STEW 218A at 9:20-9:40

Beyond the Equations: Philosophical Interpretations of Spacetime, Black Holes, and the Nature of Reality.

Humanities

Authors(s):

Andrew James Coleman† (Science)

Abstract:

Throughout human history there has always been the lingering question around the nature of the universe; recently---through Einstein's Theory of General Relativity---scientific advancements have given us a mathematical account of the universe. However, mathematical equations don't tell us the whole story. This project explores how different philosophers of physics interpret contemporary theories of spacetime, allowing us to give answers to questions such as: "What is spacetime?", "What are blackholes?", and "Does time have a direction?". Keeping the scope small, this project will mainly focus on blackholes; however, aspects like time will be considered as they come up. To accomplish this, I perform a comprehensive literature review of both books and articles, investigating physical, metaphysical, and epistemic perspectives. One trend that will be realized is the overdetermination problem of physics: there are many philosophical interpretations that match the same physical theory---highlighting that there is still lots to uncover as physics and philosophy of physics advances.

Keywords:

Philosophy of Physics; General Relativity; Spacetime; Black Holes; Theory Underdetermination

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7005

Presentation Time: STEW 218A at 9:40-10:00

Ethics and Economics of Patenting Lifesaving Vaccines

Social Science

Authors(s):

Dhriti Jasti† (HHS)

Abstract:

My research question is whether pharmaceutical companies should patent important lifesaving vaccines. Some may argue that patents can help with new innovations and can allow these pharmaceutical companies to recover the high costs of research that went into making vaccines. Others might believe that people and companies should not patent things that are lifesaving as patents make important vaccines extremely expensive which prevents equal access to health care. This exploratory research project will investigate how to balance between protecting people's health and medical innovation and technology. Research will explore how patents work, laws involving it, and how patents have affected people in the past few years.

Keywords:

Healthcare Equity; Pharmaceutical; Patents; Vaccine Accessibility; Ethics

Mentor(s):

Catherine Jean Shukle (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7006

Presentation Time: STEW 218B at 9:00-9:20

Establishing an Automated Pipeline for Multiple Sequence Alignment STEM

Authors(s):

Rachel Marie Isaac† (Science|JMHC); Michael David Gardner*
(Science|JMHC)

Abstract:

Phylogenetic analyses are essential in conservation, medical research, and biotechnology to provide insights into evolutionary relationships. In turn, modern phylogenies depend on the alignment of molecular sequences from multiple species, which are computationally intensive to produce. Standard tools thus rely on heuristics to produce a single alignment, introducing bias, obscuring uncertainty, and requiring manual editing that compounds errors and limits throughput. A scalable and transparent approach for generating alignments that handle uncertainty is therefore needed. The program MUSCLE5 captures alignment uncertainty by producing multiple alignments. This reveals consistently and ambiguously aligned sites but is challenging to use in downstream applications. The program CLOAK summarizes the multiple alignments of MUSCLE5 into a single alignment by separating any ambiguous site into separate columns. This provides transparency around ambiguity but sacrifices information since not all sites are equally uncertain. The implementation of CLOAK is also memory-intensive and thus impractical to use on moderately sized datasets. We therefore redesigned CLOAK's backend, preserving consensus logic while reducing memory usage for larger datasets, and added a condensation module that reassigns sites with low alignment ambiguity into consensus columns, removing only those with unresolved uncertainty. This produces alignments that retain phylogenetic signal, minimize over-alignment, and remain computationally tractable. Together, these innovations scale CLOAK from small sets to thousands of sequences, preserving informative variation, supporting high-throughput consensus building, and reducing bias to enable more accurate phylogeny construction. These improvements enable phylogenetic analyses to keep pace with modern datasets and lead to reproducible insights across conservation, medicine, and biotechnology.

Keywords:

Phylogenetics; Bioinformatics; Evolutionary Biology; Sequence Alignment

Mentor(s):

Brian Patrick Ha Metzger (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7007

Presentation Time: STEW 218B at 9:20-9:40

Structural Analysis and Targeting of BamA in *A. baumannii* with a Stapled Peptide for Novel Therapeutic Development STEM

Authors(s):

Karthik Varigonda† (Science|JMHC)

Abstract:

Acinetobacter baumannii is a critical threat due to its status as a multidrug-resistant pathogen, creating an urgent demand for new classes of antibiotics, particularly against nosocomial (hospital-acquired) infections. The β -barrel assembly machinery component A (BamA) is an essential protein for outer membrane protein biogenesis and an attractive, non-traditional target for therapeutic intervention. This study aims to structurally and biochemically characterize BamA from *A. baumannii* and exploit its vulnerabilities using a novel therapeutic strategy. The key tool for this study is the stapled peptide X2W7, synthesized through a collaboration with the Bhardwaj lab at the University of Washington. This peptide is specifically designed to interfere with BamA's function. Structural analysis using X-ray crystallography will determine the high-resolution structure of the BamA-X2W7 complex to guide further design and optimize affinity. This comprehensive work is anticipated to provide critical structures and functional insights and will validate the stapled peptide platform for developing urgently needed therapeutics against life-threatening Gram-negative infections.

Keywords:

Acinetobacter baumannii; BamA; Antibiotic Resistance; X-Ray Crystallography; Stapled Peptide

Mentor(s):

Nicholas Noinaj (Science)

Other Acknowledgement(s):

Nourin Ferdausi (Science)

Talk Presentation Abstract Number: 7008

Presentation Time: STEW 218B at 9:40-10:00

Synthesis and Reactivity of Lanthanides with Redox-Active Frameworks Towards Early Chalcogens? STEM

Authors(s):

Landon Oliver King† (Science)

Abstract:

Lanthanide elements have a stable oxidation state of (+3) and are limited in their reactivity with small molecules due to the relative redox inertness of the metals. To overcome this, redox active ligands can be used to temporarily store electrons, which can then be used for small molecule activation. The purpose of this research was to first synthesize and characterize both bis and tris redox active ligand complexes with neodymium, gadolinium, and ytterbium. Next, we explored their reactivity towards sulfur and oxygen with these redox-active complexes in the hopes of finding a pathway to stable terminal chalcogens. The Bart group has previously published the Neodymium bis ligated system as well as its reactivity towards S₈. Extending this work, the successful synthesis of the Neodymium tris ligated system, as well as the bis and tris system for Ytterbium and Gadolinium were completed and characterized with x-ray crystallography. Reactivity of the early chalcogens, sulfur and oxygen, was explored and yielded a repeatable creation of the 6-member sulfur-metal metallocycle in a twist boat formation with both Yb and Gd. Along with the metallocycle, an unexpected and repeatable 7-member sulfur chain was observed and characterized by x-ray crystallography. Exploration of oxygen's reactivity with the bis ligated systems yielded change in spectroscopic data but proved difficult to produce single crystals suitable for x-ray crystallography. This twist boat conformation is contrasted with the transition's metals preference towards chair conformations.

Keywords:

Lanthanide; Heavy Metal; Inorganic; Chalcogen; Crystals

Mentor(s):

Kelly Lorraine Gullett (Science)

Other Acknowledgement(s):

Suzanne C Doucette (Science); Matthias Zeller (Science)

Talk Presentation Abstract Number: 7009

Presentation Time: STEW 218D at 9:20-9:40

An Examination of Ways Normative Grading Structures are Embedded and Articulated in Engineering Syllabi Social Science

Authors(s):

Ava Katherine Lyall† (Engineering|JMHC)

Abstract:

Grading systems play a central role in shaping the culture of engineering education, influencing how students approach learning, collaboration, and persistence in the field. Normative grading, or “grading on a curve,” remains a pervasive practice, yet its varied forms have received little scholarly attention. This paper investigates how normative grading is communicated in undergraduate engineering syllabi, with particular attention to the transparency, justification, and implications of these policies. Utilizing a close analysis of 28 syllabi spanning 12 engineering disciplines, we identify explicit and implicit references to normative grading, examine their prevalence across course levels, and highlight the ways that vague or subjective language contributed to student uncertainty and stress. In addition, we consider how alternative grading approaches such as mastery-based and specifications grading are represented in engineering syllabi, and situate these practices within broader discussions of equity and student success. By analyzing how grading systems are framed at the beginning of a course, this study provides new insights into how policies shape student perceptions, behaviors, and outcomes, while raising questions about whether normative structures continue to serve educational goals. The findings emphasize the importance of greater transparency and alignment between grading practices and learning objectives, and point toward opportunities for instructional reform that prioritize both academic rigor and student well-being.

Keywords:

Normative Grading; Alternative Grading; Assessment; STEM Education

Mentor(s):

Daniel A Guberman (Office of the Provost)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7010

Presentation Time: STEW 218D at 9:40-10:00

Implementation of Scaffolding in Undergraduate Engineering Project-Based Learning: Mixed-Method Analysis of Student Perceptions and Engagement STEM

Authors(s):

Prachet P Sowale† (Engineering|JMHC)

Abstract:

This research investigated the impact of integrating scaffolding in project-based assignments on learning engagement and perceptions among undergraduate engineers. Project scaffolding was used as a systematic approach to designing and developing projects by breaking them down into manageable phases. It provided a framework that helped students build projects incrementally, reinforcing learning and problem-solving skills along the way. The engineering students were exposed to the scaffolding structure for three courses: programming, signal processing, and numerical analysis. The scaffolding structure was introduced through three project milestones: proposal, update, and final submission. Data were obtained through a mixed-methods approach; quantitative data were collected through retrospective post-then-pre surveys, while qualitative data were gathered from open-ended student reflections. Additionally, quantitative data utilized a control group with non-scaffolded course cohorts. Such methodology helped investigate shifts in students' self-reported understanding of course material and tracked their confidence in academic performance over time. Initial results suggested that scaffolded milestones led to deeper engagement, consistency in iterative progress, and significantly positive student perceptions of growth, compared to non-scaffolded counterparts. Furthermore, qualitative reflections highlighted how structured checkpoints inspired reflection, reduced overwhelming feelings, and helped pace comprehension. Such findings yielded implications for engineering instructors who sought to integrate scaffolded project pedagogy in discipline-specific courses.

Keywords:

Engineering; Scaffolding; Undergraduate

Mentor(s):

Lisa B Bosman (Polytechnic)

Other Acknowledgement(s):

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

Talk Presentation Abstract Number: 7011

Presentation Time: STEW 214A at 10:00-10:20

Voltage-Dependent Degradation Mechanisms in Layered Sodium-Ion Battery Cathodes STEM

Authors(s):

Abhaya Sundar† (Engineering)

Abstract:

Sodium-ion batteries (SIBs) have emerged as a promising alternative to lithium-ion systems due to the abundance and low cost of sodium. However, their commercialization is hindered by rapid capacity fading and poor long-term stability, largely driven by complex degradation mechanisms within layered oxide cathodes. This study investigates the electrochemical performance and degradation behavior of layered sodium transition-metal oxide cathodes (NaNFMO) cycled within different voltage windows. By systematically varying the upper and lower cut-off voltages, we aim to decouple structural, interfacial, and electrolyte-related degradation pathways. Electrochemical testing revealed that higher voltage operation enhances capacity but accelerates phase transitions and oxygen loss, leading to increased surface reconstruction and impedance growth. In contrast, narrower voltage windows mitigate these effects but limit energy density. The results highlight a trade-off between performance and stability, emphasizing the importance of optimizing voltage range to balance structural integrity and electrochemical efficiency. Understanding these degradation mechanisms provides valuable insights for designing more durable cathode materials and developing voltage management strategies to extend the cycle life of sodium-ion batteries.

Keywords:

Sodium Ion; Layered Oxide Cathode; Battery; Voltage Window

Mentor(s):

Pooja Ranganathan (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7012

Presentation Time: STEW 214A at 10:20-10:40

Heterogenous Multicore Extension and Benchmarking STEM

Authors(s):

Aishwarya Saikrupa Anand† (Engineering); Seongjoong Yim†
(Engineering)

Abstract:

A multicore, or multiprocessor, is a type of microprocessor on a single chip with 2 or more CPUs. Our project is extended from SoCET's AFTx07 RISC-V CPU, which features functional multicore capability. In the first half of the project, integration of 2+ homogeneous multicores into the top-level design for the upcoming AFTx08 chip tapeout was completed, along with the performance characterization of multicore scalability.

The next phase of the project involves implementing heterogeneous multicore. Our proposed design is similar to ARM's big.LITTLE architecture, where a high-performance core handles compute-intensive workloads while a power-efficient core manages simple background or sensor-driven tasks. To achieve this, we are developing a heterogeneous multicore framework that enables per-core customization of core extensions and cache configurations. This framework translates human-readable specifications into SystemVerilog code that implements customized core designs. The completed framework will be used to analyze power-performance trade-offs and demonstrate the efficiency gains achievable through heterogeneous design.

Keywords:

Multicore; Performance; RISC-V; Heterogenous; Tapeout

Mentor(s):

Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7013

Presentation Time: STEW 214A at 10:40-11:00

Nutrition Change Estimation Through Video STEM

Authors(s):

Donald Alexander Weintz† (Engineering); William Benjamin Tao† (Engineering); Piotr Stanislaw Nabrzyski† (Engineering); Benjamin Tyler Nguyen† (Engineering)

Abstract:

Tracking the different ingredients and their caloric content in a meal is essential for personal health and dietary management. Having the ability to identify and estimate the caloric value of an item when picked up can be extremely beneficial when making real-time decisions for meal prepping. It can also reduce the need to manually measure and log the amount of food you're using because it's all digital. By utilizing an object detection model trained on datasets containing ingredients and foods from around the world, identifying ingredients from a video becomes an easy task. However, mapping each item to an accurate calorie value is challenging. Our project addresses this problem by leveraging a YOLO (You Only Look Once) object detection model for ingredient identification, utilizing the FNDDS dataset for calorie mapping, and tracking the current and cumulative calorie values in a video.

Keywords:

Computer Vision; Deep Learning; Nutrition Estimation; Video Understanding

Mentor(s):

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

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7014

Presentation Time: STEW 214B at 10:00-10:20

Utilizing Histological Technique Approach to Tomato Species Under *Ralstonia solanacearum* STEM

Authors(s):

Colin Francis Kelly† (Science|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 root structure 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 large-scale experimental technique to cultivate, inoculate, section, stain, and confocally image each species with and without pathogenic stress. The resulting structures will be used to determine the resistant tomato's 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:

Histology; Structure; *Ralstonia*; Microscopy; Agriculture

Mentor(s):

Sana Anum Mohammad (Agriculture)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7015

Presentation Time: STEW 214B at 10:20-10:40

Unsupervised Clustering of Electrochemical Impedance Model Parameters in Ultramicroelectrode Arrays STEM

Authors(s):

Aidan Hirscht† (Engineering)

Abstract:

Currently, there are 5.6 million people in the world diagnosed with some form of permanent or transient limb paralysis. However, invasive brain machine interfaces (BMIs) can provide these patients with solutions by decoding neural signals, however a medical procedure capable of restoring functionality is not realized yet. Previous BMI efforts could not achieve a substantial restoration of limb function due to foreign body response (FBR) effects, which degrade signal quality by decreasing the signal to noise ratio (SNR). Literature suggests shrinking the dimensions of a device results in a lesser FBR from the brain. Ultramicroelectrode arrays (UMEAs) are a class of extremely small BMIs that reduce the brain's FBR to a point where invasive implantations can be left in for six months to a year before degradation. The UMEAs utilized in this study are coated with a sputtered iridium oxide film (SIROF) to ensure high stimulation and recording performance. However, the FBR still causes degradation of the signal quality, resulting in the UMEA gradually becoming ineffective for long-term stimulation purposes. Our third generation (G3) UMEAs were implanted in Sprague-Dawley rats for a period of sixteen weeks and the degradation of the UMEA was measured using electrochemical impedance spectroscopy (EIS). By modeling the physical characteristics of the UMEA from the EIS data, a correlation was found between the constant phase element representing the wire capacitance and the impedance magnitude of the electrode. Future research examining the electrodes to determine exact failure mode is necessary.

Keywords:

Ultramicroelectrode Arrays; Electrochemical Impedance Spectroscopy; Neural Interfaces; Brain Computer Interface; Electrophysiology

Mentor(s):

Qiwei Dong (Engineering); Kevin John Otto (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7016

Presentation Time: STEW 214B at 10:40-11:00

Real-Time 1-D Self-Balancing Control System on RISC-V AFTx07 Platform STEM

Authors(s):

Jeremy Jingrui Mao† (Engineering); Duc Minh Son Nguyen‡ (Engineering); Chris Jun Park† (Engineering); Taviish Bothra† (Engineering)

Abstract:

There are numerous applications of real-time control systems observable in daily life. One example would be a hoverboard, which balances a board while also accelerating it forward. This project aims to develop a real time control system on a RISC-V architecture to enable the former aspect of a hoverboard, a one-dimensional self-balancing board, while demonstrating the real-time capabilities of the AFTx07 platform. Using the FPGA emulation of the AFTx07, we aim to reduce testing and iteration time. The self-balancing board uses IMU sensor data to enable real time control of the tilt of the board. The IMU sensor data (acceleration in one dimension) provides the required counterforce - after signal processing and data modification to bypass the lack of a Floating Point Unit (FPU) on the board - to be applied through a servo. A successful demonstration of the project would involve a force applied on the board to be counterbalanced through the servo, thus keeping the board balanced. Future extensions of the self-balancing board could involve balancing in 2D, integrating the in-progress FPU implementation to improve precision and fine-tune the control system, and perhaps enabling lateral motion to emulate a hoverboard.

Keywords:

Real-Time Control Systems; RISC-V; FPGA Emulation; Signal Processing; Embedded Systems

Mentor(s):

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

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7017

Presentation Time: STEW 218A at 10:00-10:20

Scoping Review of Resilience Strategies to Mitigate Burnout for Social Service Providers

Social Science

Authors(s):

Jasmine Xiu Cai† (HHS|JMHC); Arshia Ganesh† (HHS); Prisha Nitin Shethia† (Engineering|JMHC)

Abstract:

Background: Social service providers often face chronic stress from heavy caseloads, limited resources, and emotionally demanding interactions. These factors contribute to burnout, compassion fatigue, and secondary traumatic stress, which compromise both provider well-being and service quality. Although resilience-building is recognized as essential for sustaining a healthy workforce, evidence on effective strategies remains limited.

Objectives: This preliminary scoping review, conducted by an undergraduate research team under the mentorship of a principal investigator and doctoral student, aims to identify and synthesize evidence on interventions that promote resilience and well-being among social service providers.

Methods: Using the Population, Exposure, Outcome framework, the team will systematically search PsycINFO, PubMed, ERIC, and CINAHL for peer-reviewed describing interventions addressing burnout, compassion fatigue, or secondary trauma. Data will be charted collaboratively and iteratively refined through faculty and graduate mentorship to ensure methodological rigor.

Anticipated Results: Preliminary screening suggests that existing evidence disproportionately focuses on healthcare settings with limited attention to community-based or social service contacts. The review is expected to identify common strategies such as mindfulness training, peer support, reflective supervision, and trauma-informed organizational practices while highlighting a need for stronger evaluation designs and workforce-specific measures of impact.

Significance/Implications: By integrating student learning with structured mentorship, this project builds research capacity and contributes to the growing evidence base on workforce resilience. Findings will inform future workforce development, organizational policy, and well-being initiatives. By focusing on the challenges of community-based providers,

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

such as underfunding, emotional strain, and systemic disparities, the review underscores the need for sustainable, evidence-based solutions.

Keywords:

Social Service Providers; Resilience; Burnout; Compassion Fatigue; Workforce Well-Being

Mentor(s):

Yumary Ruiz (HHS); Madeline Elise Moser (HHS); Andrea M Hayes (Libraries)

Other Acknowledgement(s):

Kylie Marie Wilson (HHS)

Talk Presentation Abstract Number: 7018

Presentation Time: STEW 218A at 10:20-10:40

Proteomic insights into shared and unique mechanisms driving Alzheimer's and Parkinson's disease across cortical regions **STEM**

Authors(s):

Hannah Narelle Mendel† (HHS)

Abstract:

Alzheimer's Disease (AD) and Parkinson's Disease (PD) are both progressive neurodegenerative disorders characterized by the gradual loss of neurons and brain atrophy, leading to impaired cognitive and/or motor functions. In AD patients, functional and structural changes are observed in the dorsolateral prefrontal cortex (DLPFC), while dysfunction in the anterior cingulate cortex (ACC) in PD is associated with non-motor symptoms, including cognitive and emotional disturbances. Some patients exhibit overlapping AD and PD pathology classified as ADPD with degeneration in both DLPFC and ACC regions.

Approximately 1.1 million people in the United States have PD, costing \$52 billion USD in 2020, with the economic burden projected to reach \$65.1 billion USD by 2025. Similarly, AD accounts for 60–80% of all neurodegenerative diseases, with projected costs exceeding \$781 billion USD.

This research aims to compare and contrast molecular alterations in AD and PD across cortical regions (DLPFC and ACC) using proteomics data from postmortem brains. Data were obtained from the Emory Alzheimer's Disease Research Center Brain Bank, including 40 individuals (10 each of AD, PD, ADPD, and controls). The data were corrected for age of death, postmortem interval, and sex to minimize bias. Using limma for differential protein expression, we identified common pathways altered in DLPFC and ACC. Upregulated pathways included VEGFA–VEGFR2 signaling, CDK5 deregulation, and gap junction/leukocyte transendothelial migration suggesting vascular dysfunction, neuronal cytoskeletal breakdown, and chronic neuroinflammation, while downregulated pathways reflected reduced neuronal energy availability and mitochondrial dysfunction, indicating greater mitochondrial impairment in AD compared to PD.

Keywords:

Alzheimer's; Parkinson's; ADPD; Proteomics; Cortical Regions

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

Mentor(s):

Purba Mandal (Pharmacy)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7019

Presentation Time: STEW 218A at 10:40-11:00

Children's Perceived Socioeconomic Status and Inclusion of Peers from Different Countries

Social Science

Authors(s):

Vaishnavi Bansal† (HHS|JMHC)

Abstract:

As communities in the United States become increasingly diverse, children have more opportunities to interact with peers from various cultural, ethnic, and national backgrounds (Keles et al., 2024). However, their willingness to include others may be shaped by how they perceive their own socioeconomic standing. Because friendships in childhood often rely on expectations of reciprocity and mutual benefit rather than obligation (Veland et al., 2009), children's self-perceived socioeconomic status (SES) may influence their inclusive behaviors toward peers from different backgrounds.

This study examined the relation between children's perceived SES and their inclusion of peers from other countries. Participants were children aged 8–11 years, a developmental stage when understanding of fairness and stereotypes becomes more complex. Children reported their perceived SES using a 10-rung "social ladder," where higher rungs represented families with more money, education, and occupational prestige. Inclusive behavior was assessed through self-reported willingness to include a peer from another country in everyday social scenarios (e.g., "How much would you want to invite this kid to your birthday party?"; 1 = Really don't want to, 7 = Really want to).

Results indicated that perceived SES was not significantly related to inclusion, $r(433) = .07$, $p = .12$. These findings suggest that during middle childhood, inclusion may be shaped more by moral or social factors—such as fairness and empathy—than by perceived socioeconomic status. Future research could examine whether these associations shift with age or across cultural contexts where class distinctions are more pronounced.

Keywords:

Morality; Inequality; Social Developmental

Mentor(s):

Myeong Won Kim (HHS); Laura Elenbaas (HHS)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7020

Presentation Time: STEW 218B at 10:00-10:20

Investigation of Solar Wind Compressible Fluctuations Using Inner Heliospheric In Situ Observations STEM

Authors(s):

Thomas Anthony Slamecka† (Science)

Abstract:

Observations from Parker Solar Probe (PSP) reveal that the solar wind near the Sun exhibits larger density fluctuations compared to 1 AU observations. This motivates a closer examination of the nature and origin of compressible fluctuations in the near-Sun solar wind. In this study, we use in situ plasma and magnetic field measurements from Wind, Solar Orbiter, Helios, and PSP to investigate the evolution and properties of compressible fluctuations as the solar wind propagates outward. We find that the contribution of fast magnetosonic waves decreases with radial distance and is not negligible near the Sun. At 1 AU, density fluctuations are primarily associated with slow-mode waves and pressure-balanced structures. Both density and magnetic field magnitude fluctuations exhibit strong wavevector and spectral anisotropies. These fluctuations are opposite to the plasma beta correlation, have a weak dependence on the solar wind speed, and show a positive correlation with the residual energy magnitude. Furthermore, the intervals with positive residual energy are closely related to the fast mode contribution, manifested as a positive correlation between the magnetic field strength and the density fluctuations. The power spectra of the density fluctuations show clear differences in the intervals where the fast or slow mode is secondarily dominant. Overall, our results show that compressible fluctuations are non-negligible and may play an important role in shaping the dynamics of the near-Sun solar wind.

Keywords:

Solar Wind; Sun; Astronomy

Mentor(s):

Lingling Zhao (University of Alabama in Huntsville)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7021

Presentation Time: STEW 218B at 10:20-10:40

Young or Rejuvenated? Probing the Origins of Massive Alpha-Enriched Stars STEM

Authors(s):

Akshith Karri† (Science)

Abstract:

Massive Alpha-Enriched Stars (MAES) are intriguing because they exhibit the chemical makeup of the Milky Way's older thick-disk population but appear young due to their relatively high masses. The exact details of how these stars form are still unknown, but likely scenarios involve binary interactions or stellar mergers. We explore how studying yttrium - a heavy element created through slow neutron-capture processes - can help reveal details about the histories of these stars. We measure yttrium abundances of a sample of MAES using high-resolution spectra taken with the Immersion Grating Infrared Spectrometer (IGRINS) on the 2.7-m Harlan J. Smith telescope. By comparing our Y abundances with other elemental abundance profiles in these stars, we can determine whether these stars are truly young, as their masses would indicate, or old stars whose masses have been inflated through interactions. We also draw conclusions as to what kind of binary interactions these stars have been through.

Keywords:

Stellar Evolution; Galactic History; Astrophysics; Stars; Spectroscopy

Mentor(s):

Jeffrey Miles Gerber (Science)

Other Acknowledgement(s):

Leland Bednarz (Science)

Talk Presentation Abstract Number: 7022

Presentation Time: STEW 218B at 10:40-11:00

Efficient and Cost-Effective Enzyme Deposition onto Tissues for Mass Spectrometry Imaging of N-Glycans 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, which are important biomarkers for various diseases, present in biological tissues. Analyzing N-linked glycans requires the deposition of an enzyme onto a biological tissue section to release them from proteins. However, current instrumentation for enzyme deposition is not readily accessible to laboratories employing liquid-extraction MSI methods. Here, we developed and utilized a mini-humidifier to apply peptide N-glycosidase F (PNGase F) for MSI analysis of N-linked glycans present within mouse brain tissue sections. Our results demonstrate that the mini-humidifier is a cost-effective and efficient option for PNGase F deposition enabling N-linked glycan analysis by MSI. This work presents an alternative approach for enzyme application on biological samples to study the spatial localization of N-linked glycans using MSI.

Keywords:

Mass Spectrometry; Biological Imaging; Electrospray Ionization; N-Glycans; Glycoproteomics

Mentor(s):

Alyssa Marie Moore (Science); Miranda Renee Weigand (Science); Julia Laskin (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7023

Presentation Time: STEW 218C at 10:00-10:20

Distinctive Vowel Lengths in Mayangna
Humanities

Authors(s):

Prasiddhi Shivakumaran† (HHS)

Abstract:

[Abstract Redacted]

Keywords:

Typological Diversity; Morphosyntactic Analysis; Endangered Language; Mayangna; Vowels

Mentor(s):

Elena Benedicto (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7024

Presentation Time: STEW 218C at 10:20-10:40

Designing AI Interactions That Foster Human Creativity Transferrable Beyond AI Use

Social Science

Authors(s):

saumya verma† (Science)

Abstract:

People are increasingly using generative AI (GenAI) systems for brainstorming and early-stage idea generation across various creative domains, a practice that has quickly become normalized. Yet, concerns remain that such use may undermine human creativity by outsourcing cognitive effort to AI. Prior work suggests that instruction and feedback encouraging divergent thinking can enhance creative processes. Extending this principle to AI-assisted creativity, the present study examines whether interaction with GenAI can have transferable effects on human creativity, helping users internalize creative thinking processes that persist even without AI support.

Participants will first complete a primary creative task (Task A: generate as many ways as possible to encourage recycling in a workplace) while interacting with either a generic AI (i.e., ChatGPT) or a creativity-oriented AI designed to promote divergent thinking. After completing the first task, participants will be instructed to complete a structurally similar task (Task B: Provide as many ways as possible to encourage the use of public transportation in a city) without AI assistance across all groups. The purpose of the second task is to assess whether AI-supported brainstorming fosters transferable creative strategies that they can apply independently in an unaided context. The transfer of creativity is evaluated through both the objective creative output and subjective self-reported ratings of enjoyment and divergent thinking from the participants. We hypothesize that both AI conditions will enhance creative output compared to a control group, but that the Creative AI condition will better preserve participants' sense of engagement in the creative process.

Keywords:

Communication; Artificial Intelligence; Creativity; Human Computer Interaction; Human-AI Collaboration

Mentor(s):

Hyesun Choung (Liberal Arts)

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

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7025

Presentation Time: STEW 218C at 10:40-11:00

Employee Turnover in the Automotive Industry: Causes, Consequences, and Implications.

Business Case Study

Authors(s):

Karla Quintero Osorio†

Abstract:

This research examines the phenomenon of employee turnover within the U.S. automotive production industry, a challenge that has increasingly affected the broader manufacturing sector in recent years. The study provides a precise conceptual definition of employee turnover and analyzes its diverse impacts on organizational performance, including productivity losses, higher recruitment and training costs, reduced employee morale, and lower engagement. It also investigates the multiple underlying causes of turnover that apply to the automotive industry, such as rigid work schedules, inadequate leadership, poor working conditions and excessive workload in combination with other external factors, like the availability of employment opportunities with more attractive benefits on other organizations; all to provide a comprehensive understanding of how and why employee departures occur.

Keywords:

Turnover; Automotive; Workforce; Manufacturing

Mentor(s):

Dutt Jagdish Thakkar (DSB); Steven R Dunlop (DSB)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7026

Presentation Time: STEW 218D at 10:00-10:20

Integrating Social Justice into Differential Calculus: A SoTL Study on Student Perceptions of Learning and Engagement STEM

Authors(s):

Nidhi Kirani† (Engineering|JMHC)

Abstract:

Engineering students often struggle to see the relevance of mathematics in their coursework, which can lead to disengagement and reduced persistence. To address this challenge, this project integrates a four-week, semester-ending intervention in a differential calculus course that focuses on themes of social justice and equity, aiming to connect mathematical concepts to real-world issues. A mixed-methods design was employed, comprising retrospective pre- and post-surveys, a final post-course survey, and qualitative analysis of student reflections, with outcomes compared to those of other calculus sections. Preliminary findings suggest that students reported higher motivation, deeper conceptual understanding, and stronger connections between technical skills and societal applications. These results highlight the potential of equity-centered pedagogy to enhance student learning and engagement, while also broadening participation in engineering education. The study provides actionable evidence for instructors seeking innovative and inclusive practices that prepare students to apply technical knowledge to pressing global challenges.

Keywords:

Engineering Education; Mathematics Relevance; Equity-Centered Pedagogy; Student Engagement; Social Justice

Mentor(s):

Lisa B Bosman (Polytechnic)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7027

Presentation Time: STEW 218D at 10:20-10:40

Project oCEANIC - Computing Environmental Adaptation and Navigation in Island Communities

Social Science

Authors(s):

Jacob David Dorson† (Science|JMHC); Christopher Gerald Farbert (Science|JMHC); Marlo Ann Weber† (Science|JMHC); Giovanni Ignatius Stabile‡ (Engineering|JMHC); Danielle C Ejiogu‡ (Science|JMHC); Hannah Morgan Stegall‡ (Engineering|JMHC); Allyson Lynn Dinwiddie‡ (Liberal Arts|JMHC); Anna Kathleen Dorson‡ (Agriculture|JMHC); Naeem Saeed Bahemia‡ (Science|JMHC)

Abstract:

Residents of small Pacific islands face devastating effects from climate change, such as sea level rise, loss of biodiversity, and intensifying storms. The project uses an agent-based model to investigate how traditional navigation practices can build community resilience amid climate change and post-pandemic disruption. The project's interdisciplinary approach combines historical, environmental, and geospatial data with Indigenous and local peoples' environmental knowledge (ILEK) from communities in the Marshall Islands, Yap, and Hawai'i. The combination of ILEK and computational modeling is a novel methodology. Evidence suggests that paleoclimate data resemble environmental futures. By incorporating past data into our model's decision making, we can inform the present-day revitalization of traditional seafaring practices as a sustainable mode of transportation. We utilize paleoclimate data from the past 2000 years to investigate environmental anomalies and analyze which variables have the greatest impact on human navigation. The project's current study area is Yap State in western Micronesia, where the sawei system of exchange historically took place. It is an optimal case study to model due to the extensive documentation exemplifying how interisland navigation supports commerce, kinship, and aid.

Keywords:

Agent-Based Model; Paleoclimate; Indigenous and Local Peoples' Environmental Knowledge (ILEK); Disaster Resilience; Micronesia

Mentor(s):

Katherine Jarriel (JMHC)

Other Acknowledgement(s):

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

Talk Presentation Abstract Number: 7028

Presentation Time: STEW 218D at 10:40-11:00

Researching the Purdue State Bank

Social Science

Authors(s):

Kirah Leigh Knobel† (Engineering|JMHC)

Abstract:

This research project, in conjunction with the Department of Development within the city of West Lafayette, aimed to discover the history as well as the overall significance of the Purdue State Bank and the story behind why its famous architect Louis Sullivan designed this structure. There is plenty of published information about Sullivan's life as he was such a public figure, however not much is known about the construction of the Purdue State Bank and its link to West Lafayette. I used a newspaper archive within Newspapers.com to find some early childhood biographical information about Sullivan as well as to craft a timeline of the history of the Purdue State Bank. I also worked with the Tippecanoe County Historical Archives to find more information about the company mergers that transformed the Purdue State Bank to eventually a branch of the larger corporation Chase Bank. Through this research, it was discovered that the original institution had close ties with Purdue University, as many members of the bank board were also Purdue faculty. It was unearthed that, although Sullivan had constructed many Jewel box banks in this era, this was his smallest, and as of now, his worst preserved. As a result of this research, not only should this structure be made into a historical landmark, but additional steps should be taken to preserve this structure that had such close ties to Purdue University.

Keywords:

Purdue State Bank; Purdue University; Louis Sullivan; Architecture; Jewel-Box Bank

Mentor(s):

Ashima Krishna (JMHC)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7029

Presentation Time: STEW 214A at 11:00-11:20

Modeling and Fabrication of Resistive Random Access Memory in the Back-End-of-Line for In-Memory Computing Applications STEM

Authors(s):

Geetika Chitturi† (Engineering|JMHC)

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 non-volatile memory technology. 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 crossbar RRAM array using a process flow compatible with CMOS BEOL processes, materials, and thermal budget. To realize the array, we are fabricating RRAM at Birck Nanotechnology Center and modeling our device in Ginestra TCAD. Leveraging the results from our RRAM fabrication, we will develop a 3D vertical RRAM device for high-density in-memory computing applications. Our expected outcome is the realization of a highly energy-efficient memory array that can serve as a basis for future innovations in CMOS+X semiconductor technology.

Keywords:

RRAM; CMOS+X; TCAD; Fabrication

Mentor(s):

Jou-Ting Lai (Engineering); Zeshu Wang (Engineering); Haitong Li (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7030

Presentation Time: STEW 214A at 11:20-11:40

Reliability of High-Temperature Pb-free Solders STEM

Authors(s):

Rachel Christine Quisil Ordiales† (Engineering); Carl Alexander Bravata‡ (Engineering)

Abstract:

Eutectic tin-lead solder alloys were traditionally used in microelectronics due to their favorable melting temperatures, wettability, low reactivity of Pb, and affordability. However, European Union legislation had eliminated the use of Pb-based solders in all consumer electronics, replacing Sn-Pb with Sn-Ag-Cu (SAC) Pb-free solder alloys. The dominant alloy for consumer and automotive electronics is SAC305 (Sn-3wt.%Ag-0.5wt.%Cu). Defense and aerospace alloys continued to use Sn-Pb alloys due to their good performance under impact and high-strain-rate application compared with SAC alloys. Concerns over poor high strain rate performance of SAC-based alloys and Sn-Bi based alloys in modern microelectronic and defense/aerospace applications have prompted our research into measuring the effects of elemental additions and processing techniques on microscopic and macroscopic mechanical properties. While SAC305 shows decreased strength after isothermal aging when compared to as-reflowed samples, microalloyed solders, such as Innolot (90.95wt.% Sn-3.8wt.%Ag-0.7wt.%Cu-3wt.%Bi-1.4wt.%Sb-0.15wt.%Ni), contrastingly exhibit increased strength after isothermal aging. We attribute these differences in mechanical behavior to differences in their microstructural evolution under the same conditions. Thus, to explore the performance and manufacturing differences between solders for different use cases as a function of composition, thermodynamic simulations (CALPHAD) will be presented to show equilibrium phase fractions and precipitation behavior predictions as a function of composition, solidification processing, and aging. By comparing these with experimental results obtained from Scanning Electron Microscopy (SEM) image analysis, we are measuring microstructural evolution and the intermetallic compound changes of different alloys as a function of temperature and composition.

Keywords:

[no keywords provided]

Mentor(s):

Carol A Handwerker (Engineering); John E Blendell (Engineering); Lijia Xie (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7031

Presentation Time: STEW 214A at 11:40-12:00

Large Language Models are Software System Optimizers STEM

Authors(s):

Arjun Sandeep Gupte† (Engineering); Stefan Teodor Maxim† (Engineering); Christopher Timothy Chan† (Engineering); Ananya Jajoot (Science)

Abstract:

Automatic software system optimization is essential for enhancing speed, scalability, and energy efficiency, yet traditional approaches depend on manual tuning and compiler heuristics that struggle to generalize across diverse applications and workloads. Earlier LLM-based systems introduced automation to this process but were limited to prompt-driven generation, lacking systematic ways to internalize performance knowledge or adapt from runtime experience.

We introduce SysLLMatic, an advanced learning-based framework that extends prior LLM-based optimization pipelines through a structured, multi-stage fine-tuning process. The system begins with Supervised Fine-Tuning (SFT) on a curated dataset of performance-oriented code transformations, allowing the model to internalize canonical optimization patterns and system-level heuristics. It then applies Reinforcement Learning (RL) to refine its behavior based on direct runtime feedback, aligning generation policies with measurable performance signals and preferences. Finally, SysLLMatic integrates human and system feedback without explicit reward models, creating a more stable and interpretable optimization process.

These learning stages are guided by a profiling module that collects latency, energy, and resource metrics, and a pattern catalog that encodes reusable performance strategies. Together, they enable SysLLMatic to iteratively diagnose, refactor, and validate software in a closed optimization loop.

By integrating fine-tuned learning and runtime diagnostics, SysLLMatic bridges the gap between generative modeling and systems optimization, advancing toward autonomous, adaptive, and sustainable software performance improvement.

Keywords:

Machine Learning; Software Optimization; Reinforcement Learning; Code Generation

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

Mentor(s):

James C Davis (Engineering); Huiyun Peng (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7032

Presentation Time: STEW 214B at 11:00-11:20

Quantifying Circular Economy Progress Using NLP and Word Embedding Models: An Industry-Level Semantic Analysis STEM

Authors(s):

Aryav Gogia† (Engineering); Arin Joshi‡ (Walt Whitman High School)

Abstract:

The transition to a circular economy requires objective, data-driven indicators to evaluate firms' progress toward sustainable production and resource recovery. This research develops a computational framework to quantify circularity in industry reports using natural language processing and semantic modeling. Industry reports from the Food and Construction sector were collected and processed through a structured pipeline involving tokenization, lemmatization, and n-gram analysis to extract key terms associated with circular economy themes. Using Word2Vec embeddings trained on the processed corpus, we generated high-dimensional semantic vectors representing each word's contextual meaning. Pairwise similarity matrices and clustering techniques were then applied to identify linguistic patterns and thematic convergence across sub-sectors such as organic, frozen, retail, and canned foods and residential, materials, and non-residential construction. The resulting embeddings capture conceptual proximity between sustainability-related terms, allowing for the construction of interpretable indicators that measure circularity intensity in firms. This framework provides a scalable and generalizable methodology for assessing corporate sustainability communications, bridging machine learning with environmental economics. Future work will extend this approach to additional sectors and integrate temporal trend analysis to trace evolving circularity narratives across industries.

Keywords:

Circular Economy (CE); Closed-Loop System; Resource Efficiency; Life-cycle assessment (LCA); Product Circularity

Mentor(s):

Aparna Gupta (Rensselaer Polytechnic Institute)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7033

Presentation Time: STEW 214B at 11:20-11:40

Design and Simulation of a 4 Gbit/s Receiver analog front end for Chiplet Die-to-Die Interconnects STEM

Authors(s):

Dong Wang† (Engineering); Tzu Huan Chang‡ (Engineering)

Abstract:

This project presents the receiver-side design of a chiplet die-to-die interconnect channel operating at a 4 Gbit/s Non-return-to-Zero modulation data rate in 180 nm CMOS technology with a 1.8 V supply. The receiver maintains signal integrity across a channel using a passive continuous-time linear equalizer (CTLE), Cherry–Hooper amplifier, StrongARM slicer, and one-tap decision feedback equalizer (DFE). The passive CTLE provides high-frequency boost to compensate up to 13 dB of channel attenuation at Nyquist, while the Cherry–Hooper amplifier achieves 12 dB gain and extends bandwidth beyond 1 GHz. The StrongARM slicer performs high-speed data detection with a Clock-to-Q delay of 212.5 pSec, and the DFE cancels the first post-cursor tap. Simulation results show eye width improvement from 0.75 UI to 0.85 UI and peak-to-peak jitter reduction from 72.5 pSec (channel) to 42.5 pSec (after CTLE) and 62.5 pSec (after amplification). The receiver demonstrates stable 4 Gbit/s operation across process, voltage, and temperature variations, confirming suitability for short-reach chiplet interconnect applications.

Keywords:

[no keywords provided]

Mentor(s):

Seyedehmarzieh Rouhani (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7034

Presentation Time: STEW 214B at 11:40-12:00

Physical Modeling Placental Transfer of Small Molecule Drugs STEM

Authors(s):

Rhea Rakhra† (Engineering); Clayton Drook† (Engineering|JMHC);
Lourd Saba AbuHadid† (Engineering); Aakash Sanjay‡ (Engineering);
Sanika Sudhir Bane‡ (Engineering)

Abstract:

Testing how medications behave during pregnancy presents ethical and safety challenges, as pregnant women are often excluded from research due to fetal risk concerns. In vitro and model-based approaches, including physiologically based pharmacokinetic modeling, are used to study maternal physiology and fetal drug exposure. Many drugs cross the placenta; small, lipophilic, non-ionized molecules typically transfer by passive diffusion. This depends on molecular weight, protein binding, and maternal blood flow. Only the unbound fraction crosses membranes, making plasma protein binding critical. Albumin, a key plasma protein, binds many small molecules, and its decline during pregnancy can increase the unbound drug fraction, influencing fetal exposure.

We will examine how maternal albumin concentrations (0–60 g/L) affect small-molecule binding and penetration. Drug solutions will be incubated with albumin at 37 °C and processed by centrifugal ultrafiltration to separate bound and unbound fractions. Total and filtrate concentrations will be measured by HPLC to calculate the unbound fraction.

We hypothesize that higher albumin levels lower the unbound fraction and reduce penetration, clarifying how small molecules cross the placenta. Physiological changes, including decreased albumin, alter drug disposition, making this relationship critical for predicting fetal exposure and guiding dosing.

Pregnancy causes physiological changes that can increase the free, active form of drugs, influencing their distribution and clearance. Because only the unbound fraction crosses membranes, studying maternal albumin's effect is crucial for predicting fetal drug exposure and ensuring safe dosing during pregnancy.

Keywords:

Placental Transfer; Albumin Binding; Unbound Drug Fraction; Pregnancy; In Vitro Modeling

Mentor(s):

Arezo Ardekani (Engineering); Ryan B Wagner (Engineering)

Other Acknowledgement(s):

Harsa Mitra (Engineering)

Talk Presentation Abstract Number: 7035

Presentation Time: STEW 218A at 11:00-11:20

Sex Differences in Internalizing and Externalizing Symptoms in Toddlers with Autism.

STEM

Authors(s):

Rachel Marie Rieck† (HHS)

Abstract:

Background: Understanding sex differences in autism are key to improving diagnosis and support by recognizing how traits may vary between males and females. To date, several studies have examined sex differences in internalizing and externalizing (I-E) behaviors in autism and have reported inconsistent findings. Furthermore, it remains unclear how sex-based differences in arousal regulation may shape distinct I-E profiles. To address this gap, the current study examined the relationship between sex and I-E symptoms in toddlers with autism and the relationship between an eye-tracking index of arousal (pupil diameter) and I-E symptoms.

Methods: Participants included 94 autistic children (21 females) and 44 children with other developmental disabilities (18 females). We used the Child Behavior Checklist (CBCL), a caregiver-report measure of I-E symptoms and short eye-tracking assessment of resting pupil diameter to measure arousal.

Results: There were no statistically significant differences across sex for internalizing or externalizing symptoms in autism. Additionally, there was no statistically significant correlations between arousal levels (i.e., pupil diameter) and I-E symptoms for either sex. However, children with autism had significantly lower internalizing symptoms than children with other developmental disabilities.

Conclusions: Sex differences in internalizing and externalizing symptoms in those with autism are not present in early childhood. Thus, previously reported differences may emerge later in development. Additionally, patterns of I-E measures were not associated with our index of arousal. Future studies should focus on identifying the timing at which these I-E differences develop and the mechanisms underlying their emergence.

Keywords:

Autism; Internalizing; Externalizing; Arousal; Childhood

Mentor(s):

Brandon Keehn (HHS); Yesol Kim (HHS)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7036

Presentation Time: STEW 218A at 11:20-11:40

Seeds of Suffering: How Pesticides Harm Farmers and Cause Parkinson's Disease STEM

Authors(s):

Greeshma Manchikanti† (HHS)

Abstract:

Parkinson's disease (PD) is a progressive neurological disorder that has been increasingly linked to long-term exposure to pesticides used in agriculture. In India, many farmers depend on these chemicals to protect their crops, but they face higher risks of developing PD without proper safety equipment. This paper analyzes research from sources like The Lancet Neurology and the Journal of Movement Disorders to explore how pesticides such as paraquat and organophosphates can damage dopamine-producing neurons in the brain, leading to symptoms like tremors and stiffness. A meta-analysis of scholarly and popular studies is used to understand the biological effects of pesticide exposure and social and environmental factors that increase the danger for agricultural workers. This paper explores current research limitations, like limited data in rural areas, and also emphasizes the need for more government funding, stricter pesticide regulations, and better global awareness about farmer health. This topic holds personal meaning for me because my grandmother, who worked in the fields of Ramchandrapuram, India, was diagnosed with Parkinson's disease after years of pesticide exposure. Protecting the health of farmers is not only a matter of fairness but also necessary for the safety and stability of food systems worldwide.

Keywords:

Parkinson's Disease; Pesticide Exposure; India; Farmer Health

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7037

Presentation Time: STEW 218A at 11:40-12:00

Assessing Gait Stability at Variable Walking Speeds Using IMUs STEM

Authors(s):

Trevor James Fishert† (Engineering|JMHC); Mary Kathleen Schuht† (HHS); Andrew Joseph Rolofson† (Engineering|JMHC)

Abstract:

Traditional gait assessment methods often rely on laboratory-based motion capture systems, which, while precise, are limited by high cost, restricted environments, and reduced ecological validity. Inertial measurement units (IMUs) offer a portable, low-cost alternative capable of capturing gait dynamics across varied, real-world settings. As gait stability increasingly emerges as a critical indicator of functional mobility, especially in aging populations, the ability to quantify stride-to-stride variability with temporal resolution becomes essential. The Spatiotemporal Index (STI), originally developed in speech motor control research, provides a time-resolved measure of variability across normalized movement cycles. Unlike traditional discrete metrics, STI captures how variability fluctuates across the entire stride, highlighting specific gait phases where control demands may be elevated.

When applied to different walking speeds (conditions known to affect gait variability) STI enables detection of both global and phase-specific changes in motor control, supporting its potential as a sensitive tool for assessing gait stability in ecologically valid environments. Preliminary analysis of varied walking speeds in 10 college-aged subjects returned an average slow STI of 3.856 and an average fast STI of 3.864. While group-level differences in overall STI magnitude may be subtle, the measure reveals localized regions of elevated variability within the stride cycle that are undetectable with standard discrete metrics. This suggests that STI may provide enhanced sensitivity to early or context-specific gait instabilities by identifying where within the movement cycle control is more variable. Such temporal precision may support future efforts to characterize adaptive versus compensatory gait strategies and inform targeted interventions.

Keywords:

Gait Assessment; Inertial Measurement Units; Spatiotemporal Index; Walking Variability; Walking Speed

Mentor(s):

Jeffrey M Haddad (HHS)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7038

Presentation Time: STEW 218B at 11:00-11:20

Potential of Microbial Movement as Agnostic Biosignatures STEM

Authors(s):

Gretchen K Minich† (Science|JMHC)

Abstract:

The search for life beyond Earth requires knowledge of robust biosignatures. With such a diversity of potentially inhabited planetary environments in the Solar System, e.g., subsurface oceans on the Moons of Jupiter, it is prudent to develop strategies to detect life independent of chemical composition. Movement has been previously suggested to be a biosignature (Glaser, 1996; Nadeau, 2016; Nadeau, 2017). However, it is not yet understood whether living movement and non-living movement can be accurately distinguished. The purpose of this study is to investigate microscopic movement of life that can be definitively distinguished from abiotic movement. This study involves recording videos on a microscopic level of abiotic movement that could be detected on planets beyond Earth such as evaporation, melting, and vibration. In addition, videos depicting potentially distinct biotic movements of microbial life such as rotation and directional motion of single particles have been taken and compared to the captured abiotic motion. In collaboration with Johns Hopkins Applied Physics Laboratory, a computer program will be developed using velocity vectors of the motions to train the program to characterize motions as abiotic or biotic. The program will be tested utilizing videos taken in our lab and our collaborators' lab at Niagara University. We are currently developing the metrics that the program will use to evaluate potentially biotic or abiotic movements. The development and training of a program such as this could be utilized to analyze recorded data from a probe on a different planet to passively search for life.

Keywords:

Astrobiology; Microbiology; Abiotic Motion; Biosignatures; Extraterrestrial Life

Mentor(s):

Ben K D Pearce (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7039

Presentation Time: STEW 218B at 11:20-11:40

**Predictors of Disease Features and Severity in
Mycobacterium Avium Complex Lung Disease
STEM**

Authors(s):

Aadya Pandey† (Science)

Abstract:

[Abstract Redacted]

Keywords:

Mycobacterium Avium Complex; Non-Tuberculosis Mycobacterial Infections; Cavitory Lung Disease

Mentor(s):

Patricio Escalante (Mayo Clinic)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7040

Presentation Time: STEW 218B at 11:40-12:00

Advances in Monte Carlo Tree Search for Multi-Step Enzymatic Synthesis Planning STEM

Authors(s):

Danny Andre Thornewell† (Science)

Abstract:

The complexity of natural product analogs and synthetic molecules can complicate the development of practical synthesis routes. Nature provides inspiration for solving this challenge, as enzymes can perform highly specific transformations under mild conditions, enabling sustainable manufacturing. Scientists can use retrosynthesis to plan enzymatic routes by working backwards from a target molecule, sequentially breaking it down based on known enzymatic reactions until commercially available building blocks are identified. Computer-aided synthesis planning (CASP) tools such as RDEnzyme can automate this process and fully harness enzymes' synthetic capabilities. However, as a single-step tool requiring manual input for each subsequent step, RDEnzyme requires significant expert guidance for multi-step pathway planning. This recursive application creates a combinatorial explosion of possibilities, making navigation of this vast chemical space impractical. To address this, we developed a Monte Carlo Tree Search (MCTS) algorithm to automate multi-step enzymatic retrosynthesis. MCTS explores the search space through repeated cycles of selection, expansion, simulation, and backpropagation, probabilistically balancing the exploration of new reactions with the exploitation of promising routes. The tool successfully recovers published routes while proposing chemically plausible alternatives. Building on this foundation, we introduce methodological extensions aimed at improving both search efficiency and pathway quality. These include a graph-based search structure to reduce redundant computation and new cheminformatics-driven heuristics that incorporate biochemical similarity and feasibility metrics to guide the search toward more plausible transformations. Together, these developments move toward a more automated, scalable, and biologically informed framework for CASP, supporting the discovery of sustainable and experimentally relevant reaction pathways.

Keywords:

Enzymatic Retrosynthesis; Monte Carlo Tree Search (MCTS); Drug Synthesis; Computational Chemistry

Mentor(s):

Olga Costa Alves Souza (Agriculture); Karthik Sankaranarayanan
(Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7041

Presentation Time: STEW 218C at 11:00-11:20

Flora Candle Company Marketing Research

Business Case Study

Authors(s):

Ethan James MacKinnon† (DSB); Emeline Marie Papp† (DSB); Sydney Jo Muller† (DSB); Andrew Thomas Gheen† (DSB)

Abstract:

This marketing research project is focused on Flora Candle Company. This company specializes in their fragrance products, specifically eco-friendly candles. There are many issues that boutique brands face and the one we will be focusing on is the limited brand awareness that they face in the local market. The objectives discussed in this research include identifying and profiling target market segments within Lafayette and West Lafayette, determining Flora Candle Company's key differentiators compared to competitors like Antique Candle Company, and analyzing customer behavior through measures like satisfaction levels, purchasing patterns, and retention rates. The study gives actionable insights to improve the brand positioning, customer loyalty, and marketing strategies of the Flora Candle Company.

Keywords:

[no keywords provided]

Mentor(s):

Erin Alkire Britton (DSB)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7042

Presentation Time: STEW 218C at 11:20-11:40

Use of Ephemeral Messages in Online Transactions STEM

Authors(s):

donna Prince† (Science)

Abstract:

Ephemeral content like disappearing messages and stories have changed online communication by focusing on quick, personal, and temporary interactions. While these features can make communication feel more private and spontaneous, they may also open new paths for deception when used in online scams. This study examines how temporary digital messages affect user perception, emotion, and behavior in adversarial settings. Grounded in Cialdini's principles of persuasion, the research explores how limited visibility and social pressure shape users' responses to potential scams.

A preliminary survey (N = 25) was conducted with social media users to understand their experiences with ephemeral scam messages, the tactics they observed, and how they reacted. Early responses show that most participants encountered scams on social media platforms such as Instagram, Facebook, and WhatsApp, often involving fake giveaways, impersonation, or romance schemes. Urgency and scarcity were the most common persuasive tactics, frequently tied to disappearing messages that made users feel rushed to decide. Most chose to block or report the sender, though several mentioned confusion or difficulty verifying what they had seen once it disappeared.

Initial patterns suggest that ephemeral design makes it harder to judge credibility, amplifying emotional pressure and persuasive effects. Overall, this work calls for a deeper focus on the human experience of ephemeral communication, how limited visibility, pressure, and uncertainty shape trust and influence user behavior online.

Keywords:

Social Media Deception; Online Scams; Ephemeral Content; Persuasion; User Behavior/Perception

Mentor(s):

Tatiana Ringenberg (Polytechnic)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7043

Presentation Time: STEW 218C at 11:40-12:00

STRUCTURAL PERFORMANCE RESTORATION OF FIBER-REINFORCED COMPOSITE PATCH REPAIR FOR STEEL BRIDGE GIRDERS STEM

Authors(s):

Caden Cole Cowlest† (Polytechnic)

Abstract:

Composite materials have recently gained traction in infrastructure repairs and strengthening within the construction industry due to their high strength-to-weight ratio, stiffness, and ease of application.

Traditional repair methods of repairs include either replacing the entire beam or applying composites following the shape of the damage, both repairs can be time extensive, intrusive, and shut down traffic over the bridge. In this study, fiber reinforced composite patch repairs, often used for aerospace or automotive repairs, will be implemented and demonstrated for bridge girder repairs. Composite patch repairs are bonded to test specimen fabricated with machined sections to replicate corrosion damage, these specimens are then put under compressive testing along with a control specimen to understand the performance of the composite patches. Throughout this study different composite patch repair methods are explored such as ply number, ply orientation, and bonding methods. These test specimens will be repaired with composite patches designed to align fiber direction with the primary compressive stress path, augmenting the strength. Finite Element Analysis (FEA) is employed to generate predictive models of compressive behavior, while experimental testing is performed under comparable loading conditions to validate numerical results. This research aims to investigate how the use of composite patches restore the mechanical properties of the damaged test specimen. By correlating FEA predictions with experimental results, the study evaluates how the bonding technique and ply configuration influence the mechanical property recovery of the test specimen.

Keywords:

Finite Element Analysis (FEA); Fiber Reinforced Composite Patch Repairs; Bonding; Optimization; Structural Properties Recovery

Mentor(s):

Garam Kim (Polytechnic)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7044

Presentation Time: STEW 218D at 11:00-11:20

Researching the Caretakers' Cottage in Grand View Cemetery Social Science

Authors(s):

Rylie Lynn Knobel† (Engineering|JMHC)

Abstract:

This project, in collaboration with the Department of Development in the City of West Lafayette, Indiana, was meant to research, document and share the history of specific heritage sites in the West Lafayette area. The heritage site that I specifically researched was the Caretakers Cottage in Grand View Cemetery within the context of park style cemeteries. Information for this research project came from online research articles, so that I could better understand how the invention and growth of park style cemeteries could have influenced the construction of Grand View and the use of the Caretaker Cottage, as well as the newspaper archive within Newspapers.com so I could find information about the cottage throughout time. I also found information for my research project through the Tippecanoe County Historical Archives. While conducting this research, I was able to find a link between the first park style cemetery and Grand View, the inspiration behind the architecture of the cottage, as well as who has had ownership of the cottage over the years. The Caretakers Cottage is an incredibly significant facet to the West Lafayette area and should continue to be protected by the community.

Keywords:

Grand View Cemetery; Cemetery; Park; Restoration; Prior

Mentor(s):

Ashima Krishna (JMHC)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7045

Presentation Time: STEW 218D at 11:20-11:40

Researching One-Room Schoolhouses and the Preservation of the Morris Schoolhouse Social Science

Authors(s):

Norah Miller† (Science|JMHC)

Abstract:

This project investigates the Morris Schoolhouse in Tippecanoe County, Indiana, and places it within the broader context of one-room schoolhouses in the United States and Indiana. It explores how rural schoolhouses greatly influenced both education and community in the 18-1900s. Conducted research involved archival materials from the Tippecanoe County Historical Association, the West Lafayette Public Library, and Purdue Archives, as well as digitally preserved newspapers and on-site visits to the now restored Morris Schoolhouse. Interviews with individuals involved in the schoolhouse's preservation aided in bringing a deeper look into the school's cultural and historical significance.

This research demonstrates how preserving sites like the Morris Schoolhouse helps to strengthen community engagement as well as public understanding of local history. The project's findings will be presented as a written narrative and interactive Story Maps page to make this history accessible to a wider audience and demonstrate the importance of historic preservation in a local context

Keywords:

Schoolhouse; Education; Indiana; Restoration; Preservation

Mentor(s):

Ashima Krishna (JMHC)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7046

Presentation Time: STEW 218D at 11:40-12:00

The Language of Stalinist High Politics

Humanities

Authors(s):

Isidore Peter White† (Liberal Arts)

Abstract:

Many historians have studied the use of Russian throughout the Soviet Union during the Stalin-era. This includes the implementation of Russian in schools as a form of “Russification” likened to the imperialism of the Czarist period, as well as the specific way in which Soviet citizens were expected to speak, referred to by Stephen Kotkin as “speaking Bolshevik.” However, little research has been done on the nature of language at the upper echelons of Soviet government. Researching language at the highest levels of Soviet power differs substantially from similar studies of, for example, the way upper-class English developed in the British Empire, as researchers such as Leith Dick and Geoff Lindsey have done. This is because the Stalinist leadership, despite speaking Russian, hailed from a variety of linguistic backgrounds across the former Russian empire, and was, for the most part, lacking in higher education. This study examines telegrams sent between members of the Central Committee and other regional leaders between 1924 and 1932. It argues that the Stalinist leadership sought to display traditional markers of legitimacy, such as the highly bureaucratic language of the Czarist period, while also signaling its 'Bolshevik virtues' through the use of lower-class vernacular, Marxist terminology, and, when pertinent, a passive aggressive tone reminiscent of the writings of Lenin and later Stalin himself. This research has implications for our understanding of how Soviet Russian differs from other languages in its role as a prestige dialect during the Stalin era.

Keywords:

Soviet Union; Prestige Dialect; Stalinism

Mentor(s):

Olga Lyanda-Geller (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7047

Presentation Time: STEW 214A at 12:00-12:20

Design of Electrically Small Dielectric Resonator Antennas STEM

Authors(s):

Jack Thomas Willard† (Engineering|JMHC)

Abstract:

Electrically small antennas (ESAs) continue to receive attention as their compact size and high directivity are useful for size constrained applications. An ESA is defined by Wheeler's criterion as a device where the product of the radius of the circumscribing sphere and wave number at the operating frequency is less than one. These are commonly constructed using metallic radiators; however, the complexity of these architectures places a ceiling on their performance. This prompts the design of alternative antennas including electrically small dielectric resonator antennas (ESDRAs). This research seeks to expand on existing ESDRA research by characterizing a new antenna structure. The initial phase of this research consists of designing of a feeding network to an ESDRA while preserving its radiation pattern. This will take place in Ansys High Frequency Simulation Software (HFSS). After completion of this, the designs will be sent for fabrication. In the future, the design will be characterized in an anechoic chamber, to validate the performance and compare the measured and simulated results.

Keywords:

Antenna; RF

Mentor(s):

Alex David Santiago Vargas (Engineering); Ahmed Abdelraheem (Purdue University); Dimitrios Peroulis (Purdue University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7048

Presentation Time: STEW 214A at 12:20-12:40

Trusted Tech in Motion: Building AI for Space & Maritime Domain Awareness STEM

Authors(s):

Lucia Aurora Morton† (Engineering)

Abstract:

In an era characterized by geopolitical complexity and rapidly accelerating technical capabilities, trusted technology, particularly with regards to artificial intelligence (AI), serves as the strategic backbone to global cooperation and democratic resilience. AI is quickly emerging as a critical tool for meeting national security demands.

Space Domain Awareness (SDA) and Maritime Domain Awareness (MDA) are two key issue areas that demand real-time tracking, anomaly detection, and predictive modeling at scale. While orbital congestion continues to intensify and maritime activities grow more unpredictable, building reliable frameworks for quickly interpreting empirical data becomes increasingly more crucial for protecting both critical infrastructure and international relationships.

A preliminary assessment was conducted to analyze both the shared and divergent machine learning (ML) techniques for object identification and tracking in SDA and MDA applications. The work aims to quantify performance metrics for AI-driven solutions across domains and normalize results for determining representative technology readiness levels (TRL) for a variety of techniques. The ultimate goal for the project is to uncover the regulatory considerations that may emerge when deploying AI-systems between orbital and maritime domains and contextualizing them in the current development status of the existing technology.

Keywords:

Trusted Tech; Space Debris; Maritime Security; Artificial Intelligence; Machine Learning

Mentor(s):

Eric Waltenburg (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7049

Presentation Time: STEW 214A at 12:40-1:00

Characterizing Glycogen Metabolism in Cyanobacteria During Light-Dark Cycles STEM

Authors(s):

Emily Lucille Richardson† (Engineering|JMHC)

Abstract:

Cyanobacteria are photosynthetic microorganisms that play a major role in global carbon cycling by converting carbon dioxide into biomass. Their ability to store carbon in the form of glycogen allows them to maintain energy balance during dark periods when photosynthesis stops. This project explored how glycogen levels change across a 14-hour light and 10-hour dark cycle to better understand how these organisms manage their energy under naturally shifting conditions. Glycogen was measured through an enzymatic assay that breaks down glycogen into glucose and converts it into a measurable colored compound, with absorbance recorded at 460 nm. Experiments were performed under controlled light and temperature conditions to support consistent results. The data showed a clear increase in glycogen during the light period and a gradual decrease during the dark and even the first few hours of light, due to the dependence on stored energy before photosynthesis was fully restored. These results support the idea that cyanobacteria use glycogen dynamically rather than as a passive reserve. Understanding how these cells allocate carbon between storage and growth helps explain how they adapt to environmental changes and can inform strategies to improve growth efficiency in biotechnological and industrial settings.

Keywords:

[no keywords provided]

Mentor(s):

John A Morgan (Engineering); Isaac John Timmer (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7050

Presentation Time: STEW 214B at 12:00-12:20

I2C Integration and Validation on a RISC-V SoC STEM

Authors(s):

Andy Hanjun Hu† (Engineering); Jash Snehal Pola‡ (Engineering); Anna Z Dalton† (Engineering); Fatma Mohamed Ahmed Youssef Alagroudy* (Engineering); Yara Ahmed Mohamed Abbas* (Engineering)

Abstract:

Inter-integrated Circuit (I2C) is a commonly used serial communication protocol that allows one controller device to communicate with multiple target devices. Some of its benefits over other interfaces include simpler wiring and low cost. The addition of an I2C controller module will enable connection between the AFTx08 microcontroller and large off-chip memories or sensor devices, significantly increasing its functionality in embedded applications.

The existing I2C implementation was found to have significant errors, such as incorrect acknowledgement logic and unstable data transmission, which are not compliant with universal I2C specifications and could prevent reliable communication. To accommodate for these errors, the team has worked on updating the I2C controller design, by specifying design parameters specific to the system and creating RTL diagrams to demonstrate correct data transmission logic. After finalizing design specifications, the team began writing RTL code and creating testbenches to verify that the design functioned as planned.

After debugging known issues, full simulation verification will be performed to ensure stable communication and error handling for a wide range of test cases. In order to validate the design in hardware, the team will create an FPGA-based test environment and evaluate similar test cases. Finally, the controller module will be integrated with the AFTx08 chip and additional hardware testing will be performed.

Keywords:

I2C; System on Chip; RISC-V; Verification; FPGA

Mentor(s):

Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7051

Presentation Time: STEW 214B at 12:20-12:40

Physical Modeling Placental Transfer of Small Molecule Drugs STEM

Authors(s):

Aakash Sanjay† (Engineering); Sanika Sudhir Banet† (Engineering);
Rhea Rakhra‡ (Engineering); Clayton Droom‡ (Engineering|JMHC);
Lourd Saba AbuHadid‡ (Engineering)

Abstract:

Testing how medications behave during pregnancy presents ethical and safety challenges, as pregnant women are often excluded from research due to fetal risk concerns. In vitro and model-based approaches, including physiologically based pharmacokinetic modeling, are used to study maternal physiology and fetal drug exposure. Many drugs cross the placenta; small, lipophilic, non-ionized molecules typically transfer by passive diffusion. This depends on molecular weight, protein binding, and maternal blood flow. Only the unbound fraction crosses membranes, making plasma protein binding critical. Albumin, a key plasma protein, binds many small molecules, and its decline during pregnancy can increase the unbound drug fraction, influencing fetal exposure.

We will examine how maternal albumin concentrations (0–60 g/L) affect small-molecule binding and penetration. Drug solutions will be incubated with albumin at 37 °C and processed by centrifugal ultrafiltration to separate bound and unbound fractions. Total and filtrate concentrations will be measured by HPLC to calculate the unbound fraction.

We hypothesize that higher albumin levels lower the unbound fraction and reduce penetration, clarifying how small molecules cross the placenta. Physiological changes, including decreased albumin, alter drug disposition, making this relationship critical for predicting fetal exposure and guiding dosing.

Pregnancy causes physiological changes that can increase the free, active form of drugs, influencing their distribution and clearance. Because only the unbound fraction crosses membranes, studying maternal albumin's effect is crucial for predicting fetal drug exposure and ensuring safe dosing during pregnancy.

Keywords:

Placental Transfer; Albumin Binding; Unbound Drug Fraction; Pregnancy

Mentor(s):

Arezo Ardekani (Engineering); Ryan B Wagner (Engineering)

Other Acknowledgement(s):

Harsa Mitra (Engineering)

Talk Presentation Abstract Number: 7052

Presentation Time: STEW 218A at 12:00-12:20

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 γ -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 $\mu\text{g/mL}$ 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)

Mentor(s):

Matthew Louis Scarpelli (HHS)

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

Other Acknowledgement(s):
Anukrishna Radhakrishnan (HHS)

Talk Presentation Abstract Number: 7053

Presentation Time: STEW 218A at 12:20-12:40

Bridging Small Businesses and Community Health: The Case for Recovery-friendly Workplaces in the North Central Region STEM

Authors(s):

Sai Geethanjal Koduru† (HHS); Olivia K Williams* (Agriculture)

Abstract:

The purpose of this study was to develop a paper and presentations to educate Extension educators and small businesses on the benefits and considerations of becoming a Recovery Friendly Workplace (RFW), specifically in the North Central Region of the United States (NCR). Substance Use Disorder (SUD) is pervasive across the nation, especially in the NCR, affecting communities economically and socially. Simultaneously, small businesses in the region face persistent staffing shortages and high employee turnover. This study reconciles these two challenges by providing evidence that small businesses adopting recovery-friendly policies as a mutually beneficial solution.

A comprehensive literature review was conducted using Google Scholar and PubMed, supplemented by data analysis from the SAHMSA National Survey on Drug Use and Health (NSDUH) and the NCR-STAT database's Baseline 2024 Survey and 2024 Small Business Survey. The Baseline Survey captures household-level economic and social data like health status, quality of life, and income. The Small Business Survey focuses on small business owners' challenges, policies, and attitudes related to mental health and substance misuse. Data were analyzed in Excel and Stata to provide regionally relevant recommendations.

Findings show recovery-friendly workplaces offer clear economic, social, and health benefits. Even at minimal cost, they can benefit both those in recovery and businesses by increasing employment, reducing turnover, and providing social systems that support sustained recovery. Therefore, small businesses should consider adopting recovery-friendly policies for their own economic gain and community well-being.

This study also provides a semi-comprehensive list of regional, state-specific, and Extension-based recovery-friendly workplace toolkits.

Keywords:

Recovery-Friendly; Substance Abuse; Addiction Recovery; Small Businesses; Economic Policies

Mentor(s):

Nicole Adams (Centers & Institutes); Michael D Wilcox (Agriculture)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7054

Presentation Time: STEW 218A at 12:40-1:00

Rooted in Wellness

Social Science

Authors(s):

Denice Arriane Guillot† (HHS)

Abstract:

The proposal Promotion of Greenery in Public Settings investigates how increasing access to natural environments can enhance overall well-being, particularly in the context of growing urbanization in the United States. Over the past century, rapid industrial and residential development has replaced much of the nation's green space with concrete infrastructure, leading to higher levels of stress, pollution, and social disconnection. As cities continue to expand, the absence of natural spaces has been shown to negatively impact both mental and physical health. This project aims to explore how reintroducing greenery, through parks, community gardens, trails, and fountains, can restore balance and promote a healthier society. A combination of scholarly research, environmental reports, and popular sources was analyzed to examine the connection between greenery and the eight dimensions of well-being: physical, mental, intellectual, financial, social, environmental, occupational, and spiritual. Findings demonstrate that green spaces reduce anxiety, encourage physical activity, foster social interaction, and promote cognitive growth. Additionally, exposure to nature strengthens spiritual and emotional well-being by creating a sense of peace and belonging often lost in urban environments. Results strongly support the hypothesis that greater access to greenery positively influences all areas of well-being, with the most significant effects seen in spiritual, social, mental, and physical health. The study concludes that integrating more greenery into urban planning could counteract the negative consequences of excessive urbanization and significantly improve the quality of life across communities nationwide.

Keywords:

Greenery

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7055

Presentation Time: STEW 218B at 12:00-12:20

Unprotected Lefts and Merges: Evaluating Classical vs. Learned Planners in Rare Traffic Interactions STEM

Authors(s):

Sofi Zhang Schmitt† (Engineering); Siddhant Monish Tandale† (Engineering); Milica Slavkovic† (Science|JMHC); Akul Goyal† (Engineering)

Abstract:

Autonomous vehicles must plan and follow safe, human-like trajectories in complex traffic scenarios such as unprotected left turns and highway merges. This project investigated how classical path planning algorithms (Hybrid A*, RRT*) compared to real human driving behavior captured in Argoverse 2 and INTERACTION, two large-scale, real-world motion datasets. These datasets served as behavioral references, reflecting how human drivers negotiate gaps, yield, and merge under real traffic conditions in the USA, EU, and China.

The Path Planning sub-team generated trajectories offline and analyzed existing dataset scenarios to evaluate if classical planners can replicate realistic, safe, and rule-compliant motion patterns. Each planned trajectory was compared to human data using metrics such as Average Displacement Error (ADE) and Final Displacement Error (FDE), and qualitative measures like smoothness and off-road percentage.

The Control sub-team then tested the feasibility of these planned trajectories in simulation. Using Model Predictive Control (MPC), they simulated how autonomous vehicles would follow the paths generated by the planners. Their goal was to evaluate how accurately and safely the vehicle could track generated paths, measuring steering stability, acceleration smoothness, and tracking error.

Collectively, these two components form a complete workflow: planning determines “where” the vehicle should go, and control ensures it can “follow” that path safely. The final integrated simulation visualized both components, showing how different planners perform in realistic driving conditions. It was identified which planning and control strategies produce the most human-like, feasible, and safe driving behavior, contributing to the reliability and trustworthiness of autonomous vehicles in everyday traffic.

Keywords:

Autonomous Vehicles; Path Planning; Motion Control; Unprotected Left Turns; Highway Merging

Mentor(s):

Samuel Labi (Engineering); Reed Joseph Freer (Engineering); Andres Felipe Hoyos Moreno (Engineering); Richard Osita Ajagu (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7056

Presentation Time: STEW 218B at 12:20-12:40

Unprotected Lefts and Merges: Evaluating Classical vs. Learned Planners in Rare Traffic Interactions STEM

Authors(s):

Milica Slavkovic† (Science|JMHC); Jacob Junjie Zhang† (Engineering);
Diya Meeniga† (Science)

Abstract:

Autonomous vehicles must plan and follow safe, human-like trajectories in complex traffic scenarios such as unprotected left turns and highway merges. This project investigated how classical path planning algorithms (Hybrid A*, RRT*) compared to real human driving behavior captured in Argoverse 2 and INTERACTION, two large-scale, real-world motion datasets. These datasets served as behavioral references, reflecting how human drivers negotiate gaps, yield, and merge under real traffic conditions in the USA, EU, and China.

The Path Planning sub-team generated trajectories offline and analyzed existing dataset scenarios to evaluate if classical planners can replicate realistic, safe, and rule-compliant motion patterns. Each planned trajectory was compared to human data using metrics such as Average Displacement Error (ADE) and Final Displacement Error (FDE), and qualitative measures like smoothness and off-road percentage.

The Control sub-team then tested the feasibility of these planned trajectories in simulation. Using Model Predictive Control (MPC), they simulated how autonomous vehicles would follow the paths generated by the planners. Their goal was to evaluate how accurately and safely the vehicle could track generated paths, measuring steering stability, acceleration smoothness, and tracking error.

Collectively, these two components form a complete workflow: planning determines “where” the vehicle should go, and control ensures it can “follow” that path safely. The final integrated simulation visualized both components, showing how different planners perform in realistic driving conditions. It was identified which planning and control strategies produce the most human-like, feasible, and safe driving behavior, contributing to the reliability and trustworthiness of autonomous vehicles in everyday traffic.

Keywords:

Autonomous Vehicles; Path Planning; Motion Control; Unprotected Left Turns; Highway Merging

Mentor(s):

Samuel Labi (Engineering); Andres Felipe Hoyos Moreno (Engineering); Reed Joseph Freer (Engineering); Richard Osita Ajagu (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7057

Presentation Time: STEW 218B at 12:40-1:00

SMART Cities Audio Sentiment Analysis Model for PASER Asphalt Grading Creative

Authors(s):

Yaduvir Singh† (Science); Mohit Sachin Ambet‡ (Science)

Abstract:

This study presents a machine learning framework for the automated classification of road condition assessments into standardized PASER (Pavement Surface Evaluation and Rating) categories. The objective is to leverage natural language processing (NLP) and speech-to-text technologies to enhance the efficiency, objectivity, and scalability of municipal infrastructure evaluation processes.

Field assessment data were initially collected as MP3 audio recordings and subsequently transcribed into text using Whisper, OpenAI's state-of-the-art automatic speech recognition model. The transcriptions were curated and labeled according to PASER categories. Text preprocessing included noise reduction, tokenization, and vectorization using a term frequency-inverse document frequency (TF-IDF) representation with trigrams, sublinear term frequency scaling, and stop-word removal. A Logistic Regression classifier with L2 regularization, balanced class weighting, and the saga solver was trained on 80% of the dataset and validated on the remaining 20%. Model performance was evaluated using accuracy, precision, recall, F1-score, and confusion matrix analysis.

The optimized model achieved high validation accuracy with balanced performance across classes. Retraining on the full corpus enabled robust predictions on unseen data, generating probabilistic confidence scores for each PASER label.

This research demonstrates the viability of integrating automatic speech recognition with NLP-based classification for infrastructure assessment. The proposed framework reduces human subjectivity and labor requirements while providing a scalable foundation for multimodal systems that incorporate geospatial, visual, and sensor-based data in future smart infrastructure management.

Keywords:

Machine Learning; PASER; Sentiment Analysis; Logistic Regression; Infrastructure

Mentor(s):

Nikkhil Vijaya Sankar (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7058

Presentation Time: STEW 218C at 12:00-12:20

Piano Playing Passwords

STEM

Authors(s):

Andrew H Ngo† (Polytechnic)

Abstract:

Fingerprints can be forged from imprinted marks left on an object, and Face ID can be bypassed through realistic 3D masks. These are examples of traditional biometric authentication methods that rely on unique attributes yet can easily be replicated. On the other hand, during the process of learning, skillsets begin to be harder to distinguish from others. Currently, many studies have developed technological systems that can analyze these techniques. Specifically with the piano, keystroke dynamics (key to key timing) achieved a 94.6% recognition accuracy, while behavioral typing (playing style) demonstrated a 99.4%. This project reports on how pianists can utilize their skills to play certain songs, allowing authentication based on their playing style. By connecting a piano to a system, each combination of notes can be converted into raw data. Then, the system matches the raw data with the preset song, checking if it has been properly replicated. This authentication method not only relies on a person's capabilities, but also utilizes their memory, similarly to how a password needs to be retained. However, while more playing experience determines how secure and accurate the password can be, the behavior traits of playing music are specific to everyone. This study will demonstrate an alternative method for user authentication via piano, only granting access when an individual's playing style is recognized.

Keywords:

Piano; Biometrics; Authentication; Password; Skills

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7059

Presentation Time: STEW 218C at 12:20-12:40

Thermomechanical Stress Prediction and Validation in Modular Additively Manufactured Fiber-Reinforced Composite Tooling with Adhesive Bonding STEM

Authors(s):

Paul Kyu-Hwan Park† (Polytechnic)

Abstract:

3D-printed fiber-reinforced composites are increasingly used for tooling applications because they offer customizable and rapid fabrication while generating less material waste than traditional metallic tools. However, the build volume of the print bed restricts tool size, necessitating modular tooling, where multiple printed sections are combined to achieve larger geometries. Adhesive bonding is widely employed for this purpose, and the structural and thermal integrity of modular tools depends strongly on adhesive performance at elevated temperatures. The anisotropy of 3D-printed composites, arising from differences in the print, transverse, and stacking directions, produces mismatches in coefficients of thermal expansion (CTE) both within the printed material and at adhesive interfaces. Under thermal cycling, these mismatches create localized stresses at bondlines, which can accelerate thermal degradation, interfacial damage, or delamination, ultimately compromising tool reliability. To study these effects, thermomechanical analysis and finite element analysis (FEA) was applied to predict deformation and interfacial stresses under thermal loading and validated the models by exposing printed specimens to controlled thermal cycles and comparing experimental measurements with simulations. This work examines the coupled influence of adhesive type, bondline thickness, and printing orientation on the thermomechanical response of bonded modular tools, providing a validated framework for optimizing design parameters to minimize failure under thermally demanding conditions.

Keywords:

Adhesive Bonding; 3D-Printed Composites; Modular Tooling; Fiber-Reinforced Composites; Additive Manufacturing

Mentor(s):

Garam Kim (Polytechnic); Eduardo Barocio Vaca (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7060

Presentation Time: STEW 218C at 12:40-1:00

Evaluating Community Involvement Efficacy in the Adoption of Airport Noise Mitigation Programs STEM

Authors(s):

Rhea Dutta† (Engineering|JMHC); Joao Pedro Biondo Perest† (Polytechnic); Oleksandr Sergey Crowell† (Polytechnic)

Abstract:

The management of noise stemming from airport operations has been at the center of regulatory efforts aimed at balancing airport expansion with both environmental and community impacts. This study evaluates the effectiveness of community involvement in creating and implementing noise mitigation programs. It explored the methods through which airports are adopting federal regulations, established by agencies such as the Federal Aviation Administration (FAA), and implementing initiatives, such as Noise Compatibility Programs (NCPs) and Noise Exposure Maps (NEMs). Specific attention was applied to the community involvement aspects of these processes. Five airports were established as case studies for gaining insights into implemented programs and regulations. The airports, each representing a different airport classification, are Akron-Canton Regional Airport (CAK, Non-Hub); Westover Metropolitan Airport (CEF, Regional-Hub); Fresno Yosemite International Airport (FAT, Small-Hub); Indianapolis International Airport (IND, Medium-Hub); and Seattle-Tacoma International (SEA, Large-Hub). The findings show that noise abatement NCPs, such as preferential runway adoption and noise insulation for schools and residential areas, showed the most efficacy. Furthermore, iterative engagement with communities to evaluate noise procedure effectiveness, through outreach workshops and stakeholders' meetings, has been shown to fuel shared understanding and alignment around noise management strategies.

Keywords:

Airport Noise Mitigation; Community Involvement; Noise Exposure Maps

Mentor(s):

Caroline Kathure Marete (Polytechnic)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7061

Presentation Time: STEW 218D at 12:00-12:20

Chekhov's Literal and Cultural Legacy in Viet Nam

Humanities

Authors(s):

Tran Nguyet Anh An† (Polytechnic|JMHC)

Abstract:

This project examines the literary and cultural legacy of Anton Chekhov through a comparative study of his influence on both Vietnamese and Russian literary traditions in the twentieth century. Focusing particularly on Vietnamese literature during the first Indochina War, the study analyzes how Chekhov's narrative style, thematic depth, and psychological realism were adapted by writers in Vietnam to reflect local social and historical conditions. The research involves close reading and textual comparison of Chekhov's original Russian works with Vietnamese authors' works that were influenced by him, as well as secondary analyses of scholarly journals and literary criticism. The project seeks to uncover how Chekhov's exploration of human emotion, moral ambiguity, and social transformation resonates across cultural contexts, offering insight into the shared and divergent human experiences represented in Russian and Vietnamese literatures.

Keywords:

Russian Literature; Comparative Literature; Asian Studies; Linguistics; Chekhov

Mentor(s):

Olga Lyanda-Geller (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7062

Presentation Time: STEW 218D at 12:20-12:40

IL-21 delivery to lymph nodes via albumin complexation for vaccine applications STEM

Authors(s):

Rosalyn S Chu† (Science|JMHC)

Abstract:

Influenza (flu) viruses undergo frequent mutations, causing current flu vaccines to require frequent boosters. We aim to develop a universal flu vaccine that can protect from more variants of flu viruses. Interleukin-21 (IL-21) is shown to promote B cell proliferation into long-lived plasma cells in the germinal center of the lymph node. We hypothesize that IL-21 can act as an adjuvant to enhance cross reactivity to flu variants and the duration of antibody responses. To enhance the drainage of IL-21 to the lymph nodes, we neutralize its positive charge by complexing it with albumin. Initial tests were conducted with lysozyme as a model of IL-21. The lysozyme/albumin complex exhibited a z-average of < 50 nm and slightly negative charge of > -4 mV, suitable for lymph node drainage. Using fluorescence imaging, a Cy7-lysozyme/albumin complex was shown to drain to the popliteal lymph node upon footpad injection in mice. Like the model lysozyme/albumin, an IL-21/albumin complex exhibited a small z-average of < 30 nm. The IL-21/albumin complex is currently being tested in mice as an adjuvant to a flu vaccine. This complex may improve immune response to flu vaccines and reduce the need for repeated boosters.

Keywords:

Vaccine; Adjuvant; Immune Response; Influenza

Mentor(s):

Yanying He (Pharmacy); yoon Yeo (Pharmacy)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7063

Presentation Time: STEW 218D at 12:40-1:00

The Pink Foundation - Consumer Behavior Project Business Case Study

Authors(s):

Chloe Maureen Newman† (DSB); Alexis Joy Roberts† (DSB); Advaitika Badruka† (DSB); Katherine Mary Kaizer† (DSB); Carson Anderson Ollila‡ (DSB); Brooke Regina Evans‡ (DSB)

Abstract:

This research applies consumer behavior theories to understand the motivations driving engagement with The Pink Team Foundation, a nonprofit dedicated to increasing awareness of children in need and distributing funds to impactful organizations that support vulnerable children's education, health services, and stable housing.

The study employs a multi-theoretical framework, including values segmentation theory (using means-end chains), social identity theory (examining stakeholder self-concept reinforcement), the identifiable victim effect (demonstrating stronger emotional responses to individual child stories versus statistics), and the 5 Ps of fundraising model (pride, pity, personal interest, pleasure, and PR). Dual-processing decision-making models are used to analyze both emotional heuristics and deliberative evaluation processes across stakeholder segments.

Findings indicate that individual donors respond most strongly to specific children's stories through the identifiable victim effect, with the pleasure of giving as the primary motivator. Corporate partners engage through values alignment and reputation enhancement, while volunteers demonstrate intrinsic motivation to make meaningful contributions to children's welfare.

Trust formation follows dual routes requiring both emotional appeals and transparency in fund distribution effectiveness. Messaging should emphasize individual stories over statistics, leverage social proof, and demonstrate transparent fund allocation. Brand positioning must highlight the Foundation's trusted intermediary role, while authentic storytelling fosters lasting stakeholder commitment to supporting vulnerable children globally.

Keywords:

Motivation; Emotional; Fundraising; Intrinsic

Mentor(s):

Stephen R Leitch (DSB)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7064

Presentation Time: STEW 214A at 1:00-1:20

Discoverability for LLM Agents STEM

Authors(s):

Parv Kumart (Engineering); Lavangi X Yadavatt (Science); Rohan S Pottatt (Science); Zackary Pieter Homricht (Engineering); Omar Ahmed Elsayed Attiat (Engineering)

Abstract:

As LLM agents become more common, existing registry systems only partially support communication between humans, servers, and other agents. These systems often rely on scattered discovery layers that make it difficult to identify the most suitable agent for a given task.

This project explores a standardized discovery and recommendation layer for LLM agents. Our approach uses capability-aware matching to dynamically identify and recommend agents based on their functions and performance. We also introduce benchmarks and metrics to evaluate how effectively different discovery mechanisms select agents. The goal is to improve the reliability of agent recommendation and enable more scalable, connected ecosystems of LLM agents.

Keywords:

LLM; Agents; Recommendation System

Mentor(s):

James C Davis (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7065

Presentation Time: STEW 214A at 1:20-1:40

A Full-Stack Application and Statistical Pipeline to Streamline Proteomics Data Analysis for Enhanced Accuracy and Interpretation STEM

Authors(s):

Vatsal Sanjeevkum Dudhaiya† (Engineering); Jackson Drew Douvast (Engineering); Isaac Kojima Shanet (Science)

Abstract:

Proteomics and biomarker discovery rely on mass spectrometry (MS) data, yet existing platforms often require extensive manual workflows that reduce efficiency and limit scalability. To address these challenges, our aim is to develop a deployable, user-friendly application that automates key stages of preprocessing and statistical analysis while preserving flexibility for different experimental designs. The application consists of a React-based frontend, a Django-based backend, and statistical/ML functions implemented in Python. The preprocessing pipeline includes filtering, normalization, transformation, and imputation, with interactive visualizations for each preprocessing step. Heatmaps and volcano plots are being implemented to support biomarker identification and downstream interpretation. Additional analysis techniques are in development to expand functionality. A central part of the design process involves iterative feedback from biochemists in the Tao lab, whose input is guiding workflow refinement, interface improvements, and feature prioritization. With deployment planned, this application aims to reduce human error, improve interpretability, and standardize proteomics workflows across research environments. The platform has been tested using Alzheimer's disease patient data and is designed for broader research applications. By automating and streamlining MS-based analysis, this tool will improve the efficiency of biomarker discovery.

Keywords:

Proteomics; Biomarker Discovery; Mass Spectrometry; Statistical Analysis; Full-Stack Application

Mentor(s):

Zhuojun Luo (Agriculture); Weiguo Andy Tao (Agriculture); Amirhesam Mashaollahi (Agriculture)

Other Acknowledgement(s):

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

Talk Presentation Abstract Number: 7066

Presentation Time: STEW 214A at 1:40-2:00

A Novel Fluid Metering Technology for Aerospace & Defense Applications STEM

Authors(s):

Aarav Zutshi† (Engineering|JMHC)

Abstract:

Fluid delivery is a crucial component of various aerospace technologies. In particular, the ability to meter liquids down to a precise flow rate is important to the focus of this research--engine lubrication. Lubrication is used to reduce friction and heat between rotating components such as bearings, shafts, and gears, and modern jet engine lubrication utilizes pumps that supply gallons per minute of jet fuel or oil through these compartments.

Zulu Pods, an aerospace startup, discovered that supplying milliliters per hour of oil as opposed to gallons per minute also prevents thermal runaway, while temporarily maintaining engine performance. This enables an unprecedented thrust-to-weight ratio improvement to low-lifespan aerospace applications such as missile interceptors, Unmanned Aerial Vehicles, and decoy drones.

To create the "Zulu Pod," it was necessary to develop a cheap fluid metering component occupying less than ~0.5 cubic inches, while also capable of delivering a predetermined flow rate of military-grade oil at 300 F and with a pressure drop up to 50 psi. This component had to overcome clogging, viscosity sensitivity, and pressure variation, all while being mass-manufacturable and mathematically predictable.

The dimensions of the component's inner flow channels were fine-tuned through multiple cycles of performance modeling in Mathcad, flow tests in a temperature-controlled oven, data analysis in Excel, and Computer-Aided Design iterations in SolidWorks. This research culminated in the invention of a novel fluid metering technology that met the aforementioned criteria at a ~100x lower cost than commercial alternatives, and for which a patent is currently being pursued.

Keywords:

Fluid Metering; Lubrication; Flow Rate; Oil; Aerospace

Mentor(s):

Brandon C Chynoweth (Engineering)

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

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7067

Presentation Time: STEW 214B at 1:00-1:20

Greener Data Centers: How Custom Chips Can Power Sustainable AI and Blockchain Systems STEM

Authors(s):

Sarathisamy Velmurugan† (Engineering)

Abstract:

The rapid growth of artificial intelligence and blockchain technologies has led to increased energy use in data centers, raising concerns about their environmental impact. This research explores how custom computer chips, called application-specific integrated circuits (ASICs), can help reduce this energy demand. Unlike standard processors, such as CPUs and GPUs, that are designed to perform multiple tasks, ASICs are built to handle specific tasks efficiently, using less power while maintaining a high degree performance. By reviewing studies across engineering, computing, and sustainability research, this project examines how custom chips can make AI and blockchain systems more energy efficient and environmentally responsible. However, challenges remain around hardware flexibility, manufacturing costs, overall sustainability, and long-term environmental impact. Ultimately, this work aims to assess the potential of specialized chip design to support greener data centers, reduce energy consumption, and make AI and blockchain technologies more sustainable and practical for widespread adoption in the future.

Keywords:

ASIC Design; Energy-Efficient Computing; Artificial Intelligence Hardware; Blockchain Systems; Data Centers

Mentor(s):

Linda E Haynes (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7068

Presentation Time: STEW 214B at 1:20-1:40

Acoustic Enhancement of Porous Filters in HVAC Systems for Submicron Bioaerosol Removal STEM

Authors(s):

Tyler James Hughes† (Engineering)

Abstract:

The average person spends 80-90% of their life indoors, making indoor air quality especially important. However, many Heating, Ventilation, and Air Conditioning (HVAC) systems struggle to remove common viruses from the air due to the small size of these particles. Acoustics have been shown to increase particle interaction with filters and channel walls through acoustic streaming, radiation forces, and the interaction force. Our lab aims to experimentally test the effects a parallel plate configuration has on the capture efficiency of a system. Experimental testing was conducted using the Aerogen Solo Nebulizer to generate particles of varying sizes, which were then measured using an optical particle scanner (OPS) and a scanning mobility particle sizer (SMPS). Using these scanners, the capture efficiency can be accurately calculated, as well as other parameters, to determine if a parallel plate type filter with a channel's flow would be feasible. Our preliminary results show that the capture efficiency increases when the acoustics are implemented into a parallel plate channel. The parallel plate geometries are commonplace in traditional filtration methods, such as electrostatic precipitators (ESP). However, the enhancement of parallel plate filtration using acoustics provides a new paradigm for ESPs' use high voltages which can lead to other harmful byproducts in the air.

Keywords:

Filtration; Acoustics; Parallel Plate

Mentor(s):

Sudharshan Anandan (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7069

Presentation Time: STEW 214B at 1:40-2:00

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 limitations in conventional filtration systems. Even high-efficiency filters are subject to a Most Penetrating Particle Size (MPPS) range of 0.1–0.3 μm , where filtration performance is lowest. Notably, hazardous bioaerosols such as SARS-CoV-2, Influenza, and Rhinovirus fall within this size range. To address these limitations, controlled acoustic standing waves are applied to enhance filtration efficiency by generating radiation and streaming forces. Acoustic radiation creates pressure gradients that direct particles toward the filter, while acoustic streaming induces small vortices that restrict particle movement. Together, these mechanisms extend particle interaction with the filter and improve capture efficiency, particularly within the MPPS range. A bench-scale experimental setup was developed for filter characterization under various acoustic frequencies, pressure levels, and particle compositions. Quantitative analysis of filtration performance demonstrated significant improvements in particle capture efficiency under acoustic excitation compared to baseline conditions. Our findings suggest that integrating acoustic forces into existing filtration systems can effectively address the MPPS challenge and enhance protection against airborne bioaerosols. Future work will focus on optimizing acoustic parameters, refining filter materials, and scaling this technology for real-world air purification applications.

Keywords:

HVAC; Acoustics; Air Purification; Particle Dynamics

Mentor(s):

Sudharshan Anandan (Engineering); David Warsinger (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7070

Presentation Time: STEW 218A at 1:00-1:20

Associations between age and education level on the acceptability of contraceptive methods among South Africa adolescents

Social Science

Authors(s):

Madelyn Elizabeth Ehrhardt† (HHS)

Abstract:

South Africa faces barriers to sexual health services and lacks comprehensive sexual education. Rates of overall acceptability of different contraceptive methods may differ based upon age and level of education. This study aimed to examine the effect that age, education level, and gender have on the acceptability of different contraceptive methods among South African adolescents. South African adolescents aged 14 to 17 years (N= 2325) completed a cross-sectional survey. Then, with two new dichotomous variables using responses that included the overall acceptability of contraceptive methods and demographics, which included age of survey participants and education level. A series of independent t-tests were performed to examine the associations between demographic factors and the acceptability of various contraceptive methods. It was hypothesized that those who were older and those who have completed a higher educational level would have higher levels of acceptability among all contraceptive methods with those younger and less educated having lower rates of acceptability. Specific results indicated that those who were younger reported less use of condoms ($t = -3.54$, $p < .001$) and that those who completed more educational levels reported more use of condoms ($t = -6.189$, $p < .01$). Discussion will include gaps in education regarding effective methods to prevent sexually transmitted diseases and unintended pregnancies, as well as the need for targeted interventions to strengthen sexual health education in South Africa.

Keywords:

Contraceptive Methods; Sexual Education; South Africa; Age Differences; Education Level

Mentor(s):

Jennifer Lynn Brown (HHS); Luis A Gomez (HHS)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7071

Presentation Time: STEW 218A at 1:20-1:40

Breaking the Cycle: Improving the US Justice System with Rehabilitation Strategies

Social Science

Authors(s):

Abigail Elizabeth Byers† (HHS)

Abstract:

The criminal justice system has been at the center of debate regarding whether punishment or rehabilitation is a more effective strategy at reducing recidivism and addressing the United States problem of high imprisonment. I am investigating and evaluating different models of rehabilitation in prisons compared to punishment and how it can help address issues of mass incarceration, psychological harms of incarceration, and effects of solitary confinement. My research explores different strategies from areas all over the world including Alberta, Canada, and California's shift to rehabilitation models. Results indicate that rehabilitation focused programs are more effective at addressing these issues, highlighting therapies such as the Risk Needs Responsivity model, Cognitive Behavioral Therapy, and correctional education. The implications of this study emphasize the need for an institutional shift towards individualized, rehabilitative strategies to break the cycle of incarceration and support reintegration into society. Adopting these strategies is necessary to create a safer, effective, and humane justice system.

Keywords:

Rehabilitation; Recidivism; Prison Systems; Law; Criminal Justice

Mentor(s):

Kyle Robert Alvey (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7072

Presentation Time: STEW 218A at 1:40-2:00

Overreliance on Artificial Intelligence and Impairment of Human Creativity and Innovation

Humanities

Authors(s):

Andrew Thomas Hanlon† (HHS)

Abstract:

It is not hard to see that artificial intelligence (AI), particularly large language models (LLMs), have been increasingly implemented into the lives of individuals more and more around the world. These LLMs are designed to be able to communicate information in a way that resembles human speech and are intended to help provide comprehensive answers to people's questions. With AI's greater presence in people's lives, more research is being done surrounding its use and the effects it might have on cognition. One of these studies, "Your brain on ChatGPT," gained popularity due to its results which showed a significant decrease in the cognitive abilities of those who were told to write an essay using only AI (Armitage 2025). In this literary review, I summarize the findings of this article and investigate similar studies with a focus on how modern LLMs are impacting the creative thought process. Due to AI's rapid improvements and the lack of long-term studies, I will be reviewing the data researchers have most recently collected and making inferences about how it would apply to scenarios of creative thought. These findings are meant to help further discussion surrounding AI integration into daily life. It is also important for Generation Alpha, those born between 2010 and 2024, to consider these findings, as they have grown up amid radical implementation of this AI, and are due to be most affected by it.

Keywords:

Artificial Intelligence; Large Language Models; Creative Process; Innovation; Cognitive Development

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7073

Presentation Time: STEW 218B at 1:00-1:20

Fluorescent Lifetime Readout of Cellular Opto-Control STEM

Authors(s):

Ishaan Kartik Singh† (Science|JMHC)

Abstract:

In cell biology, an experiment requires two things: perturbation and observation. The perturbation is some sort of chemical, genetic, or environmental modification to a population of cells, and the observation aims to read out its effects. This approach generally lacks spatial selectivity, and can render real-time observation impossible. Real-time precision opto-control (RPOC) resolves this by combining perturbation and observation, offering diffraction-limited, spatially selective optical treatment coupled to a standard confocal microscope. A laser scanning architecture is the only system requirement for RPOC to be possible, so it can be applied to a wide range of imaging modalities. Motivated by its use in metabolic imaging, we present an RPOC-enabled fluorescent lifetime imaging (FLIM) microscope. We present two electronic architectures: one uses a high-bandwidth field programmable gate array (FPGA), and the other a time correlated single photon counting (TCSPC) unit. We also show the various ways one can integrate FLIM with RPOC: either as a post-treatment lifetime readout, or a real-time indicator for treatment targeting. Finally, we demonstrate the microscope with data on cellular autofluorescent lifetimes indicative of metabolic shifts due to spatially selective optical treatment. The combination of FLIM and RPOC shows strong potential for photodynamic therapy and optogenetics, and paves the way for RPOC's integration with other unique laser-scanning imaging modalities.

Keywords:

Bioimaging; Fluorescence; Microscopy; Electronics; Optics

Mentor(s):

Chi Zhang (Science); Bin Dong (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7074

Presentation Time: STEW 218B at 1:20-1:40

Tracing the Origins of Water: Constraining the Distribution of Heavy Water to Ordinary Water in a Planet-Forming System STEM

Authors(s):

Shruti Subramaniyan† (Engineering)

Abstract:

There are two main theories that attempt to explain the presence of water on Earth: The Inheritance Theory and the Reset Theory. While the Inheritance Theory proposes that water is formed in the parental molecular cloud and inherited by the planets that form from that cloud, the Reset Theory proposes that water formed in the cloud is destroyed and re-formed during planet formation. Determining the validity of each theory not only informs research into the origins of water on Earth, but also the presence of life in the Universe. The Inheritance Theory implies that water is readily available to planetary systems forming from a single cloud, while the Reset Theory implies that a specific set of conditions must be met to allow the formation of water. Using data from the Atacama Large Millimeter/Submillimeter Array (ALMA), this study tests these theories by identifying how the ratio of ordinary water (H_2O) to semi-heavy water (HDO) changes with radial distance from the central star of the HOPS-370 planet-forming disk, as this ratio is sensitive to the conditions under which water is formed. Preliminary results favor the Inheritance Theory, indicating a fairly uniform distribution of water throughout the disk. Further research aims to compare these results to planet-forming regions of different ages, noting that similar ratios would indicate that water is indeed inherited from its parental disk. Ultimately, this study will enhance our understanding of water-formation processes in such regions, shedding light on how common Earth-like planets may be across the Universe.

Keywords:

Planet-Forming Regions; Circumstellar Disks; Water Abundances; Millimeter/Submillimeter Astronomy

Mentor(s):

Merel van 't Hoff (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7075

Presentation Time: STEW 218B at 1:40-2:00

Deep Neural Network to Separate the Higgs Boson Signal from Background Noise using Compact Muon Solenoid (CMS) data STEM

Authors(s):

Dewang Sahay† (Engineering); Kai James Sustersic† (Science); Jacob Antony† (Science)

Abstract:

We are training a Deep Neural Network (DNN) to separate the Higgs signal from background processes that mimic the same final states as the Higgs decay. The Higgs boson is a gauge boson of the Higgs field whose interaction gives all particles mass. The Higgs boson is theorized to have a mass of $125 \text{ GeV}/c^2$ and decay into 4 leptons; this decay could include 4 electrons ($4e$), 4 muons (4μ), and 2 electrons and 2 muons ($2e2\mu$) from proton-proton (ZZ) collisions. To train and test the model, we are using a dataset from the Compact Muon Solenoid (CMS) detector at the Large Hadron Collider (LHC) with the 4-lepton decay events. The model will take collision data as an input, use a hidden layer of ReLU activation and a sigmoid function for binary classification, calculate loss via cross entropy, and optimize via ADAM optimization. The data will be split into training and testing, where training data will be further split into validation and training data sets to monitor loss convergence during training. We are expecting the model to be able to separate background noise from actual Higgs boson decay.

Keywords:

Machine Learning; High Energy Physics; Deep Neural Network; Higgs Boson

Mentor(s):

Andreas Jung (Science); Heather Nicole Martin (Science); Santosh Bhandari (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7076

Presentation Time: STEW 218C at 1:00-1:20

Agentic AI for Adaptive Cyber Defense STEM

Authors(s):

Milica Slavkovic† (Science|JMHC)

Abstract:

Artificial Intelligence (AI) enables real-time response to cyberattacks through intelligent intrusion detection systems (IDS). However, most existing solutions remain reactive, detecting attacks only after they occur and producing excessive false positives that overwhelm analysts. This study evaluates the performance and limitations of traditional reactive models as a foundation for developing more adaptive, proactive defenses. Random Forest and Logistic Regression baseline models were trained on the KDDCup99 dataset to evaluate the limits of traditional supervised approaches. After data preprocessing and feature encoding, both models achieved high accuracy, with the Random Forest reaching 99.9% accuracy and a false positive rate of approximately 0.08%. While these results confirm that static machine learning methods detect known attacks effectively, they also highlight a critical weakness, which is reflected in limited adaptability to unseen or evolving threats. Excessive false positives can further contribute to analyst fatigue, reducing responsiveness to true security incidents. The findings emphasize the need for frameworks where AI agents dynamically learn optimal defense policies from simulated attack environments. Intelligent, proactive, and resilient RL security systems promise to reduce false alarms, shorten response latency, and autonomously adjust strategies against novel attacks, enabling the transition from static detection toward adaptive, agentic cyber defense.

Keywords:

Agentic AI; Reinforcement Learning; Intrusion Detection Systems (IDS); Adaptive Cyber Defense; Machine Learning in Cybersecurity

Mentor(s):

Brian C Zuel (Polytechnic)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7077

Presentation Time: STEW 218C at 1:20-1:40

Analyzing Purchasing Trends and Consumer Segments to Enhance Marketing Strategy for Purdue Convocations

Business Case Study

Authors(s):

Alexandra Mae Hildreth† (DSB); Kimi Wilkinson‡ (DSB); Ella Grace Bottorff† (DSB)

Abstract:

The purpose of this project is to analyze key customer segments, purchasing trends, and target strategies for Purdue Convocations, a nonprofit and financially independent performing arts organization affiliated with Purdue University. As Purdue Convocations operates independently of university funding, it relies primarily on ticket sales and donations for revenue. Using sales data from the current season and previous two seasons, we will examine consumer demographics, purchasing behaviors, and trend patterns. Based on these insights, we will develop strategic recommendations to support Purdue Convocations' marketing team in enhancing audience engagement and revenue generation.

Keywords:

[no keywords provided]

Mentor(s):

Erin Alkire Britton (DSB)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7078

Presentation Time: STEW 218C at 1:40-2:00

Advancing Delivery Prediction Accuracy in Supply Chain Forecasting

Business Case Study

Authors(s):

Aditya Ghorpade† (DSB); Brandon James Rodarmel‡ (DSB); Omamah Khalud Jamil† (DSB); Rachel Elizabeth Carlson† (DSB); Yang Wu† (DSB)

Abstract:

Timely supplier deliveries are essential for maintaining efficient and resilient supply chains. This project focuses on predicting supplier delivery performance by estimating the number of days a purchase order will arrive early or late. Using historical procurement data, we apply and compare several machine learning models—including decision trees, random forests, and gradient boosting—to identify patterns in supplier behavior and order characteristics. Our goal is to generate accurate, actionable forecasts that help organizations reduce procurement delays, improve planning, and optimize supplier management. By turning raw data into predictive insights, this work contributes to smarter supply chain operations and more informed decision-making.

Keywords:

Supply Chain; Forecasting; Predictive Analytics; Machine Learning

Mentor(s):

Xing Wang (DSB)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7079

Presentation Time: STEW 218D at 1:00-1:20

The emergence of annual patterns in bobcat (*Lynx rufus*) presence in relation to seasonal flooding and species life history STEM

Authors(s):

Sierra Hunnicutt† (Science|JMHC); Atlas James Linville*
(Agriculture|JMHC)

Abstract:

Continued urbanization has been increasing the number of physical barriers in the environment, preventing wildlife from accessing necessary safe paths for migration. 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 alter the geography of the river corridors in ways that make them impassable at certain times of the year. Studies observing small terrestrial mammals found cyclical patterns in flood plains species, specifically that small mammals leave only when forced to and typically return to their original habitats once the water levels have receded. However, little research has been done to determine the effect of floodwaters on bobcat (*Lynx rufus*) movement patterns. Bobcats have historically held a crucial position in the Indiana ecosystem as prominent predators, made more important by the significant lack of larger predators in Indiana ecosystems. While not particularly attracted to water, bobcats have been observed to use waterways for catching prey, defecation, and play with noticeable lack of hesitation. Remote sensing has become an increasingly prevalent approach to obtaining ecological community and diversity data in order to avoid negative interactions with the environment and improve detection of cryptic species, via visual sensors like the camera traps used in this study. This study compares bobcat camera trap image captures within the Wabash river watershed against historical floodwater data and known life history traits. We expect to see the emergence of annual presence patterns as the bobcats return to their territories after flooding. Ultimately, local conservation efforts can be greatly improved by understanding patterns in behavior and movement of this at-risk species.

Keywords:

Corridor; Bobcat; Flooding; Cyclical; Ecology

Mentor(s):

Kristen Marie Bellisario (JMHC)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7080

Presentation Time: STEW 218D at 1:20-1:40

Ecological impact of controlled deer hunting on bobcat prey activity and richness in Indiana STEM

Authors(s):

Antonia Christina Alexiou† (Science|JMHC); Lourdes Gabrielle Ferrer-Ortiz‡ (Agriculture|JMHC)

Abstract:

Throughout Indiana, human activities have significantly altered ecosystem dynamics by reducing natural predator populations and increasing food availability, resulting in higher densities of white-tailed deer (*Odocoileus virginianus*) across the state. To manage the ecological consequences of overabundant deer, such as habitat degradation, reduced biodiversity, and overbrowsing, annual deer-control hunts are implemented as a primary management strategy. Previous studies have shown that these hunts successfully promote vegetation recovery and ecosystem balance. However, while the effects of deer management on vegetative communities are well documented, the broader ecological impacts on wildlife behavior and biodiversity remain less understood.

This study investigates how deer-control hunting affects the activity and richness of bobcat (*Lynx rufus*) prey species, including small mammals and other potential prey. We utilize bobcat movement patterns to explore how deer-control hunting may indirectly affect predator habitat usage. Here, bobcats serve as a focal species for identifying potential wildlife corridors that maintain suitable conditions for migration and dispersal. Using a combination of camera trap and acoustic recording data collected at sites with and without hunting throughout the 2023-2024 year, we assess changes in prey species activity patterns and community composition in relation to deer abundance. We hypothesize that deer-control hunting may lead to an increase in prey species activity and higher biodiversity in hunted areas, as reduced deer densities promote improved understory vegetation structure and resource availability. Ultimately, this research aims to expand our understanding of how deer management practices influence ecological interactions and community dynamics beyond the target species.

Keywords:

Deer; Hunting; Biodiversity; Wildlife Management; Bobcats

Mentor(s):

Kristen Marie Bellisario (JMHC)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7081

Presentation Time: STEW 218D at 1:40-2:00

A Sweet Spot in the Shade: Dynamics between canopy cover, herbaceous vegetation, predators, and prey STEM

Authors(s):

Cameron Jean Gibson† (Science|JMHC); Felicity Hayahn Park-Smith* (Engineering|JMHC); Zoe Kathryn Mercer* (Engineering)

Abstract:

Global biodiversity is undergoing an unprecedented decline from habitat loss, climate change, and human activity. One species that is being harmed by these factors in Indiana is the Bobcat (*Lynx rufus*). Bobcats are keystone predators in Indiana whose population dynamics are closely tied to the availability of certain species, particularly the eastern cottontail rabbit (*Sylvilagus floridanus*). Other studies have provided information that suggest that intermediate canopy density may offer an ecological sweet spot by balancing understory cover for prey and providing visibility for predator success. This study investigates how canopy density and understory influence the abundance of eastern cottontail rabbits and their impact on bobcat presence in the study area. This study answers whether canopy density is a factor that is affecting the bobcat population. In this study, we use a combination of visual and auditory data collected from camera traps, acoustic recording units, vegetation surveys using a 1m quadrat, and canopy densiometers across multiple sites (n=28). A redundancy-based analysis to understand the relationship between density and presence was conducted to analyze the data. This information may provide a framework for promoting biodiversity, specifically through supporting the bobcat population from informed canopy regulation.

Keywords:

Bobcat; Eastern Cottontail Rabbit; Canopy; Understory; Densiometer

Mentor(s):

Kristen Marie Bellisario (JMHC)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7082

Presentation Time: STEW 214A at 2:00-2:20

Computer Vision and Generative Models - Music Performance Video Synthesis and Verification STEM

Authors(s):

Bingyi Liu† (Science); Avery Fisher Noroozi† (Science); Shireen Malhotra† (Science); Qiuyang Huang† (Engineering); John Alexander White† (Science)

Abstract:

This project develops a framework that extracts MIDI files from piano performance videos using computer vision, Unity Game Engine to create realistic videos of music performances, and verifies the correctness of the generated videos with respect to the original clips. The system initially explored approaches with diffusion models to generate the performance videos, but current models proved insufficient for producing lengthy, physically accurate, and sonically coherent results. To address this, the project has pivoted to using Unity for increased video control and realism for piano and hand animation. Future work involves integrating predictive motion modeling using the PianoMotion10M dataset, experimenting with various approaches to predict hand motions and trajectories from musical inputs. The current goal is to create a realistic, convincing, and accurate piano performance from music input. Ultimately, the project unifies generative AI, computer vision, and music to create a system that both generates and evaluates its own results, connecting the art of music to human motions and video creation.

Keywords:

Generative Models; Computer Vision; Artificial Intelligence; Computer Science; Machine Learning

Mentor(s):

Yung-Hsiang Lu (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7083

Presentation Time: STEW 214A at 2:20-2:40

Designing for Social Good

STEM

Authors(s):

Pranav Ramnath† (Engineering)

Abstract:

Connecting the Homeless to Local Resources: Community-engaged engineering integrates technical problem-solving with civic responsibility, allowing students to apply engineering design principles to address real-world social challenges. This project exemplifies such engagement through a partnership with the Lafayette Transitional Housing Center (LTHC), an organization dedicated to supporting individuals and families experiencing homelessness in Lafayette and West Lafayette, Indiana. The goal of the project is to design and develop a mobile and web-based application that helps unhoused individuals easily locate and access essential community resources, such as shelters, food pantries, healthcare, legal aid, and transportation services. Working collaboratively with LTHC staff, the student team conducted needs analyses to understand user challenges and data management requirements. The resulting design emphasizes accessibility, intuitive navigation, and up-to-date resource listings. Key features include interactive maps, service filters, and a user-friendly interface adaptable for both clients and service providers. The project not only enhances resource visibility for vulnerable populations but also streamlines data organization for LTHC, reducing manual information updates. Through this experience, students developed competencies in user-centered design, ethical engineering, teamwork, and community partnership building. The project demonstrates how engineering education can foster empathy, social awareness, and sustainable design practices while contributing to the well-being of local communities. Lastly, this collaboration reflects the broader mission of engineering for the common good, illustrating how technology can serve as a bridge between innovation and social impact.

Keywords:

Community; Engineering; Impact; STEM

Mentor(s):

Aparajita Jaiswal (Engineering)

Other Acknowledgement(s):

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

Talk Presentation Abstract Number: 7084

Presentation Time: STEW 214A at 2:40-3:00

Online Pedestrian Annotation Tool STEM

Authors(s):

Dave Vishalkumar Patel† (Science); Divyansh Pramanick† (Science);
Nived Ambadipudi‡ (Engineering); Anish R Devulapalli† (Science)

Abstract:

This project presents the development of an online pedestrian annotation tool designed to streamline and enhance the process of labeling pedestrians in visual datasets. Accurate pedestrian annotations are crucial for training computer vision models used in autonomous driving, surveillance, and urban analytics. Traditional manual labeling workflows are often time-consuming, inconsistent, and fragmented across tools. Our solution integrates a web-based interface built with Streamlit that enables users to upload, visualize, and annotate images directly through a browser. The platform supports bounding box creation, modification, and deletion, along with model-assisted suggestions using zero-shot pedestrian detection models such as Grounding DINO, SAM, and YOLO-World.

Keywords:

Computer Vision; Automation; Machine Learning; Pedestrian; Annotation

Mentor(s):

Fengqing Zhu (Engineering); Bryce Jensen Dietrich (Liberal Arts);
Siddeshwar Raghavan (Engineering); Soudabeh Taghian Dinani
(Engineering); Carla Zoltowski (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7085

Presentation Time: STEW 214B at 2:00-2:20

Automated Segmentation of Aortic Wall Boundaries in patients with Thoracic Aortic Aneurysms STEM

Authors(s):

Joshua Paik† (Science)

Abstract:

Thoracic aortic aneurysm (TAAs) is a type of aortopathy that increases the risk of sudden and potentially fatal aortic dissection or rupture. Accurate measurement of aortic root diameters is critical for clinical monitoring, yet it is time-consuming and prone to interobserver variability.

Using manual annotations from our previously developed feature-tracking algorithm (Damen et al., 2024) and graphical user interface (GUI) (Paik et al., 2025), we developed a deep learning pipeline for the automatic segmentation of the aortic root wall in the parasternal long axis (PSLAX) view of pediatric echocardiographic images. Accurate localization of these borders enables the algorithm to compute reproducible aortic root diameters, providing a standardized and objective alternative to manual measurement.

PSLAX images from 66 pediatric patients aged 1 to 22 years (39 with TAAs and 27 controls; 39 males and 27 females) were preprocessed with normalization, contrast enhancement, and geometric augmentation. U-Net with a ResNet-34 encoder pretrained on ImageNet and DeepLabV3, two architectures widely used for biomedical image segmentation, were trained using a combination of loss functions such as Dice and Tversky with five-fold cross-validation. When evaluated against the ground truth annotations, the average diameter error was 0.15 ± 0.07 cm (7.9%) for U-Net, while 0.16 ± 0.08 cm (8.9%) for DeepLabV3.

Both models demonstrated moderate correlation with ground-truth annotations, enabling faster and more objective diameter estimation without the need for manual measurement.

Keywords:

Echocardiography; U-Net; DeepLabV3; Aortic Wall; Marfan Syndrome

Mentor(s):

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

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7086

Presentation Time: STEW 214B at 2:20-2:40

NSWC AIMM ICC Autonomous Boating Challenge STEM

Authors(s):

Alexander T Valdest† (Engineering); Andrew Joseph Shelley† (Polytechnic); Steven James Van Hulle† (Science); Margulan Mukhametkarim† (Engineering); Chengming Wu‡ (DSB); Jacob Charles Long‡ (DSB); William David Bridgnell‡ (Engineering)

Abstract:

This research develops an autonomous navigation system for maritime environments, addressing the dynamic challenges of aquatic navigation. Unlike land-based autonomous systems that navigate relatively static environments, our approach must account for shifting wave patterns, unpredictable currents, and transient obstacles. Navigation is conducted using relatively few landmarks present on otherwise flat water. Using an integrated multi-sensor AI model, we aim to achieve real-time obstacle detection, localization, and adaptive pathfinding in complex water conditions. Our model incorporates data from four RGB depth cameras for identification of markers, inertial measurement units, and LiDAR for longer-distance sensing. Sensor inputs are processed through a pipeline designed to filter out noise from water movement and sensor error, ensure compatibility between sensor systems that output data at different rates, and prioritize critical real-time data to path-find its destination. Though results are pending, this technology has significant applications across global trade, disaster response, defense, and environmental monitoring. By advancing autonomous navigation at sea, this project aims to reduce human risk and improve operational efficiency.

Keywords:

Autonomy; Artificial Intelligence; US Navy; Boating

Mentor(s):

Samuel Labi (Engineering); Richard Osita Ajagu (Engineering); Andres Felipe Hoyos Moreno (Engineering); Reed Joseph Freer (Engineering)

Other Acknowledgement(s):

Brittany A Newell (Polytechnic)

Talk Presentation Abstract Number: 7087

Presentation Time: STEW 214B at 2:40-3:00

Experimental Validation of Fatty Acid Synthesis Pathway to Produce Biodegradable Plastic Monomer STEM

Authors(s):

Madelyn Clair Watson† (Agriculture|Engineering)

Abstract:

Gem-dimethylated monomers and their corresponding polymers enhance the mechanical strength and biodegradability of polymeric materials. Producing these monomers biosynthetically requires precise enzymatic control to introduce the gem-dimethyl groups efficiently. The type II fatty acid synthesis (FAS) pathway provides a mechanistic framework for constructing such complex biosynthetic processes, as its reaction chemistry can be adapted to perform new-to-nature transformations. Our lab has computationally predicted a modified pathway that leverages FAS enzymes to generate gem-dimethylated monomers, and our current objective is to experimentally validate the predicted pathway. To test this, we have identified ten enzymes which will be expressed in *E. coli*. The proteins were purified using nickel affinity and anion exchange chromatography and confirmed by SDS-PAGE. The purified enzymes were stored individually until all components were available for pathway reconstitution. The next phase of the project involves reconstituting the complete FAS reaction in vitro and verifying product formation using mass spectrometry as well as studying the pathway kinetics to determine bottlenecks.

Keywords:

Fatty Acid Synthesis; Protein Expression; Protein Purification;
Biodegradable Plastics; Retrosynthesis

Mentor(s):

Karthik Sankaranarayanan (Engineering); Nilanjan Samanta
(Interdisciplinary & Special Programs)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7088

Presentation Time: STEW 218A at 2:00-2:20

Astrocytes and the MR1/MAIT Cell Axis in the PS19 Transgenic Model of Alzheimer STEM

Authors(s):

Sujal Joshi† (HHS|JMHC)

Abstract:

Alzheimer's Disease (AD)—the most common form of dementia—is accompanied by beta-Amyloid (Abeta) plaques involving the buildup of the protein Abeta, as well as tau “tangles”. Although tau typically serves a structural function, high levels of phosphorylated tau in cells of the CNS are the cause of such “tangles” in AD. In the PS19 tau-based mouse model of AD, prior research has suggested that the innate-like T cell subpopulation mucosal-associated invariant T (MAIT) cells has a protective effect against tau-related neurodegeneration. However, a role of the antigen presenting molecules recognized by MAIT cells (i.e., MR1) in tau-mediated pathology is unknown. MR1 is expressed on microglia, astrocytes and neurons, with tau being found predominantly in neurons, but also in astrocytes. To ascertain the importance of astrocyte MR1 in tau-mediated pathology, we conducted a study on both MR1+ and MR1-deficient PS19 mice. We hypothesize that there will be an increased number of MR1+ cells and astrocytes near tau tangles due to a potential protective response of the astrocytes and MR1 against tau aggregation. Immunofluorescence (IF) was performed, visualizing MR1, astrocytes, and tau within mouse brains, focusing on the cortex, hippocampus (CA1 region), and dentate gyrus. To confirm memory deficits, Novel Object Recognition (NOR) tests were performed. We found that MR1 knockout tissue had no major differences in astrocytes or the presence of tau from MR1+ PS19 mice. In sum, these results suggest that astrocyte MR1 does not play a role in tau-dependent AD pathology in this mouse model.

Keywords:

[no keywords provided]

Mentor(s):

Randy Brutkiewicz (Indiana University); Season Johnson (Indiana University)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7089

Presentation Time: STEW 218A at 2:20-2:40

Simulation of Particle Deposition from Manual Metal Arc Welding Fumes in the Human Respiratory Tract Using the Multiple-Path Particle Dosimetry (MPPD) Model STEM

Authors(s):

Shane Kevin Limas† (HHS|JMHC)

Abstract:

Manual metal arc welding (MMAW), also known as stick welding, is a common industrial process that generates fumes containing metallic aerosols. Inhalation of these particles poses significant occupational health risks ranging from acute respiratory irritation and metal fume fever to chronic bronchitis and lung cancer. Particle size distribution is a crucial factor determining deposition in the lungs—head airways, tracheobronchial, or alveolar regions—and influences the severity of health effects. Understanding particle deposition is therefore essential for developing strategies to protect workers' respiratory health. This study characterized the size distributions of fumes generated under controlled laboratory conditions using three MMAW electrodes (E6010, E7014, and E7018) and simulated their depositions in the respiratory system using the Multiple-Path Particle Dosimetry (MPPD) model. Particle size distributions were measured using a NanoScan Scanning Mobility Particle Sizer and an Optical Particle Sizer. The resulting Geometric mean diameter (GMD) and geometric standard deviation (GSD) were used as inputs for the MPPD model. Specifically, GMDs of 113.3 nm (GSD 1.64) for E6010, 107.7 nm (GSD 1.64) for E7014, and 117.7 nm (GSD 1.22) for E7018 were applied, assuming a total particle concentration of 1 mg/m³. Simulation results indicated that a significant portion of inhaled particles can reach the alveolar region, with deposition percentages of 12.9%, 13.3%, and 17.5% for E6010, E7014, and E7018, respectively. These findings highlight that MMAW fumes are predominantly smaller than 120 nm, which emphasizes the need for effective exposure controls to mitigate health risks for welders.

Keywords:

Welding Fumes; Particle Size Distribution; Respiratory Deposition; Manual Metal Arc Welding (MMAW); Occupational Health

Mentor(s):

Jae Hong Park (HHS)

Other Acknowledgement(s):

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

Talk Presentation Abstract Number: 7090

Presentation Time: STEW 218A at 2:40-3:00

Children with ADHD: Calling for Social and Academic Support Social Science

Authors(s):

Gracelyn Kay Druelinger† (HHS|JMHC)

Abstract:

The research in this project focuses on ADHD and how it affects children in their social lives and in the classroom. Both the social lives and in the classroom are in the social context of their lives but they are different points of view that should be considered. Attention Deficit/Hyperactive Disorder is not a relatively new concept in the realm of psychology, but it has been ignored for a long time. ADHD has recently become a main topic of discussion and intentional research. Different research articles and other popular articles are being synthesized and put together in order to come to a conclusion. Most of the sources are scholarly and are peer reviewed, relevant articles. I used Purdue Libraries Databases to find the articles, and I used simple Google searches to find the more popular, informal news articles and opinions as a way to include community opinions. I found that ADHD has a significant impact on children in both their social lives and while they are in the classroom. Especially in the classroom. I know from personal experience that there is not a firm infrastructure to support students properly with ADHD. This often led to struggles with grades and focusing in the classroom. It also affects their social lives as well. Impulsivity and the attention deficit can lead to frustration and misunderstanding in personal relationships. Others should be interested in these findings because education to the future generation is vital to human success. As there are more findings and more diagnoses of ADHD it will become very important to provide stable infrastructure to support those students in order to include everyone to have a good education. The implications of my research should be that there should be more studies, and more tests being done to improve education for those with ADHD. I believe that there should be further accommodations for those with ADHD and more research and studies will help find more of those options and support systems.

Keywords:

[no keywords provided]

Mentor(s):

Beth Elly Baumgartner (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7091

Presentation Time: STEW 218B at 2:00-2:20

Privacy-Preserving Machine Learning STEM

Authors(s):

Anaïysaa Deswal† (Science); Soham Mehta† (Science); Sidharth Garigipati† (Engineering); Nakshatra Hansika Tondepu† (Science)

Abstract:

Our research at Purdue's Privacy-Preserving Machine Learning (PPML) lab investigates the privacy weaknesses and resilience of modern deep learning models. Deep neural networks and machine learning models have achieved superhuman image classification performance but are susceptible to data leakage and adversarial attacks. In this study, we copied and investigated several groundbreaking publications in adversarial machine learning, including "Explaining and Harnessing Adversarial Examples" by Goodfellow et al., "BadNets: Evaluating Backdooring Attacks on Deep Neural Networks," "Model Inversion Attacks," and "Membership Inference Attacks Against Machine Learning Models."

All of these attacks target a specific phase of the machine-learning pipeline—varying from training data poisoning and covert trigger injection to post-deployment inference attacks. Using the CIFAR-10 dataset and ResNet-20 architecture on Purdue's Gilbreth high-performance computing cluster, we duplicated the original and integrated the experiments into Landseer, an open-source environment for evaluating interactions between privacy and robustness tools.

Our goal is to characterize how a single defense mechanism behaves in combination with others and quantify trade-offs between model accuracy, robustness, and leakage of private data. This work contributes to establishing a reproducible benchmarking platform for privacy-preserving deep learning and is designed to support further work towards secure deployment of AI in adversarial settings.

Keywords:

Adversarial Machine Learning; Privacy-Preserving Artificial Intelligence; Model Robustness; Data Security; Landseer Framework

Mentor(s):

Zahra Ghodsi (Engineering)

Other Acknowledgement(s):

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

Talk Presentation Abstract Number: 7092

Presentation Time: STEW 218B at 2:20-2:40

Frequency dependent visual memory encoding in V1 neuronal ensembles of TRAP2 mice STEM

Authors(s):

Sein Kim† (Science)

Abstract:

Learning and memory encoding have traditionally been attributed to higher-order brain regions such as the hippocampus and the prefrontal cortex. However, recent evidence suggests that early sensory cortices, including the primary visual cortex (V1), also play a role in these cognitive functions. While previous studies suggest V1 contributes to learning, the specific role of V1 neuronal ensembles in encoding task-relevant stimuli and guiding behavior remains unclear. In this work, we sought to identify and target ensembles specifically during Go/No-Go stimulus association. We then determined whether selective activation of these targeted ensembles during learning can alter memory formation and task performance. We hypothesize that behavioral responses can be evoked just by activating the V1 network. In order to label active neurons in V1, we used TRAP2/Ai32 mice and trained them to perform a visual Go/No-Go discrimination task. Once the mice learned the task, we labeled all active neurons during the Go stimulus and optogenetically activated them in V1 to induce reward behavior. We recorded behavioral performance across sessions and analyzed learning curves to assess the impact of the V1 network on memory encoding. Results from this study show that targeting neuronal ensembles in V1 is sufficient to induce behavioral responses in mice, even in the absence of a visual stimulus. Further, altering the frequency of the V1 response during Go stimulus presentation hinders task performance. These results support the notion that V1 is actively involved in learning and memory processes, highlighting the potential of cortical ensemble stimulation to influence learning behavior and providing a potential therapeutic avenue for neurological learning deficits.

Keywords:

V1 Neuronal Ensembles; Reward Association; Optogenetics;
TRAP2/Ai32 mice; Memory Encoding

Mentor(s):

Sanghamitra Nareddula (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7093

Presentation Time: STEW 218B at 2:40-3:00

AWARE: Affordable wearable self-powered smart pressure platform for workplace injury prevention STEM

Authors(s):

Dhruva Vedula† (Science|JMHC); Mrigas Ajay Iyer† (Science); Aryan Jignesh Patel† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Wenzhuo Wu (Engineering); Pedro Henrique de Souza Barbosa (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7094

Presentation Time: STEW 218C at 2:00-2:20

Forecasting Pharmaceutical Demand with Machine Learning: A U.S. Analysis with an Indiana Application STEM

Authors(s):

Lilian Patricia Holguin Mejia†

Abstract:

This study aims to research machine learning models and develop a forecast for pharmaceutical drug demand in the United States, with a particular focus on Indiana. The goal is to improve the accuracy of demand forecasts for Medicaid prescriptions and reimbursements, providing data-driven insights that support healthcare planning and decision-making.

This research combines a detailed review of machine learning applications in healthcare, highlighting the forecasting area, with empirical modeling using Medicaid State Drug Utilization Data (SDUD). Drug data are grouped by their therapeutic class using Rxnorm system and ATC classification. Multiple ML models are trained to forecast prescription demand and units reimbursed by state and drug classes. Model performance is evaluated through cross-validation and error metrics such as MAE, RMSE, and MAPE, enabling comparison across techniques and therapeutic categories.

Preliminary results indicate that ML models outperform traditional methods in capturing nonlinear demand behavior across states and therapeutic classes. The forecasts provide interpretable trends that can inform how pharmaceutical drug demand evolves over time and across regions. The resulting forecast provides a scalable, data-driven tool for healthcare researchers and policymakers to anticipate prescription demand trends and optimize resource planning. The approach can be adapted for other states or healthcare programs that require reliable, high-frequency demand forecasting.

Keywords:

Machine Learning; Healthcare; Demand Forecast

Mentor(s):

Dutt Jagdish Thakkar (DSB); Steven R Dunlop (DSB)

Other Acknowledgement(s):

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

Talk Presentation Abstract Number: 7095

Presentation Time: STEW 218C at 2:20-2:40

Exploring Human-AI Communication through Uses and Gratifications Theory

Social Science

Authors(s):

Yubo Sun† (Liberal Arts)

Abstract:

This study investigates why people choose to engage in conversations with AI chatbots such as ChatGPT, Perplexity and Replika rather than with human partners, using the framework of the Uses and Gratifications Theory. It asks: What psychological and social gratifications motivate users to communicate with conversational AI, and how do these differ from gratifications derived from human interaction? In this context, gratifications refer to the emotional, cognitive, and social benefits that individuals seek from mediated communication. The study examines how AI's affordances, such as perceived emotional safety, anonymity, and freedom from social judgment, shape people's willingness to self-disclose and form parasocial connections with non-human agents. To address these questions, the project adopts a qualitative approach involving semi-structured focus group interviews with university students who have used AI chatbots for non-task-oriented purposes, such as emotional support or casual conversation. Participants will discuss their motivations, experiences, and perceived advantages or limitations of AI companionship. All the transcribed interviews will thematically analyzed to identify recurring patterns of motivation and gratification. Preliminary insights are expected to reveal key gratification dimensions including affective, cognitive, and social integrative factors that drive users to engage with AI companions. The findings will extend the Uses and Gratifications framework to the emerging context of human and AI interaction and offer implications for designing more empathetic, ethical, and psychologically aware conversational AI systems.

Keywords:

Conversational AI; Uses and Gratifications Theory; Human-AI Collaboration; Digital Intimacy

Mentor(s):

Hyesun Choung (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7096

Presentation Time: STEW 218C at 2:40-3:00

Determining the Functional Domains of a *Ralstonia solanacearum* Type III Effector STEM

Authors(s):

Mateus Rocha Ripari† (Agriculture); Paula Natalia Natalia Paez Monroy‡

Abstract:

Ralstonia solanacearum (Rs, *Ralstonia*), the causal agent of bacterial wilt disease, is a devastating plant pathogen responsible for yield losses in many economically important crops. *Ralstonia* deploys type III effector (T3E) proteins, such as RipU, to promote host colonization and disease development by manipulating host cellular processes. RipU, a core T3E from Rs strain K60, was found to interact with the plant cytoskeleton. Previous findings reported that RipU disrupts cytoskeleton organization, specifically reducing microtubule density. Additionally, this previous study showed that microtubule disruption generally promotes *Ralstonia* colonization and that loss of RipU reduces *Ralstonia* virulence activity. Although much has been learned about the role of RipU and microtubules during *Ralstonia* infection, it is still unclear whether the disruption of microtubules by RipU is required for successful infection. To begin to clarify whether this interaction is required for virulence, this work seeks to characterize the functional domains of RipU. Here, we generate truncated versions of RipU to test the domains responsible for microtubule disruption and virulence activity. By investigating the co-localization and interaction of RipU truncations with cytoskeletal proteins, and the ability of these truncations to complement the loss of RipU in Rs strain K60, this study will identify the functional domains that contribute to intracellular localization and RipU-cytoskeleton interactions. These findings may contribute to developing host resistance mechanisms against *Ralstonia*, and will more broadly improve our understanding of how T3Es manipulate host immunity and target the cytoskeleton.

Keywords:

Ralstonia; RipU; Microtubules; Pathogen; T3E

Mentor(s):

Anjali Iyer-Pascuzzi (Agriculture); Abigail Keelin Rogers (Interdisciplinary & Special Programs)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7097

Presentation Time: STEW 218D at 2:00-2:20

A Multifidelity Machine Learning Approach for Airfoil Design with Transonic Buffet Constraints STEM

Authors(s):

Mason J Kramer† (Engineering|JMHC)

Abstract:

Transonic buffet is an undesirable aerodynamic instability which increases structural fatigue and limits the operating envelope of an aircraft. Usually, the onset of this transonic buffet is evaluated through expensive modeling efforts using computational fluid dynamics. As such, there exists a need to accurately predict and mitigate buffet onset at a low computational cost. This work describes the design and implementation of a novel machine learning-based optimization approach for use in airfoil design aimed at mitigating transonic buffet. The proposed approach utilizes multifidelity data, data from multiple levels of accuracy, encoded as a continuous parameter to minimize the computational costs of training the machine learning model. This machine learning model predicts aerodynamic forces and surface pressure distributions for airfoils and is implemented alongside a multifidelity acquisition function, a criterion used to discover new designs and the level of accuracy at which to evaluate the designs. Furthermore, using the predicted forces and surface pressure distribution, a criterion is established to predict the onset of buffet. This optimization strategy is tested on the RAE 2822 airfoil with the addition of transonic buffet constraints. Preliminary single fidelity results gave a normalized root mean square error of 0.153 for the forces and 6.693 for the surface pressure. The multifidelity data generation workflow has been successfully implemented. Future directions involve the application of this multifidelity optimization method to wing design or other aerodynamic design problems.

Keywords:

Multifidelity Design; Machine Learning; Transonic Buffet; Shape Optimization

Mentor(s):

Leifur Thor Leifsson (Engineering)

Other Acknowledgement(s):

Abhijnan Dikshit (Engineering)

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

Talk Presentation Abstract Number: 7098

Presentation Time: STEW 218D at 2:20-2:40

A Comparison of Lipid Nanoparticle Cholesterol Composition using Molecular Dynamics Simulations of Coarse-Grained Models STEM

Authors(s):

Isabel Estela Lusky† (Pharmacy|JMHC); Samuel S Copeland‡
(Science|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Molecular Dynamics; Lipid Nanoparticles; Coarse-Grained; GROMACS;
Martini 3

Mentor(s):

Yu Zhu (Pharmacy); A Anshul (Pharmacy); Jianing Li (Pharmacy)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7099

Presentation Time: STEW 218D at 2:40-3:00

Immersive Virtual Reality in Undergraduate STEM Education STEM

Authors(s):

Ava Thant Samuel† (Engineering|JMHC)

Abstract:

The COVID-19 pandemic revealed demand for effective remote learning solutions has surged in recent years. While platforms such as Zoom and Microsoft Teams have facilitated communication, these tools often lack the interactive qualities necessary to deeply engage students, particularly in STEM disciplines. Immersive technologies, collectively called Extended Reality (XR), provide an alternative, offering environments where learners can engage in interactive educational experiences. This study's participants were undergraduate students enrolled in a STEM course that focused on the essential leadership skills needed to foster a workplace environment that promotes high levels of employee self-motivation, quality, and productivity. The 40-participant pool was diverse in terms of age and academic standing and were randomly assigned to either Group A or Group B, each consisting of 20 students. Instead of using a traditional pre-test/post-test design, this study employed the Retrospective Pretest (RPT) method. Participants first reflected on their current knowledge and skills (post-intervention) and then rated their perceived prior knowledge (pre-intervention) on the same scale. The RPT instrument assessed participants' understanding and comfort with immersive virtual reality (IVR) equipment, as well as their preferences for IVR-based learning environments. The paired samples t-test revealed statistically significant differences between post-intervention (R1) and retrospective pre-intervention (R2) scores across all nine pairs ($p < 0.05$). In all cases, the mean scores for R1 were higher than R2, indicating that participants rated their post-intervention perceptions more positively than their retrospective pre-intervention perceptions. This suggests that the intervention had a meaningful positive impact on participants' experiences related to IVR.

Keywords:

VR; STEM; Education

Mentor(s):

Lisa B Bosman (Polytechnic)

Other Acknowledgement(s):

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

Talk Presentation Abstract Number: 7100

Presentation Time: STEW 214A at 3:00-3:20

Design and Development of a Multi-Modal Mechanical Testing Chamber for Cells STEM

Authors(s):

Miram Elagt† (Engineering|JMHC); Mehar Jetly† (Engineering); Grace Lincoln† (Engineering)

Abstract:

Cardiovascular, respiratory, and gastrointestinal diseases are often associated with abnormal mechanical forces exerted on cells and tissues, such as stretch in the heart and lungs, or shear stress in blood vessels. To accurately study these mechanobiological responses in vitro, our project focuses on developing an advanced Mechanical Testing Chamber (MTC) for Cells.

Current commercial systems, such as those from Flexcell, typically offer limited combinations of mechanical stimuli, primarily providing either cyclic stretch or fluid shear stress. Our primary objective is to engineer a novel MTC that can independently or simultaneously apply circumferential stretch and fluid shear stress to cultured cells, closely mimicking the complex pulsatile biomechanical environment found in native blood vessels.

The design methodology is segmented into three interconnected teams: the Simulation Group is responsible for CAD drawing, virtual design, and testing; the Materials Group selects materials and handles construction; and the Mechanobiology Group provides the necessary calculations and biological context. The resulting MTC design features an optical-grade transparent top and a flow channel over a rubber membrane, allowing for both microscopy and the application of vacuum-induced tension and fluid flow. This integrated, multi-modal system will provide a superior platform for exploring cell signaling pathways under pathological biomechanical conditions, ultimately advancing the understanding of diseases like atherosclerosis and dilated cardiomyopathy. This work is conducted within the Weldon School of Biomedical Engineering at Purdue University.

Keywords:

Mechanobiology; Shear Stress; Cyclic Stretch; Microfluidics; Cardiomyopathy

Mentor(s):

Namhee Ji (Purdue University); Ju Na Lee (Engineering); Natasha Rajendrara Gundapaneni (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7101

Presentation Time: STEW 214A at 3:20-3:40

Rwanda Demographic and Health Survey-Based Analysis to Identify Influence Factors on Rwanda Post-Partum Family Planning STEM

Authors(s):

Margaret H Prokopy† (Engineering|JMHC)

Abstract:

In recent years, the Rwandan government has taken multiple steps to increase use and accessibility of modern contraceptive methods, including incorporating family planning into the community health worker training. In particular, post-partum family planning use and birth spacing is important for maternal and infant health outcomes. However, there will be certain population subsections that national health policies in Rwanda have more difficulty reaching due to social and economic barriers. The research question is how can machine learning be used to investigate prominent demographic, lifestyle and other predictors of the discontinuation or continuation of post-partum family planning among Rwandan women to identify the subsections of the Rwandan population where the greatest impact can be achieved to increase uptake of post-partum family planning? Using the 2019-2020 Rwandan Demographic and Health Survey data, post-partum family planning use can be identified through birth spacing from 2014 onwards, classifying births as compliant or non-compliant according to the WHO recommendation of a minimum of 24 months between births. A literature review has been conducted and data processing steps have been implemented, including selection of independent variables based on the literature, the recoding of independent variables, and filtering for births from 2014 onwards and classification of the compliant or non-compliant outcome. Logistic regression will quantify the impact of independent variables on the outcome. This pipeline process can be applied to other countries and their respective DHS data to compare results and address the challenge of increasing post-partum family planning uptake for global health.

Keywords:

Survey Analysis; Family Planning

Mentor(s):

Nan Kong (Engineering)

Other Acknowledgement(s):

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

Talk Presentation Abstract Number: 7102

Presentation Time: STEW 214A at 3:40-4:00

Physical Vapor Deposition (PVD) for Through-Silicon Via (TSV) Fabrication STEM

Authors(s):

Anusha Gambheera† (Engineering|JMHC); Orion Kai Larson† (Engineering); Tim Jacques van Antwerpen† (Engineering); Saloni Pothireddy† (Engineering); Evanjaline Sherl Sahaya Rajesh Durai‡ (Engineering|JMHC)

Abstract:

This study investigates the optimization of Physical Vapor Deposition (PVD) processes for barrier and seed layer formation in Through-Silicon Via (TSV) fabrication to enable reliable 3D heterogeneous integration within the Purdue Birck Nanotechnology Center. PVD-based metallization is critical for establishing conformal and adherent Ti and Cu layers that mitigate diffusion, ensure uniform electroplating, and maintain electrical integrity within high-aspect-ratio vias.

Process development focuses on refining key PVD parameters including target power, chamber pressure, deposition rate, and substrate rotation to achieve continuous film coverage in vias. Integration with upstream Deep Reactive Ion Etching (DRIE) and downstream copper electroplating steps is systematically evaluated to minimize interfacial defects, void formation, and resistance variation.

Characterization techniques such as scanning electron microscopy (SEM), profilometry, and electrical resistance measurements are employed to assess film conformality, adhesion, and overall via performance. The resulting optimized PVD process establishes a foundation for robust TSV metallization and supports the advancement of on-campus capabilities in wafer-level 3D integration and the Purdue HILEOS initiative.

Keywords:

[no keywords provided]

Mentor(s):

Peter Bermel (Engineering); Saeed Mohammadi (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7103

Presentation Time: STEW 214B at 3:00-3:20

Simulation of Modified Coherent Ising Machines for LLM Inference and Training STEM

Authors(s):

Charles Spencer Bowles† (Engineering|JMHC); Andrew Robertson‡ (Engineering)

Abstract:

Interest in large-language models (LLMs) based on transformers has recently garnered

significant interest with the advent of popular consumer access to chat-bots. With growing LLM

complexity, similarly growing large energy and compute costs arise for LLM training and

inference. As such, there is a growing interest in energy-efficient computational systems, such as

Ising machines, that have shown to be a promising tool for combinatorial optimization. Previous

work has claimed that electrical dynamical systems based on CMOS technology can accurately

and scalably implement LLMs, so called DS-LLMs. However, optical machines tend to provide

higher-bandwidth, lower-energy implementations of similar CMOS circuits. Based on the

DS-LLM model, we propose the usage of a computational system known as Coherent Ising

Machines (CIMs) for their inherent ability to accelerate these problems. CIMs are optical

machines that represent the elements of combinatorial optimization problems as pulses in a

feedback system, dynamically progressing to optimal solutions. However, application of CIMs to

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

certain optimization problems may degrade the quality of solutions, through a phenomenon

known as amplitude inhomogeneity. To demonstrate the potential of using CIMs for LLM

hardware, we developed a mathematical model to represent LLMs on CIMs; furthermore, we

have begun to simulate our model via the CUDA language. We seek to show that we can

maintain a high degree of accuracy when inferring an LLM on a CIM-based platform which

would demonstrate the potential for an alternative, low-power hardware implementation. This

would offset the cost to train and use LLMs, increasing their scalability and therefore

performance.

Keywords:

Unconventional Computing; Quantum; Machine Learning; Simulation; Domain-Specific Accelerator

Mentor(s):

Peter Bermel (Engineering); Vidisha Singhal (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7104

Presentation Time: STEW 214B at 3:20-3:40

Evaluating Bone Material Properties Using Reference Point Indentation STEM

Authors(s):

Kaley Roet† (Engineering)

Abstract:

Osteoporosis treatments seek to improve bone mineral density and bone material properties. While bone mineral density can be measured by a DEXA scan, measurements of changes in bone material properties are difficult. The BioDent reference point indentation (RPI) tool can be used to measure bone material properties in patients, but there remains a lack of clarification on whether this tool provides well-defined insights. In this project, the first unloading slope from indentation testing was used to characterize bone properties. Reference point indentation measurements were first taken on 3D-printed models of radius bones. Thereby, variation in the measured properties would be linked to differences in bone anatomy rather than material properties. After validating the method on the 3D-printed bone models, the same tests were performed on cadaveric radius bones, and under consideration of treatment. From the unloading slope, both stiffness and reduced elastic modulus values were calculated and compared among all samples. We hypothesize that once RPI measurements are corrected for anatomical difference, significant differences in bone material properties for untreated and treated bone can be determined.

Keywords:

Bone Properties; Indentation; Radius

Mentor(s):

Thomas H Siegmund (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7105

Presentation Time: STEW 214B at 3:40-4:00

Gaussian Bayesian Networks for Estimating Stiff Continuous-Discrete Stochastic Systems with Ill-Conditioned Measurements STEM

Authors(s):

Priyank Behera† (Science)

Abstract:

This paper introduces a Gaussian Bayesian

Network-based Extended Kalman Filter (GBN-EKF) for non-linear state estimators on stiff and ill-conditioned continuous-discrete stochastic systems, with a further analysis on systems with ill-conditioned measurements. For most nonlinear systems, the Unscented Kalman Filter (UKF) and the Cubature Kalman Filter (CKF) typically outperform the Extended Kalman Filter (EKF). But, in state estimation of stochastic systems, the EKF outperforms the CKF and UKF. This paper aims to extend the advantages of the EKF by applying a Gaussian Bayesian Network approach to the EKF (GBN-EKF), and analyzing its performance against all three filters. The GBN-EKF does not utilize any matrix inversions. This makes the GBN-EKF stable with respect to ill-conditioned matrices. Further, the GBN-EKF achieves comparable accuracy to the EKF in stiff and ill-conditioned stochastic systems, while having lower root mean squared error (RMSE) under these conditions.

Keywords:

Bayesian Network; Stability Analysis; Stochastic System; Kalman Filtering

Mentor(s):
Charles Robert Kenley (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7106

Presentation Time: STEW 218A at 3:00-3:20

The Risks of Concussion Underdiagnosis in Youth Sports and Preventive Interventions STEM

Authors(s):

Rakshith Srinivasan† (HHS|JMHC)

Abstract:

In recent years, the dangers of concussions have become a growing concern in sports, leading to major changes at the professional level. For example, the NFL has adopted more intensive concussion protocols and return-to-play guidelines to better protect athletes. However, far less attention has been directed toward youth athletes, who face even greater risks with much fewer preventive measures. Nearly 40% of all sports-related concussions occur between the ages of 11 and 19, an age marked by rapid brain development and increased vulnerability to long-term neurological damage. Despite this, many youth sports leagues and school programs lack standardized medical oversight, baseline cognitive testing, or education on concussion recognition, resulting in chronic underdiagnosis of concussions and premature return to play rules. Beyond physiological risks, cultural factors, such as pressure to compete, limited parental awareness, and glorification of “playing through pain”, further add to the problem. This literature review explores the biological susceptibility of adolescents to brain injury, the systemic deficiencies in youth concussion management, and the social barriers preventing effective intervention. This paper argues that through the implementation of educational programs, innovative equipment, and policy reform, youth sports can become significantly safer for adolescent athletes. By prioritizing awareness, innovation, and consistent policy enforcement, we can move toward a safer, more sustainable youth sports culture that protects the health of future generations.

Keywords:

Youth Athletes; Brain Development; Concussions; Policy Reform; Preventative Healthcare

Mentor(s):

Harris J Bras (Liberal Arts)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7107

Presentation Time: STEW 218A at 3:20-3:40

Heat and Intermittent Pneumatic Compression to Lower Extremity Result in Increased Oxygen and Deoxyhemoglobin Saturation and in Healthy and Pre-Diabetic Individuals STEM

Authors(s):

Luke Thomas Bennert† (HHS|JMHC); Brhandom Jeishryel Brisueno Lopez† (HHS); Grace Enpei Chen* (Agriculture|Engineering|JMHC); Emily Courtney Chan* (Science|JMHC); Josi Laura Gallo* (Agriculture|JMHC); Allison Paige Vick Miller* (Science|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Bruno Tesini Roseguini (HHS)

Other Acknowledgement(s):

Carolyn Marie Bakx (Interdisciplinary & Special Programs); Erik Sillaste (Purdue University)

Talk Presentation Abstract Number: 7108

Presentation Time: STEW 218A at 3:40-4:00

Colors in Branding - Neuromarketing

Business Case Study

Authors(s):

Akshita Choraria† (DSB)

Abstract:

The purpose of this study is to understand the role of color in shaping consumer perception of brands within the field of neuromarketing. The research aims to study how individuals from diverse age groups and cultural backgrounds perceive and respond to brand colors. A survey was conducted with 44 respondents, categorized by age group, gender and country of origin, who answered questions such as which color they associated with particular industries (e.g., food, technology, financial services, lifestyle etc.). A significant number of respondents associated specific colors such as red with stimulating hunger and, therefore, with food brands. Meanwhile, colors like blue and green evoked stronger cognitive responses and influenced brand traits such as reliability, trustworthiness, and authority. These findings highlight the importance of strategic color selection in brand development and marketing, suggesting that well-chosen color schemes can enhance brand appeal and consumer perception.

Keywords:

Neuromarketing; Consumer Perception; Survey; Brand Development

Mentor(s):

Tongxiao Zhang (DSB)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7109

Presentation Time: STEW 218B at 3:00-3:20

Automation Methods For Gamma Ray Spectroscopy and Data Analysis STEM

Authors(s):

Sydney Metz† (Science|JMHC); James Thomas Pittard‡ (Science);
Mason Patrick Julius Levere† (Science)

Abstract:

Gamma-ray spectroscopy is used by nuclear physicists to better understand the structure of the nucleus in excited states. By observing the decays from an excited nucleus, we can create level-schemes that map allowed energy states and transitions. Isomers are states with an abnormally long half-life, allowing for compact and efficient energy storage. However, few convenient isomers are currently known, and more level-schemes are required to identify more isomers. The current method to create level-schemes demands months of expert labor, making isomer identification slow and hard to reproduce. We instead form a matrix-graph translation problem and propose a machine learning pipeline that turns an entire coincidence matrix directly into a level-scheme. We explore a solution for this problem by conditioning an autoregressive graph generator on the synthetic gamma-gamma matrix input. We cross validate by comparing to level schemes generated on real data. To build intuition before tackling sparse experimental data (<1% signal), we train and validate on Monte Carlo derived gamma-gamma matrices and level schemes, progressively increasing spectral complexity to mimic realistic noise. By staging development in these synthetic environments, we aim to deliver a framework capable of real time, reproducible spectroscopy.

Keywords:

Level Schemes; Isomers; Machine Learning; Monte Carlo

Mentor(s):

Andy Jung (Science); Ace Rounds (Science); Jacob Edward Hartwick (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7110

Presentation Time: STEW 218B at 3:20-3:40

QUAFFLE: Quantum U -Net Assisted Federated Flood Learning and Estimation STEM

Authors(s):

Alan S Yi† (Science); Daniel Anoruo‡ (Engineering)

Abstract:

Floods are among the most destructive natural hazards, impacting nearly 250 million people annually. Advances in deep learning, particularly U-Net architectures, have enabled accurate flood-extent segmentation from optical, SAR, and urban imagery, but centralized training remains limited by privacy, policy, and data-sharing constraints. Federated learning (FL) addresses these challenges by training models locally and aggregating only parameter updates, preserving data sovereignty while enabling collaboration. In this work, we introduce a federated quantum U-Net framework that integrates quantum machine learning (QML) to enhance efficiency and privacy. The architecture replaces the classical U-Net bottleneck with variational quantum circuits (VQCs), forming a quantum bottleneck that reduces parameters while leveraging quantum representational advantages. Training is conducted in a Flower-based FL setup, maintaining privacy and scalability across distributed clients. Evaluated on the IEEE GRSS 2024 Flood Dataset, the quantum-federated U-Net achieved 97.7 % accuracy on SAR and 87.6 % on optical imagery, matching centralized baselines while reducing trainable parameters by 6.1 %. On combined SAR-optical data, it outperformed both classical and centralized models, highlighting improved generalization under non-IID conditions. Implemented using PennyLane and ORCA SDK, with both PyTorch and JAX versions available at <https://github.com/SECQUOIA/QUAFFLE>, the results show that federated learning enhances model robustness in non-independent and identically distributed (non-IID) datasets, while the hybrid structure with the quantum bottleneck layer in the U-Net reduces the number of parameters with minimal loss in accuracy. Beyond flood mapping, the framework can be generalized to image segmentation tasks involving non-IID data that are more representative of real-world distributions, highlighting its potential for practical implementation and application.

Keywords:

Federated Learning; Quantum Machine Learning; Flood Mapping

Mentor(s):

Yirang Park (Engineering); David Esteban Bernal Neira (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7111

Presentation Time: STEW 218B at 3:40-4:00

Examining Myh9a Function and Localization in Zebrafish Wound Closure Utilizing PhiC31-CRISPR-Cas9 Knock-In Line Methods STEM

Authors(s):

Morgan Stephens† (Science|JMHC)

Abstract:

Wound closure is driven by the actomyosin ring, through the recruitment of actin filaments and myosin motor proteins to the damaged site. Myosin itself is known to provide the contractive force behind this process. In our zebrafish model, we aim to observe this process in by targeting the non-muscle myosin gene myh9a that is involved in tail contraction, as the mechanisms that are utilized by myh9a in the process of wound closure are not understood. This research aims to better understand these functions of myh9a. This study utilizes a two-step Knock In (KI) method with the PhiC31-CRISPR Cas9 recombination system in examining myh9a receptor interactions. The first step is the generation of an attP KI line, followed by the injection of an attB plasmid into the attP line. This integration is directed through site-specific attP-attB DNA recombination and is performed by inducing DSBs to the last few introns to lower disruption in the translation of the endogenous protein. Endogenous gene tagging can be used to examine these expressions and to study protein localization within a cell. Through utilizing myh9a that has been tagged with a green fluorescent protein (GFP) or red fluorescent protein (RFP), these interactions of myh9a with receptors and proteins can be tracked in the epithelial skin layers. Overall, the aim of this work is to observe and determine the roles of myosin gene myh9a in Zebrafish wound closure.

Keywords:

CRISPR-Cas9; Knock-In Lines; Myh9a; Wound Closure

Mentor(s):

Chang Ding (Science); Qing Deng (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7112

Presentation Time: STEW 218C at 3:00-3:20

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 fabrum* C58 and *Caulobacter vibrioides* CB15. It is hypothesized that adherent cells will be more efficiently lysed during physical extraction due to increased contact during physical beating, yielding more DNA. On the other hand, using a chemical lysis, it is hypothesized that there will be less variation in yielding DNA as compared to the physical lysis, with non-adherent cells showing slightly more yield. 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:

Bacteria; Microbiome; Adhesion; DNA Extraction; Lysis

Mentor(s):

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

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7113

Presentation Time: STEW 218C at 3:20-3:40

Using leaf disk assays to culture and diagnose Coffee leaf rust STEM

Authors(s):

Robert James Lyon† (Agriculture)

Abstract:

The Coffee leaf rust is a heavily understudied fungus, and the ways to culture and identify it are even more limited. This study uses leaf disks to attempt to culture the obligate pathogen, and with these cultures, identify photosynthetic stress on leaves to identify Rust infections before they become visible to the naked eye.

Keywords:

Rust; Fungi; Coffee

Mentor(s):

Mary Aime (Agriculture); Terry Jarianna Torres Cruz (Agriculture)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7114

Presentation Time: STEW 218C at 3:40-4:00

In Ovo their heads: Can behavioral and physiological stress responses from heat stress be replicated without a parental component in Pekin ducks?

STEM

Authors(s):

Nina Kay Wilson† (Agriculture)

Abstract:

Episodic heat stress (HS) costs the poultry industry millions of dollars each year. Previous studies in our lab have shown that HS in breeder ducks leads to an increased deposition of glucocorticoids in the egg. Furthermore, hatchlings from these eggs exhibit enhanced physiological responses to stress and increased fear. We tested the hypothesis that increased glucocorticoids cause exaggerated stress and fear responses. We utilized an in ovo injection of glucocorticoids to simulate this stress response, but without the parental component. Eggs were injected with either dexamethasone (DEX; 0.1ml of 1µg/µl in saline), or with 0.1ml saline control (n=100/treatment), and incubated. Ducklings were separated into their respective groups (n=50/treatment/pen). At 3 weeks of age, ducks were given an ACTH stim (cosyntropin, 0.04mg/kg) in saline, vs saline control challenge (0.1ml/kg saline) with .01% mannitol (n=6/treatment). Blood was collected at 0,1,2, and 4 hours. An isolation fear test was also performed at 4 weeks of age. Heterophil to Lymphocyte ratio, ELISA for glucocorticoids, FCR, and weekly body weights were all calculated and recorded. Our results show that the in-ovo dexamethasone injection increases the response to the ACTH challenge later in life in the DEX-ACTH group. Corticosterone responses to stim test were analyzed by a t-Test and behaviors using a Wilcoxon Rank test. DEX ducklings showed an increased (p<0.05) corticosterone response to ACTH compared to controls. However, no differences were observed in the isolation fear test. Our results suggest a mechanism for how epigenetic changes may occur in physiological responses but perhaps not behavioral.

Keywords:

Transgenerational; Cortisol; HPA Axis; Vocalization; Novel Environment

Mentor(s):

Greg Fraley (Agriculture)

Other Acknowledgement(s):

Jenna M Schober (Agriculture); Isabella Claire von Seggern (Agriculture); Erica Ryann Roge (Agriculture)

Talk Presentation Abstract Number: 7115

Presentation Time: STEW 218D at 3:00-3:20

Researching 501 Indiana Avenue Property

Social Science

Authors(s):

Prerona Kaushik† (Engineering|JMHC)

Abstract:

This project aimed to uncover more details about the property located at 501 Indiana Avenue, including its date of construction, demolition timeline, and historical ownership. With the help of with the Indiana Historical Society (IHS) and IU archives and in collaboration with Purdue University architect office, I gained valuable insights by examining Sanborn maps and city directories. This research revealed a wealth of information, including the fact that Indiana Avenue once thrived as a jazz hotspot and was a cornerstone for many Black-owned businesses. The 501 Indiana Avenue property was originally built in 1866. In the early 1900s, it became a vibrant center for political activities. While the building itself remained largely the same over time, ownership and the type of businesses operating there changed significantly. Today the building is owned by Purdue University. This research aims to provide an accurate historical narrative regarding the construction and history of the property.?

Keywords:

Indiana Ave; Indianapolis; Black Heritage; Restoration; Preservation

Mentor(s):

Ashima Krishna (JMHC)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7116

Presentation Time: STEW 218D at 3:20-3:40

Studying the Factors Affecting the Adoption Rate of Electric Vehicles in the U.S.

Business Case Study

Authors(s):

Devansh Sachin Kejriwal† (DSB|JMHC)

Abstract:

The increasing adoption of electric vehicles (EVs) globally indicates a clear move away from internal combustion engine (ICE) vehicles. This transition is aided by multiple factors such as environmental sustainability, purchasing and operational costs, vehicle performance, etc. This research paper creates a predictive model trained on historical data to predict EV adoption rates for future years across states in the U.S. This helps answer key questions such as how these rates vary under different policy, economic, and social conditions, the effectiveness of government incentives, consumer preferences, and barriers that hinder large-scale adoption.

The research plan involves a review of prior studies on EV adoption determinants, data collection on critical variables such as charging infrastructure density, fuel costs, and range anxiety, and the development of a model capable of forecasting adoption under multiple scenarios. The model is still under testing, but the expected results are a higher adoption rate in U.S. states enforcing EV adoption incentives and lean towards a global switch towards EVs over ICE vehicles.

The project holds significant implications for policymakers and automobile manufacturers seeking to accelerate the transition toward sustainable transportation. By identifying which incentives and market factors most effectively promote EV adoption, the study provides a strategic framework for guiding both corporate decision-making and public policy. Ultimately, this research contributes to environmental sustainability by informing efforts to enhance the uptake of clean-energy vehicles and reduce dependence on ICE vehicles.

Keywords:

Electric Vehicle Adoption; Predictive Model; Incentives; Sustainability; Forecasting

Mentor(s):

Olga Rusyaeva Senicheva (DSB)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7117

Presentation Time: STEW 218D at 3:40-4:00

The New Avenue: From Black Main Street to Boiler Green

Social Science

Authors(s):

Suhani Maini† (Engineering|JMHC)

Abstract:

This study documents the history of 518–520 Indiana Avenue—a significant property within the 500 block of Indianapolis's historic Black cultural and commercial corridor, once known as "Funky Broadway". Created under racial segregation, The Avenue became the city's focal point for Black society and music.

The research traces the structural and occupational transformation of the property: from an early one-story frame shop (1887) to a two-story brick building that housed a poultry and fish shop by 1898. Its greatest cultural significance began in the summer of 1918 when it was acquired by The Indianapolis Recorder, one of the oldest Black-owned printing presses in the city. The newspaper operated from this site until 1975, addressing vital community issues for nearly six decades.

The property's subsequent vacancy and sale coincided with the community's systemic decline, driven by factors including Urban Renewal and the expansive development of IUPUI. This paper utilizes Sanborn Fire Insurance Maps, city directories, and archival records to illustrate how a single address reflects the Avenue's trajectory from a vibrant, self-sufficient cultural hub to a landscape of institutional displacement. Ultimately, this research provides a critical lens for understanding the enduring impact of systemic erasure on Black economic and cultural continuity in Indianapolis

Keywords:

Indiana Ave; Indianapolis; Restoration; Preservation; Black Heritage

Mentor(s):

Ashima Krishna (JMHC)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7118

Presentation Time: STEW 214B at 4:00-4:20

Process Development and Characterization of Through-Silicon-Vias (TSVs) for 3D Advanced Packaging STEM

Authors(s):

Tobias Mikael Carst† (Engineering); Aaron Fernandes† (Engineering); Chase John Grimm† (Engineering); Romy Kim† (Engineering)

Abstract:

This project focuses on developing a robust Through-Silicon-Via (TSV) fabrication process to support 3D heterogeneous integration within Purdue's Birck Nanotechnology Center. TSVs enable high-density vertical interconnects between stacked silicon dies, significantly improving bandwidth, power efficiency, and system performance for applications such as high performance computing and data centers. The project focuses on optimizing deep reactive ion etching, barrier and seed layer deposition, and copper electroplating to achieve high-aspect-ratio vias with void-free fill and low electrical

resistance.

Experimental work includes refining Bosch DRIE parameters (etch/passivation ratio, C₂F₄/SF₆ gas flow, and cycle timing) to produce smooth, vertical via profiles with minimal scalloping. Subsequent steps involve PVD deposition and Cu seed layers, followed by electroplating process development to ensure uniform copper filling across the wafer.

Target specifications include via aspect ratios of 5:1–10:1 and trench depth of 300 μm . Characterization will be performed using profilometry, SEM imaging, and electrical testing to evaluate process quality, adhesion, and reliability.

Ultimately, the developed TSV process will serve as a foundation for future 3D integrated device fabrication and will directly support ongoing efforts including the Hileos 3D-IC initiative. The results from this project will contribute to advancing on campus capability for wafer-level 3D integration research and education.

Keywords:

Through-Silicon-Vias; 3D Packaging; Semiconductor; Advance Packaging

Mentor(s):

Peter Bermel (Engineering); Saeed Mohammadi (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7119

Presentation Time: STEW 214B at 4:20-4:40

Habitual Refused Doses of Enoxaparin STEM

Authors(s):

Mia M Yates† (Pharmacy|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

Enoxaparin; Lovenox; Medication Safety; Health System; Pharmacy

Mentor(s):

Monica Miller (Pharmacy); Ellen M Schellhase (Pharmacy)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7120

Presentation Time: STEW 214B at 4:40-5:00

VIP - Smart Cities - Data Annotation

STEM

Authors(s):

Arunasalam Subbiah† (Science); Sanjana Chinthalap Mohan† (DSB); Priyanka Bansal‡ (Science); Dhruvika Deekonda‡ (HHS|JMHC); Ridham Jatinkumar Patel‡ (Science); Mark Vincent Waldron‡ (Science)

Abstract:

As the world continues to urbanise at an unprecedented pace, it has become increasingly important to leverage technology to sustain and optimise urban infrastructure. One of the most important urban infrastructures today are roads, which directly impact transportation, safety and quality of life. However, maintenance and repairing this urban infrastructure poses a huge financial and logistical burden on our government, while the citizens face challenges regarding everyday transportation and hazards of road closures.

Our project aims to address this challenge by using machine learning and deep vision techniques to predict and assess road conditions before they turn into costly issues. This will enable us to reduce maintenance costs and time while enhancing the urban road experience for citizens.

Our team is working with semantic segmentation to annotate road data at the pixel level. We annotate data across 10 classes: unfilled crack, filled crack, patch, spalling, manhole, edge marking, lane marking, turn marking and miscellaneous marking - using label studio. The data is collected by the hardware team through real-world imaging in local areas. We will use the annotated data to build a convolutional neural network (CNN) that will be able to distinguish these classes on new road data. The performance of the model will be evaluated based on factors such as the F1-score, pixel accuracy, overfitting etc.

Through this project, we aim to use latest technology to help sustain and improve urban infrastructures, building safe and smart urban systems for everyone.

Keywords:

Data Annotation; Semantic Segmentation; Convolutional Neural Networks; Model Building; Urban Systems

Mentor(s):

Abhishek Subedi (Engineering); Nikkhil Vijaya Sankar (Engineering);
Mohammad Reza Jahanshahi (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7121

Presentation Time: STEW 218A at 4:00-4:20

Automatic Music Transcription – AI for Music STEM

Authors(s):

Ojas Chaturvedi† (Science|JMHC|Graduate); Emily Ran Li† (Science|JMHC); Junyong Lee† (Science); Shreeya Vishram Sarurkar† (Science); Vishaal Iyer‡ (Science); Arnav Ashish Kalekar‡ (Engineering); Elliott Jameson Soderberg‡ (DSB); Sean Xiaoyang Su‡ (Engineering|JMHC); Isha Virat Yanamandra‡ (Science); Kayshav Bhardwaj* (Science); Tanay Hemant Gondil* (Science); Sanshray Kumar* (Science); Franklin Shang* (Science); Ritwik Suresh Jayaraman* (Science|Graduate)

Abstract:

Automatic Music Transcription (AMT) converts audio into symbolic formats like sheet music or MIDI. Traditionally time-intensive for human transcribers, AMT can accelerate music creation, education, and research by saving time and enhancing accessibility. Beyond music, its applications extend to assistive hearing technologies, such as addressing the “cocktail party problem” by isolating individual sound sources from noise. Techniques that distinguish instruments by acoustic traits could similarly separate voices, improving hearing aids and speech recognition in complex auditory settings.

To explore AMT’s current capabilities, we conducted a literature review of existing software, identifying Google’s MT3 model as among the most promising. However, many tools struggle with polyphonic or multi-instrumental music, hallucinate nonexistent instruments, or fail to isolate melodies. In response, we organized an AMT competition in April 2025, where participants submitted programs that converted up to 100 classical recordings (with at most three instruments) into MIDI files. Submissions, hosted on GitHub, were evaluated on instrument accuracy, pitch, and onset/offset precision.

Each model excelled in specific areas but lacked generality. Some differentiated instruments well yet misidentified pitches, while others captured rhythm accurately but confused instrument types. Future work aims to combine these strengths into a more robust model. One approach under exploration is a model-switcher, which dynamically selects transcription models based on the music’s characteristics. Ultimately, incorporating features like musical complexity could further improve accuracy and adaptability. In the future, the progress made in

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

music transcription will not only impact the music industry, but improve overall quality of audio and speech transcription.

Keywords:

Artificial Intelligence; Machine Learning; Transformers; Music; Transcription

Mentor(s):

Yung-Hsiang Lu (Engineering); Yeon Ji Yun (Liberal Arts)

Other Acknowledgement(s):

Basil Khwaja (Engineering)

Talk Presentation Abstract Number: 7122

Presentation Time: STEW 218A at 4:20-4:40

Organometallic Cobalt(III) Complexes Supported by Pi-Acidic MePhTIM Macrocycle STEM

Authors(s):

Jeremy Joseph Roost† (Science)

Abstract:

Recently, the Ren lab has explored the synthesis and characterization of CoIII(TIM) aryl, alkenyl, and alkynyl complexes (TIM = 2,3,9,10-tetramethyl-1-4-8-11-tetraazacyclotetradeca-1,3,8,10-tetraene). Of these complexes, Co(TIM)-aryl complexes were shown to possess useful photophysical properties, undergoing photolytic cleavage of the Co–C bond, likely forming a CoII radical species. This is suggested by a confirmed radical aryl species that is seen when Co(TIM)-aryl is irradiated with 456nm LED light. Cobalt radical species are of particular interest due to their role as an intermediate in photoradical catalysis. In attempts to further promote the photolysis of Co(TIM) aryls and alkynyls a new macrocyclic system, MePhTIM, was employed, which contains extended conjugation of the macrocycle's backbone via substitution with phenyl groups. This effect aids in withdrawing electron density from the CoIII center, allowing for easier reduction to CoII. To accomplish this, CoIII(MePhTIM) aryl and alkynyl complexes were synthesized by reacting trans-[Co(MePhTIM)Br₂]PF₆ with phenyl and phenylacetylide Grignard reagents, yielding mono- and bis- substituted products. Each complex was structurally characterized through X-ray diffraction, and their electronic properties were observed through UV-Vis absorption spectroscopy, cyclic voltammetry, and photophysical characterizations.

Keywords:

Organometallic Chemistry; Inorganic Synthesis; Sustainability; Green Chemistry

Mentor(s):

Tong Ren (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7123

Presentation Time: STEW 218A at 4:40-5:00

Variable Emission in JWST Observations of the Supernova Remnant Cassiopeia A Reveal Light Echoes and Ejecta Flickering STEM

Authors(s):

Madeline G Taylor† (Science)

Abstract:

Cassiopeia A (Cas A) is the youngest known core-collapse supernova remnant in the Milky Way (age ~350 years), located at a distance of approximately 3.4 kpc. Its close proximity enables resolved inspection of its dynamic structure, which includes fast-moving ejecta knots, reverse-shocked filaments, and interactions with circumstellar and interstellar material. The James Webb Space Telescope (JWST), with its exceptional sensitivity and spatial resolution in the mid-infrared, allows detection of faint, small-scale features and time-variable phenomena that were previously inaccessible. Using multi-epoch imaging from JWST's Mid-Infrared Instrument (MIRI) obtained in Cycle 1, we surveyed Cas A for evidence of variable emission on timescales of approximately 2–4 months. We detect dozens of regions exhibiting variability, which we attribute to two distinct phenomena: light echoes and flickering ejecta knots. Light echoes arise from supernova light scattering off and heating interstellar dust clouds. In contrast, localized flickering of ejecta emission likely results from interactions between high-velocity, metal-rich debris and inhomogeneous circumstellar or interstellar media (CSM/ISM). We describe efforts to robustly distinguish between light echoes and ejecta flickering based on morphology, spectral characteristics, and temporal behavior. These rapid changes in emission reveal a vast array of light echoes around Cas A at very small scales, and provide new insight into the dissipation and evolution of supernova ejecta. Our work demonstrates JWST's unique capability for time-domain studies of supernova remnants and lays the groundwork for identifying transient infrared phenomena in other Galactic and extragalactic remnants.

Keywords:

Supernova; Light Echo; Cassiopeia A

Mentor(s):

Danny Milisavljevic (Science)

Other Acknowledgement(s):

Danielle Dickinson (Science); Noah William Zimmer (Science)

Talk Presentation Abstract Number: 7124

Presentation Time: STEW 218B at 4:00-4:20

Ariadne: Discovering PBT Generator Weights with Dynamic Sampling STEM

Authors(s):

Francille Zhuang† (Science|JMHC)

Abstract:

Property Based Testing (PBT) is a popular automated testing methodology that uses thousands of randomly generated inputs to probe a program's behavior. PBT frameworks create these inputs using input generators, functions that non-deterministically sample from the input space of the program under test. To be effective, input generators must produce representative samples of the inputs of interest to the developer of the program under test. However, manually adjusting the distribution of a generator is a tedious and error prone task.

This work introduces a technique for automatically tuning an input generator to better align with a specified target distribution. The proposed technique stochastically modifies the generator, by using dynamically sampling to estimate how closely its outputs align with the target distribution. Compared to prior work, our proposed approach supports richer classes of target distributions and input generators. As one example, our approach can automatically tune a binary search tree generator to produce trees with uniformly distributed heights. In addition, our approach can ensure that a generator produces values that satisfy a disjoint set of predicates. We have realized our technique in a tool called Ariadne; our experiments show that Ariadne can automatically adjust generators for a diverse set of data types so that they produce samples that align with a variety of semantically rich target distributions.

Keywords:

Software Testing; Dynamic Sampling; Programming Languages;
Property Base Testing

Mentor(s):

Benjamin J Delaware (Science); Patrick William LaFontaine (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7125

Presentation Time: STEW 218B at 4:20-4:40

The Mother of all Bones: A Case Study of the Calcium-Rich Transient SN 2023xwi STEM

Authors(s):

Owen T Odney† (Science)

Abstract:

Calcium-rich supernovae (SNe) are a unique class of transients because of their low magnitudes, quick rises in light-curve peaks, and elevated presence of calcium relative to other transients. These properties make them difficult to both observe and model. There is no current consensus on the progenitor star system that creates these explosions, necessitating further study in this area. A useful method of analysis is case studies of specific Calcium-rich SNe to extract properties of the explosions, like their density, chemical composition, and their surrounding environment to name a few. This project is a case study of a recently observed Calcium-rich transient SN 2023xwi using the radiative transfer code TARDIS to fit the observed spectrum. After exploring various parameters in TARDIS including the density profile, chemical abundance profile, luminosity, and ejecta velocity, a best-fit model spectrum is presented and compared to the observed spectrum. The fit parameters are then used to evaluate potential progenitor systems and explosions mechanisms of 2023xwi. Future work could attempt to further explore any discrepancies in the models and study new Calcium-rich transients with the tools developed in this project.

Keywords:

Supernova; Radiative Transfer; Spectroscopy

Mentor(s):

Abigail Polin (Science)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7126

Presentation Time: STEW 218B at 4:40-5:00

Characterization of river discharge and interaction with shallow groundwater aquifers along the Wabash River using seismological methods STEM

Authors(s):

Jessica Marie Cyr† (Science)

Abstract:

The interaction between shallow aquifers and local rivers in the West Lafayette, Indiana area remains poorly understood. While surface water levels in the Wabash River and its tributaries are monitored at several USGS stream gauges, groundwater fluctuations are less well documented. Methods using seismic recordings, sensitive to subtle ground vibrations and subsurface structure, provide an alternative to characterize groundwater levels and river discharge. This project analyzes the temporal variations of ambient noise seismic data, examining the relationship to USGS river discharge, precipitation records, and other environmental factors. We currently focus on 1) changes in maximum amplitudes and peak frequencies within 0.1-5 Hz, and 2) variations of subsurface seismic velocities. The continuous waveform was converted into the frequency domain using Fourier transforms on 2-hour windows, followed by detection of peak frequencies and the corresponding amplitudes. In addition, we examine temporal changes in seismic wave velocity using the autocorrelation of vertical-component recordings, a method previously linked to groundwater fluctuations in other regions. The preliminary analysis is focused on data from a seismometer located approximately 30 meters from the Tippecanoe River. Given that spring is typically the season with the most precipitation in Indiana, we first looked at seismic data from March to June 2022 to identify potential correlations with peaks in river discharge. We plan to expand the analysis to 4 other seismometer sites and incorporate data from other seasons to better understand seasonal variability. Our approach highlights the potential of ambient noise seismic monitoring to contribute to hydrologic studies in regions where groundwater-surface water interactions are not well constrained.

Keywords:

Hydrology; Seismology; Aquifer

Mentor(s):

Xiaotao Yang (Science); Marty D Frisbee (Science)

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

Other Acknowledgement(s):
Charles Schafer (Science)

Talk Presentation Abstract Number: 7127

Presentation Time: STEW 218C at 4:00-4:20

Comparison of Environmentally Collected Bacteriophages STEM

Authors(s):

Olivia Madison Krzyzanowski† (Agriculture|Engineering); Natalie George Khazal† (Agriculture|Engineering|JMHC); Adriana K Sanchez† (Agriculture|Engineering)

Abstract:

Bacteriophages, or phages, are viruses that specifically infect and replicate within bacteria. Each phage contains a genome that can include a multitude of genes, which they deliver into the bacterial cytoplasm by injecting their genetic material. Discovered in the early 20th century, bacteriophages were quickly recognized for their potential to kill bacteria and were even used to treat infections before the development of antibiotics. Although their use declined with the advent of antibiotic therapy, phage therapy continues to be practiced in some regions today. The growing threat of antibiotic resistance has renewed global interest in phages as potential alternatives for combating bacterial infections. Beyond their antimicrobial capabilities, recent research suggests that phages could also play a role in therapeutic and genetic treatments. Our research focused on isolating, amplifying, and analyzing bacteriophages collected from environmental samples. The procedures followed the Howard Hughes Medical Institute's SEA-PHAGES program, a two-semester, discovery-based undergraduate research initiative centered on the isolation and characterization of novel bacteriophages.

This study aims to compare two distinct bacteriophages that were independently isolated. The comparison includes differences in the environments where each phage was found, plaque morphology and appearance, the number of plaques required to web an agar plate, serial dilution results, spot titer and full titer data, lysate collection, and lysogen testing. Through these analyses, we seek to better understand how environmental factors influence phage behavior and characteristics.

Keywords:

Bacteria; Microbiology; Lysate; Phage; Virus

Mentor(s):

Kari L Clase (Engineering); Taylor Sophia Buchowski (Agriculture); Anurag Rajendra Pujari (Agriculture); Amanda K Limiac (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7128

Presentation Time: STEW 218C at 4:20-4:40

Developing Experiential Learning for Aviation Maintenance Technicians STEM

Authors(s):

Ronan Edward Lang† (Polytechnic|JMHC); Avarey Newman* (DSB);
Joshua James Jackson* (Polytechnic|JMHC); Caleb Bierdeman Probst*
(Polytechnic|JMHC)

Abstract:

The aviation industry faces a significant shortage of Aviation Maintenance Technicians (AMTs), which threatens operational reliability and future growth. Boeing estimates that 710,000 new maintenance personnel will be needed, and the U.S. Bureau of Labor Statistics projects 13,100 annual job openings by 2034. The Aviation Technician Education Council (ATEC) reports that current training programs meet only 60% of the demand. This project sought to develop a program that prepares AMTs through practice-based instruction and creates adaptable instructional design models for workforce development. Program development was guided by Kolb's experiential learning theory and instructional design frameworks, with AMT job tasks serving as the basis for content creation. This included developing presentations and question banks aligned with FAA-H-8083-30 and AMT preparatory materials, explanatory feedback, diagrams and visuals, and assessing test structures. A quality control team reviewed all materials before integrating them into the Absorb Learning Management System (LMS). The project generated more than 500 exam-style questions, lectures, and laboratory projects to support the FAA Airframe and Powerplant exam. Technicians indicated that explanatory feedback substantially enhanced comprehension compared to questions alone. Additionally, the design process improved the team's understanding of FAA standards, regulations, and testing conventions. These outcomes demonstrate that developing and implementing instructional materials deepens technical knowledge and reflects the ongoing learning required in aviation maintenance. This experiential learning model offers a scalable approach to aviation maintenance training and instructional design, while also fostering collaboration between universities and industry, and addressing the AMT shortage at its core.

Keywords:

Aviation; Aviation Maintenance Technicians (AMTs); Experiential Learning; Workforce Development; Technical Education

Mentor(s):

Manoj S Patankar (Polytechnic)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7129

Presentation Time: STEW 218D at 4:00-4:20

Investigating Liposomal Drug Carrier Interaction Forces with Membranes STEM

Authors(s):

Ella Grace Olson† (Engineering|JMHC)

Abstract:

Liposomes are hollow, spherical capsules with an outer lipid membrane layer that can encapsulate different drugs and transport them within the body. One example is liposomal doxorubicin which is a clinically approved cancer treatment. While these carriers are effective, the mechanics that govern how liposomes detach from biological surfaces are still being studied. In this work, we use Atomic Force Microscopy (AFM), a technique that probes interactions at the nanoscale, to measure the forces required to separate liposomal doxorubicin from selected substrates. The chosen substrates mimic the softness and mechanical properties of biological surfaces. By analyzing the measured forces, we aim to better understand how liposomal drugs interact with surfaces, providing insights that could guide the development of more effective drug delivery systems.

Keywords:

Liposomes; Liposomal Doxorubicin; Atomic Force Microscopy (AFM); Liposome Membrane Interactions; Nanolithography

Mentor(s):

Ryan B Wagner (Engineering); Subham Das (Engineering)

Other Acknowledgement(s):

Talk Presentation Abstract Number: 7130

Presentation Time: STEW 218D at 4:20-4:40

Designing Inclusive Student Organizations: A Student-Led Accessibility Initiative at Purdue Social Science

Authors(s):

Natalie Grace Horgan† (Pharmacy|JMHC); Francis Willow Quinn Corvint‡ (Agriculture|JMHC)

Abstract:

There are 3.5 million Disabled college students in the United States, with 4,671 utilizing disability services at Purdue University. Nationwide, 8-14% of students in higher education are Disabled, indicating a substantial number of students whose needs should be supported. Inaccessibility impacts the way Disabled college students are able to engage with the college experience. Notably, student organizations are not subject to ADA requirements, and when they are inaccessible, Disabled students may face increased stress, social exclusion, and a lack of belonging at their institution. Recognizing these effects, HonorServes, a community service student committee at Purdue's John Martinson Honors College, launched an initiative in August 2024 to improve accessibility within its own events and create an accessibility model for other student organizations. The project aims to assist student organizations at Purdue in being more inclusive of Disabled students while also educating the broader student body on the importance of advocating for accessibility. By creating a culture where accessibility is the norm, HonorServes seeks to ameliorate the long-term negative effects of inaccessibility. Greater accessibility on and off college campuses is vital to ensure that all students have the opportunity to thrive.

Keywords:

Accessibility; Disabled Students; HonorServes

Mentor(s):

Rosanne Altstatt (JMHC)

Other Acknowledgement(s):

Jessi-Alex Brandon (JMHC)

VIRTUAL PRESENTATION

Posters sorted by first author's last name. Only presenting authors (italicized) and mentors are listed below. Contributing authors and acknowledgements are listed later in the abstract book.

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Mohamed khaled Mohamed Atta; Don Anh Nguyen; Anas Zyad Abughali; Ayush Singh; Mark Johnson
- 9001** The Regenerative Cycle of Flooring Materials: Mycelium and Piezoelectric Applications
Isabella Rose Beagles; Ryan Lanark Antemann; Mariela Dawn Rampersad; Genell Wells Ebbini
- 9002** Extending FreeRTOS for Dual-Core Scheduling on the AFTX08 Microcontroller
Hsiang-Chun Chang; Jacob Thompson Lawrence; Murad Ibrahimov; Po-Chin Yang; Cole Aaron Nelson
- 9003** Intelligent Data Validation for Agricultural Sensor Networks Using LLMs
Frank Mingyuan Chen; Courtney Grace Marsh; Mariana Ortiz Martinez Troncoso; Christopher Hao Xuan Xie; Kevin T Lee; Ramaa Saket Suri
- 9004** Privacy Preserving Machine Learning
Henry Jones Cheung; Zahra Ghodsi
- 9005** The Space Between
Olivia Jo Clemons; Genell Wells Ebbini
- 9006** Think Globally, Act Locally: The 17 UN Goals at Purdue
Jada Celeste Culver; Elena Christine Rodriguez; Jackson Howard Warren; Genell Wells Ebbini
- 9007** Pikes Peak Aerodynamical Analysis
Shrikar N Dayalu; Krish Agarwal; Shusei Robson; Charles Holliday Jenckes
- 9008** Open Access Design Flow Sub-team of SoCET
Noah Everett Desserich; Nathan Nanchuen Yu; Lucy Chenlu Xu; Laura van Ritbergen; Timothy Francis Hein
- 9009** Pre-Assessment Clinic Service Audit
Madison Marie Detzer; Monica Miller; Ellen M Schellhase
- 9010** Design and Implementation of Hardware Performance Monitors for RISC-V Processors with Selective Counter Management
Matthew Du; William Rowan Cunningham; Cole Aaron Nelson; Mark Johnson
- 9011** Smart Lighting Retrofit for Energy Efficiency and Circadian Health in PAO Hall
Kaylee Grace Gesick; Genell Wells Ebbini
- 9012** Building the Well-Engineered Scholarship - Mental health prioritization among Purdue Engineering Students
Kendall Greer Gibson; Kristy Eaton

- 9013** Implementation of a Floating Point Unit for a RISC-V SoC
Jeremy Logan Hakimi; Jared Marc Settler; Levi J Thompson; Raghuv Potdar; Cole Aaron Nelson
- 9014** Scan DFT Implementation in Both Tapeoutable and Untapeoutable PDKs
Seongwon Hong; Raghav Srivaths; Aniketh Bhaskar Bandi; Abinands Ramshanker
- 9015** Why Banner Ads Annoy Users: Testing AI Misalignment in Recommender Systems
Shun Ide; Petros S Drineas
- 9016** Likes, Shares, Extremism: How Social Media Fuels Radicalization
Deona Julary; Eric Waltenburg
- 9017** Evaluation of Therapeutic Drug Monitoring in Adult Critical Care Units (ACCUUs) at St Bartholomew's Hospital, London UK
SeoJeong Kim; Ellen M Schellhase; Monica Miller; Rhona Sloss
- 9018** OS Development with the AFTx07+
Seungho Lee; Seongbin Lee; Hojun Choi; Daeun Kim; Cole Aaron Nelson; Mark Johnson
- 9019** Facilitating space exploration through the creation of a humanoid robot able to perform complex tasks under the harsh conditions of space and other planets.
Elvin Xuyang Li; Gabriel Duarte Rengifo; Madhav Amit Arora; Drish Jaykishan Shah; Jaeun Kim
- 9020** Ansible for better maintainence of ECE Labs.io
Michael Li; Junfei Li
- 9021** All-in-One Camera
Sophia Yixuan Lu; Huijie Loy; Qi Guo
- 9022** Farm robotic challenge – S.A.F.E.-Bot
Henry John McGee; Anya Panday; Cyrus Kasten Gonzalez; Marteza Hossein Rajabi; Saurav Chittal; Kevin T Lee
- 9023** Cumulative Defense Strategies against Adversarial Attacks in Image Classification Machine Learning Models
Keisuke Alexander Nakamura; Sharanya Devgon; Zahra Ghodsi
- 9024** The Impact of Project Scaffolding on Student Success in Engineering Optimization Course
Neha Naladala; Lisa B Bosman
- 9025** The Self-Reported Impact of Foreign Accents on Speakers of English
Mackenzie L Nord; Naomi Gurevich; Talia A Bugel
- 9026** Understanding Emotion Recognition Technology (ERT) in Education
Sarah Jessica O Farril-Gonzalez; Lindsay Weinberg
- 9027** Armor Detection with computer vision within the context of a Robomaster competition
Evan Brent Osborne; Zijian He

- 9028** Integrating Drive-by-Wire Systems for Autonomous Go-Kart Control
Aarya Patnaik; Letizia Angelica Echevarria; Aidan Kwan; Martin Ufer Aldana; Andres Felipe Hoyos Moreno; Reed Joseph Freer; Richard Osita Ajagu; Samuel Labi
- 9029** Drones in Commercial Use
Tyler Clay Pieszcchala; Steven R Dunlop; Monika Tomar
- 9030** Accelerating Hardware Verification through Continuous Integration and Docker Optimization
Alexander Popescu; Abhinav Palivela; William Rowan Cunningham; Mark Johnson
- 9031** Reimagining the Stewart Center: A Green Roof Strategy for Stormwater Reduction and Habitat Restoration
Grace Marie Ryal; Allison Renee Garber; Hailey Elizabeth Parkinson; Genell Wells Ebbini
- 9032** Applying and Enhancing New Ways to Educate on FPGA's
Justin Samuel; Rhea Vashishtha; Brett Michael Heckman; Junfei Li
- 9033** USB Host Controller for AFT-series SoCs
Sandeep Saravanakumar; Matthew Yao; Michael Brayden Hudson; Brian Zhuang; William Rowan Cunningham; Devin Singh; Mark Johnson
- 9034** Ultra-high strength thermoplastic starch film for packaging
Arjun Sharma; Andres Tovar
- 9035** Using a High Temperature 3D Printer
James Siadat; Hassan Saad; Haocheng Huang; Izabella Ann-Marie Celeste-Wade; Jing Zhang
- 9036** VIP Meta AR/VR
Conrad Clifford Soares; Timothy Chandrathil Manogura; Adam Charles Lundquist; Maxwell Sean Tran; Steven R Dunlop
- 9037** eV Karts
Chloe Elizabeth Staron; Steven R Dunlop; Monika Tomar
- 9038** Adaptive Long Memory
Sai Harshith Suram; Melissa Kay DeFrench
- 9039** Reimagining the Abandoned Mall for Community Sustainability
Wynne Catherine Swick; Lauren Taylor Bean; Jade Angelina Hill; Genell Wells Ebbini
- 9040** Investigating the Role of Structured Online Discussions in Fostering Learning in Engineering Students
Trisha Bimal Thakkar; Lisa B Bosman
- 9041** Enhancing Collaborative Learning through Immersive AR/VR Environments
Maxwell Sean Tran; Adam Charles Lundquist; Timothy Chandrathil Manogura; Conrad Clifford Soares; Steven R Dunlop
- 9042** Optimization of Percutaneous Leadout Cable Suspension for Chronic Awake EEG Recordings in Rats
Khai Minh Wall; Ian Michael Scroggs; Zachary Alan Rogers; Ipek Yuzcelik; Ken Yoshida; Katelynn Rose Gallagher; Gavin Wang

- 9043** Design and Characterization of a Precision Bandgap Voltage Reference for CMOS Analog Systems
Henan Wang; Seyedehmarzieh Rouhani; Mark Johnson
- 9044** Effect of Silage Tarps on Early-Season Weed Control in Potato
Dylan James Whitlow; Stephen Lawrence Meyers; Christopher T Adair
- 9045** Matrix Multiplication Accelerator
Michael Daoming Wu; Malcolm Lloyd Seib McClymont; Mark Johnson
- 9046** Robot Arm Control
Qinjia Xu; Zijian He; Abolfazl Hashemi
- 9047** Hotel Review & Revisit Correlation Analysis
Xiaohan Yu; Wookjae Heo
- 9048** Calculating Image Depth using Focal Split
Peter Luo Yu; Junjie Luo
- 9049** Vision-Guided Autonomous Robotic Drummer Using AprilTag Localization
Tiffany Yung; Yung-Hsiang Lu; Yeon Ji Yun

Virtual Presentation Abstract Number: 9000

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

AHB-APB Bridge UVM STEM

Authors(s):

Mohamed khaled Mohamed Atta† (Engineering); Don Anh Nguyen‡ (Engineering)

Abstract:

As part of the SoCET VIP team, the UVM subteam focuses on the verification of other SoCET designs. The AHB-APB Bridge UVM team focuses specifically on the Advanced High-performance Bus (AHB) to Advanced Peripheral Bus (APB) bridge module using the Universal Verification Methodology (UVM) framework. The AHB-APB bridge facilitates communication between high-performance processors and low-speed peripherals in System on Chip (SoC) architectures by translating transactions between the two protocols defined in ARM's AMBA specification. The goal of this project is to develop a reusable UVM testbench capable of verifying the bridge's functionality and protocol compliance. The environment will include AHB and APB agents, sequencers, drivers, monitors, a scoreboard, and a reference model for result comparison. Verification scenarios will test read and write operations, burst-to-single transfer mapping, invalid address handling, error signaling, and synchronization between AHB and APB timing domains. Currently, the test plan and UVM environment diagram have been completed, outlining the verification strategy and interconnections between components. The team is now implementing the UVM environment, starting with the development of the transaction class. Future stages will include constructing drivers, monitors, and scoreboards, followed by constrained-random testing and functional coverage analysis to ensure comprehensive verification of the bridge design.

Keywords:

[no keywords provided]

Mentor(s):

Anas Zyad Abughali (Engineering); Ayush Singh (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9001

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

The Regenerative Cycle of Flooring Materials: Mycelium and Piezoelectric Applications

Creative

Authors(s):

Isabella Rose Beagles† (Liberal Arts); Ryan Lanark Antemann† (Liberal Arts); Mariela Dawn Rampersad† (Liberal Arts)

Abstract:

Our project addresses the lifecycle of flooring materials and how to implement sustainable, renewable, and regenerative practices in the built environment. This is accomplished through intentional design decisions that prioritize health, longevity, and the overall life cycle of flooring materials. The project will result in a specific design application and how to apply sustainable flooring materials in the built environment by specifying renewable and regenerative materials. We have identified mycelium and piezoelectric technologies as the primary focus. Mycelium is a vegetative part of a fungus that is found spreading through the forest floor. We use this in the built environment as an innovative and sustainable flooring solution that not only delivers an exceptional technical performance but also brings a touch of biophilia and nature into indoor spaces. The piezoelectric flooring contains embedded tiles that harness the energy from footsteps and vibrations, transforming human movement into clean electrical power for lighting, sensors, and other mechanical systems throughout a built environment. When installed in busy foot traffic areas, the cumulative effect of thousands of steps can generate an impactful amount of electricity, helping offset energy consumption and lower operational costs while still focusing on regenerative design. This technology supports sustainable design by reducing reliance on nonrenewable energy sources and making buildings more interactive and focused on wellness for both humans and the ecosystem. Piezoelectric flooring is durable, requires minimal maintenance, and demonstrates the potential for built environments to harvest local, renewable energy within public spaces.

Keywords:

Innovation; Renewable; Economic; Universal; Regenerative

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

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

Virtual Presentation Abstract Number: 9002

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Extending FreeRTOS for Dual-Core Scheduling on the AFTX08 Microcontroller STEM

Authors(s):

Hsiang-Chun Chang† (Engineering); Jacob Thompson Lawrence‡ (Engineering); Murad Ibrahimov† (Engineering); Po-Chin Yang† (Engineering)

Abstract:

As dual-core microcontrollers are common, the need for efficient real-time operating system (RTOS) support across multiple cores has grown. Our project aims to extend FreeRTOS to support dual-core scheduling on the AFTX08 microcontroller made by SoCET. We address this by adapting the FreeRTOS kernel to handle task synchronization and inter-core communication, ensuring balanced workload distribution while preventing race conditions. Additionally, we are developing GPIO drivers to allow FreeRTOS tasks to interact seamlessly with hardware peripherals. The final system will be packaged with a simplified build environment to promote reuse by future teams and developers. A demonstration on an FPGA platform will showcase the dual-core FreeRTOS's performance. This project not only enhances FreeRTOS's capabilities but also provides the SoCET team with a foundation for future extensions by other development groups.

Keywords:

AFTx08; FreeRTOS; SoCET; OS

Mentor(s):

Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9003

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Intelligent Data Validation for Agricultural Sensor Networks Using LLMs STEM

Authors(s):

Frank Mingyuan Chen† (Engineering); Courtney Grace Marsh† (Engineering); Mariana Ortiz Martinez Troncoso† (Engineering); Christopher Hao Xuan Xie† (Engineering)

Abstract:

The purpose of this project is to investigate and understand the underlying causes and behavioral patterns associated with malfunctioning sensors used in agricultural environmental monitoring systems across Indiana. In modern precision agriculture, accurate environmental data such as temperature, humidity, soil moisture, and precipitation is essential for informed decision-making, yet sensor malfunctions can lead to data inaccuracies, system inefficiencies, and misinformed agricultural practices that ultimately affect crop yield and resource management. To address these challenges, this project leverages a Large Language Model (LLM) to analyze and interpret extensive datasets collected from weather stations and environmental sensors established by the Wabash Heartland Innovation Network (WHIN). The LLM is used to detect data anomalies, identify failure patterns, and distinguish between genuine environmental fluctuations and faulty sensor readings, thereby enhancing the reliability and accuracy of sensor-based agricultural monitoring systems. The insights gained from this study will contribute to developing more robust data validation methods and supporting more efficient agricultural decision-making processes across Indiana's farming regions.

Keywords:

[no keywords provided]

Mentor(s):

Kevin T Lee (Engineering); Ramaa Saket Suri (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9004

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

**Privacy Preserving Machine Learning
STEM**

Authors(s):

Henry Jones Cheung† (Science)

Abstract:

Landseer is a privacy preserving machine learning pipeline meant to provide easy functionality for multiple defenses across different stages of the machine learning process. This includes pre-training, during training, post-training, and deployment defenses.

Keywords:

[no keywords provided]

Mentor(s):

Zahra Ghodsi (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9005

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

The Space Between

Social Science

Authors(s):

Olivia Jo Clemons† (Liberal Arts); Kailee Anne Derrick‡ (Liberal Arts);
Ava Claudia Jacobsen‡ (Liberal Arts)

Abstract:

This project explores how sustainable landscape design can improve student well-being and strengthen community on Purdue's campus. Focusing on the green space between Meredith South Residence Hall, a LEED-certified building, and the older Meredith Hall, the goal is to create a shared outdoor area that connects people and sustainability to benefit wellbeing.

Through a student survey, we will gather feedback on how different campus environments affect focus, relaxation, and comfort. These insights will guide our conceptual design for a sustainable garden that features native plants, shaded seating, permeable pathways, and a rain garden for stormwater management.

The proposed design supports both environmental and human health by improving biodiversity, reducing runoff, and providing a relaxing space for students to study, socialize, and relax. Overall, the project demonstrates how biophilic and sustainable design can turn an underused campus space into a restorative environment that enhances mental health, strengthens community connection, and contributes to Purdue's long-term sustainability goals.

Keywords:

Sustainable; Community; Biodiversity; Human Health; Long-Term

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9006

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Think Globally, Act Locally: The 17 UN Goals at Purdue Creative

Authors(s):

Jada Celeste Culver† (Polytechnic); Elena Christine Rodriguez‡ (Liberal Arts); Jackson Howard Warren† (Liberal Arts)

Abstract:

Our project addresses the limited visibility of sustainability initiatives on Purdue University's campus. Although Purdue has the resources and growing interest to promote environmental action, the campus community still lacks consistent reminders to engage in sustainable habits. To encourage awareness and participation, our team is developing a campus-wide poster campaign inspired by the 17 United Nations Sustainable Development Goals (SDGs). Each poster will feature a unique design, clear message, and QR code that links to short surveys, educational resources, and a social media movement to widen outreach and explain ways to get involved. For this semester, our focus is to complete a pilot phase of the campaign by designing and displaying posters representing a select group of the UN Sustainable Development Goals, such as SDG #3 "Good Health and Well-Being" and SDG #6 "Clean Water and Sanitation." These posters will be placed in high-traffic areas across campus, including but not limited to the France A. Córdova Recreational Sports Center, dining halls, and academic buildings, where their messages relate to the surrounding environment. Through engaging visuals, strong graphics, and memorable phrases, the campaign aims to capture attention and inspire students and faculty to take part in Purdue's sustainability efforts. The impact of the pilot will be measured through QR code interactions and survey feedback, which will guide future content shared through the campaign's social media platform. Our project shows how creative design strategies can promote sustainability awareness and inspire collective action within the Purdue community.

Keywords:

Environment; Awareness; Educational; Resources; Infographic

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9007

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Pikes Peak Aerodynamical Analysis STEM

Authors(s):

Shrikar N Dayalu† (Engineering); Krish Agarwal† (Engineering); Shusei Robson† (Engineering)

Abstract:

The purpose for this exploration is to apply fundamental aerodynamic knowledge learnt to try and develop a high performance concept car for the Pikes Peak Hill Climb. Due to its minimal aerodynamic regulation, Pikes Peak allows for a wide range of experimentation and innovation beyond the normal motorsport confinements. Our team used systems like Solidworks for the computed aided design, and Star-ccm for the analysis and CFD. Through benchmarking a good baseline could be set to work on to further increase aerodynamic efficiency. This project shows how aerodynamics directly integrate to real world applications. The Pikes Peak regulatory freedom made possible creative ideas, and allowed testing of configurations that wouldn't be allowed in most racing series. This experience enhanced our understanding in vehicle design and optimizing aerodynamics through simulation.

Keywords:

Aerodynamics; Design; Simulation; Testing; Performance

Mentor(s):

Charles Holliday Jenckes (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9008

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Open Access Design Flow Sub-team of SoCET STEM

Authors(s):

Noah Everett Desserich† (Engineering); Nathan Nanchuen Yu† (Engineering); Lucy Chenlu Xu† (Engineering); Laura van Ritbergen† (Engineering)

Abstract:

The Design Flow sub-team is central to the successful physical realization of complex integrated circuits, acting as the critical bridge between conceptual design and tape-out. Our primary objective is to synthesize and create the physical layout of modules from other sub-teams on SoCET, including the Digital Design, AI Hardware, SRAM, and GPU sub-teams, into a cohesive and manufacturable chip design. We are responsible for managing the end-to-end physical design process. This involves taking netlists and design constraints and using industry-standard Electronic Design Automation (EDA) tools, notably Cadence Genus, Innovus, and Virtuoso, to perform essential steps. These steps include floor planning, power planning, placement, Clock Tree Synthesis (CTS), routing, and comprehensive physical verification (DRC/LVS). Our work ensures that all integrated designs meet stringent power, performance, and area (PPA) targets, while adhering to the technological process rules, thereby translating high-level architectural specifications into a final, robust, and silicon-ready layout.

Keywords:

Design Flow; Layout; EDA

Mentor(s):

Timothy Francis Hein (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9009

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Pre-Assessment Clinic Service Audit
Business Case Study

Authors(s):

Madison Marie Detzer† (Pharmacy)

Abstract:

[Abstract Redacted]

Keywords:

Pharmacy; Audit

Mentor(s):

Monica Miller (Pharmacy); Ellen M Schellhase (Pharmacy)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9010

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Design and Implementation of Hardware Performance Monitors for RISC-V Processors with Selective Counter Management STEM

Authors(s):

Matthew Du† (Engineering|JMHC); Daniel Paul Wunderlich‡
(Engineering)

Abstract:

Hardware Performance Monitors (HPMs) are specialized counters integrated into processor architectures that track various execution metrics such as clock cycles, instructions retired, cache misses, branch mispredictions, and other microarchitectural events. These counters provide critical insights into processor behavior and performance characteristics, enabling software optimization, system profiling, and performance analysis without requiring external measurement tools. We present an overview to extend current RISC-V HPM by expanding counters from 3 to 31 selectable events while implementing minor RTL additions to the System-on-Chip Extension Technologies AFTx processor. The RTL design features a parameterizable 32-counter architecture with 64-bit precision, which supports selective counter enabling through an enable array input. Each counter can be individually controlled, written to (upper/lower 32-bit halves), and cleared, with automatic rollover detection at maximum count. The SystemVerilog modules include a base 64 bit component providing fundamental counting logic, an HPM module managing CSR address mapping, and an HPM wrapper for interface abstraction. The accompanying test framework demonstrates sampling all 31 performance counters during exception handling. The planned implementation includes minor RTL improvements through enhancing the RTL's enable array functionality with runtime configurability through additional CSRs, which allows dynamic counter selection based on specific performance events of interest. Software enhancements will provide selective counter enabling, reducing monitoring overhead and improving analysis usefulness. This targeted approach will enable focused performance profiling, easier bottleneck identification, and more efficient resource utilization in the processor implementation.

Keywords:

HPM; CSR; RISC-V

Mentor(s):

William Rowan Cunningham (Engineering); Cole Aaron Nelson (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Dogyu Ryu (Engineering)

Virtual Presentation Abstract Number: 9011

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Smart Lighting Retrofit for Energy Efficiency and Circadian Health in PAO Hall Social Science

Authors(s):

Kaylee Grace Gesick† (Liberal Arts); Natalie Elizabeth Baker‡ (Liberal Arts); Katherine Diane Rudini‡ (Liberal Arts)

Abstract:

Our project addresses energy inefficiencies and wellness concerns linked to outdated lighting in the second-floor interior design studios of PAO Hall. Many fixtures remain on even when spaces are unoccupied, leading to excessive energy consumption, increased operational costs, and elevated carbon emissions. Limited daylight from small windows may also compromise the circadian health of students and staff who spend extended hours in these environments.

We have conducted a comprehensive lighting audit, documenting fixture types, wattages, and usage patterns. We observed occupancy trends and identified opportunities for sensor-based controls and daylight-responsive systems. This data informs our evaluation of smart lighting solutions that reduce energy waste while supporting biological rhythms.

Our analysis demonstrates the potential for significant reductions in energy use, operational costs, and CO₂ emissions. Additionally, we highlight the benefits of circadian-supportive lighting on comfort, focus, and alertness—factors critical to academic performance and well-being.

This initiative aligns with LEED and WELL standards and applies systems thinking to a real campus setting. By integrating responsive lighting strategies, we show how thoughtful design can advance sustainability goals and foster healthier, more adaptive learning environments.

Keywords:

Smart Lighting; Usage Patterns; Circadian Health; Visual Comfort; Indoor Environment Quality

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9012

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Building the Well-Engineered Scholarship - Mental health prioritization among Purdue Engineering Students Social Science

Authors(s):

Kendall Greer Gibson† (Engineering|JMHC)

Abstract:

This research project focuses on designing a sustainable framework that supports and uplifts members of the Purdue Engineering community through a scholarship model that rewards students who prioritize well-being and foster a culture of mental health awareness. The Well-Engineered Scholarship was developed as a new initiative under the Purdue Engineering Student Council (PESC), inspired by the Resilience Scholarship created by a fellow council member. Guided by the research questions of how to effectively encourage engagement with well-being practices and how to equitably identify students committed to improving mental health, the project began with a mental health survey distributed to Purdue Engineering students. Results revealed financial strain as one of the most significant stressors. In response, the scholarship was designed to directly alleviate this burden while celebrating students who actively support themselves and others. The process involved designing the application, creating a transparent scoring rubric, and securing approval and funding from PESC. To ensure fairness and ethical evaluation, applications were reviewed in partnership with a licensed therapist and the Purdue CARES Hub director. Major ethical considerations included protecting confidentiality and evaluating personal well-being narratives equitably. Implementation efforts included campus tabling, online promotion, and outreach through the annual mental health survey. The scholarship advances long-term cultural change by highlighting role models whose actions inspire resilience, balance, and empathy within the engineering community. Established as an annual PESC initiative, it provides a replicable model for student-led well-being programs that combine financial support with cultural transformation.

Keywords:

Well-Being; Scholarship; Engineers

Mentor(s):

Kristy Eaton (Purdue University)

Other Acknowledgement(s):

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

Virtual Presentation Abstract Number: 9013

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Implementation of a Floating Point Unit for a RISC-V SoC STEM

Authors(s):

Jeremy Logan Hakimi† (Engineering); Jared Marc Settler† (Engineering);
Levi J Thompson† (Engineering); Raghuv Potdar† (Engineering); Lucas
Michael Mallen‡ (Engineering)

Abstract:

The Digital Design sub team of the System on Chip Extension Technologies (SoCET) research group is working to integrate a floating-point unit (FPU) into the existing RISC-V core. We want floating-point capabilities on the SoC to support compute-heavy embedded applications, such as signal processing, where precision and performance justify the added area cost. This semester, our objective is to implement and verify the addition/subtraction and multiplication units, and to integrate them into the processor for minimal FP support. The initial implementation cuts down on area by using a unified register architecture, operating using the integer registers rather than dedicated floating-point registers. We use Verilator to simulate and test our implementation. Our testbench is implemented using C++, utilizing its native float datatype allowing for easy validation of our design. We're using constrained randomized verification and will collect coverage statistics to ensure correctness. Future work for this project is to add division/square-root for full floating-point capability. Overall, we'd like our FP implementation to be able to be reused throughout all of SoCET wherever needed, even though its current target application is the RISC-V core.

Keywords:

FPU; Digital Design; SoCET

Mentor(s):

Cole Aaron Nelson (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9014

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Scan DFT Implementation in Both Tapeoutable and Untapeoutable PDKs STEM

Authors(s):

Seongwon Hong† (Engineering); Raghav Srivathst† (Engineering);
Aniketh Bhaskar Bandit† (Engineering|JMHC)

Abstract:

Design for Testability (DFT) is essential in modern integrated circuit design to ensure that chips can be efficiently tested for manufacturing defects. Our project focuses on implementing scan chain insertion and Automatic Test Pattern Generation (ATPG) in tapeout-ready Process Design Kits (PDKs). For the Synopsys based flow and TSMC PDK, we use Synopsys Fusion Compiler for synthesis and scan insertion and Synopsys TestMAX for ATPG. In parallel, we apply Cadence Genus to perform scan insertion and synthesis with the MITLL PDK, allowing us to compare workflows across industry-standard tools.

We began by validating the methodology on smaller designs, generating stuck-at fault patterns, measuring fault coverage, and analyzing tradeoffs. We then extended this flow to larger designs using MITLL and TSMC PDKs.

Ongoing work includes addressing challenges in tool compatibility, scan chain optimization, and handling clock/reset structures across multiple domains. We are also exploring advanced techniques such as On-Chip Clock Controllers (OCC) and scan compression at the top level. By the end of the semester, our team aims to deliver a reusable and well documented DFT flow that can be applied to future PDKs and research efforts. This work contributes both technical insights into integrating DFT with Synopsys and Cadence flows and practical guidelines for academic chip design projects.

Keywords:

Design for Testability (DFT); Scan Chain Insertion; Automated Test Pattern Generation (ATPG); Synopsys Fusion Compiler; Cadence Genus

Mentor(s):

Abinands Ramshanker (Engineering)

Other Acknowledgement(s):

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

Virtual Presentation Abstract Number: 9015

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Why Banner Ads Annoy Users: Testing AI Misalignment in Recommender Systems STEM

Authors(s):

Shun Ide† (Science)

Abstract:

In the digital age, intrusive and persistent banner advertisements in web browsers are a common user experience. Annoying users is likely not the intent of product sellers, yet why do sophisticated recommendation systems result in such evident misalignment? This study investigates this issue by introducing a random guesser test to quantify the misalignment between advanced recommendation algorithms and random recommendations. We argue that the core assumptions of recommendation systems often misalign with real-world consumer behavior. To measure this misalignment, we employ a random guesser in a controlled environment simulating consumers with predominantly indifferent preferences. Surprisingly, the random guesser outperforms most recommendation algorithms, which overly rely on exploiting spurious patterns in user data. These findings suggest the need for a paradigm shift, moving from assumptions of fixed, distinct user preferences to recognizing widespread preference indifference.

Keywords:

AI Misalignment; Recommender Systems; Multi-Armed Bandits; Thompson Sampling; Upper Confidence Bound

Mentor(s):

Petros S Drineas (Science)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9016

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Likes, Shares, Extremism: How Social Media Fuels Radicalization Social Science

Authors(s):

Deona Julary† (Polytechnic|JMHC)

Abstract:

This study investigates the relationship between social media engagement and the likelihood of internet radicalization. While existing literature establishes that digital platforms facilitate the spread of extremist ideologies, the specific mechanisms and relative impact of different online behaviors remain debated. This research tests the primary hypothesis that more frequent social media use increases radicalization risk, while also analyzing the distinct roles of active participation, platform design, and traditional media. Utilizing quantitative analysis of the Profiles of Individual Radicalization in the United States dataset. Preliminary bivariate analysis results indicate a statistically significant but modest positive relationship between frequency of social media use and radicalization. The analysis reveals that the type of engagement is a more powerful predictor than frequency alone. Active creation and sharing of extremist content and instances where social media served as the primary radicalization channel demonstrated the strongest effects. The influence of traditional media was found to be negligible. The findings suggest that social media platform algorithms and the interactive nature of content creation are central to modern radicalization processes, surpassing the role of passive consumption or offline media. This research provides actionable insights for policymakers and technology companies, highlighting the critical need for interventions that target algorithmic amplification and active extremist communities rather than merely limiting screen time.

Keywords:

Internet; Radicalization; Social Media

Mentor(s):

Eric Waltenburg (Liberal Arts)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9017

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

**Evaluation of Therapeutic Drug Monitoring in Adult Critical Care Units (ACCUs) at St Bartholomew's Hospital, London UK
STEM**

Authors(s):

SeoJeong Kim† (Pharmacy)

Abstract:

[Abstract Redacted]

Keywords:

Critical Care; Therapeutic Drug Monitoring; Narrow Therapeutic Index

Mentor(s):

Ellen M Schellhase (Pharmacy); Monica Miller (Pharmacy); Rhona Sloss (Barts Health NHS Trust)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9018

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

OS Development with the AFTx07+

Creative

Authors(s):

Seungho Lee† (Engineering); Seongbin Lee‡ (Engineering); Hojun Choi† (Engineering); Daeun Kim† (Engineering)

Abstract:

The final product of this project is the Smart Photo Frame that performs end-to-end image handling from UART packet reception to on-screen rendering, showcasing the integration of communication, computation, and display subsystems in a compact embedded environment. The Smart Photo Frame extends the AFTx07+, a student-created RISC-V microcontroller, and combines the previously developed FatFs (File allocation table File System) file system, SLIP (Serial Line Internet Protocol) protocol, CRC (Cyclic Redundancy Check) accelerator, and VGA (Video Graphics Array) controller.

Images are sent to the AFTx07+ via SLIP over UART, verified using the CRC accelerator, stored on an SD card through the FatFs layer using SPI communication, and displayed on a monitor through a custom VGA controller. All components operate on an FPGA emulation of the AFTx07+, as the chip is still in pre-silicon development. The successful demonstration illustrates the platform's capability to perform integrated data processing and output tasks, demonstrating the suitability of the AFTx07+ for simple embedded multimedia applications.

Keywords:

FatFs File System; SLIP Protocol; CRC Accelerator; VGA Controller; AFTx07+

Mentor(s):

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

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9019

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Facilitating space exploration through the creation of a humanoid robot able to perform complex tasks under the harsh conditions of space and other planets.

STEM

Authors(s):

Elvin Xuyang Li† (Engineering); Gabriel Duarte Rengifo† (Engineering);
Madhav Amit Arora‡ (Polytechnic); Drish Jaykishan Shah† (Polytechnic)

Abstract:

This research focuses on creating a humanoid robot capable of completing complex tasks to aid astronauts in space exploration on the moon, specifically targeting the hand and arm mechanisms required for precise movements. The goal is to design an arm that allows for the attachment of various customizable end effectors or hands. Our current process includes a prototype of a complete arm with 6-degree-of-freedom (DOF) from the shoulder to the forearm, along with a 3-DOF wrist that allows the attachment of numerous customizable end effectors. Currently, we are prototyping various types of end effectors for collecting samples, gripping, cutting, drilling, and other applications. The next phase of our project is to create a final aluminum version of the entire arm, wrist, and hand system that is able to be manufactured. Then we would be able to test our design in real-world scenarios that would simulate low and zero gravity environments as well as rough and rocky terrain, and begin to gather data for programming and operational purposes. Our findings aim to contribute to the understanding of how humanoid robots can aid in space exploration on the moon by performing complex tasks and supporting astronauts and the aerospace industry.

Keywords:

Degrees of Freedom (DOF); End Effectors

Mentor(s):

Jaeeun Kim (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9020

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Ansible for better maintenance of ECE Labs.io STEM

Authors(s):

Michael Li† (Engineering|JMHC)

Abstract:

ECE Labs.io is an online tool for students taking ECE27000 to quickly design, test, and upload hardware projects onto remote Field-Programmable Gate Arrays (FPGA's). This benefits students as students are given easy access to high-end, professional engineering equipment while the school can maintain a large collection of FPGA's in one place. This research focuses on developing tools to help maintain the website resources using a tool called "Ansible" to monitor and debug many server nodes at the same time. This would allow maintainers to check node status across multiple server nodes quickly and fix outages across multiple nodes in a timely manner. Overall, this research would help ECE Labs achieve more robust control over its resources.

Keywords:

[no keywords provided]

Mentor(s):

Junfei Li (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9021

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

All-in-One Camera

STEM

Authors(s):

Sophia Yixuan Lu† (Engineering); Huijie Loy† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

HDR Imaging; Metasurface; Hyperspectral Imaging

Mentor(s):

Qi Guo (Engineering)

Other Acknowledgement(s):

Yuxuan Liu (Engineering)

Virtual Presentation Abstract Number: 9022

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Farm robotic challenge – S.A.F.E.-Bot STEM

Authors(s):

Henry John McGee† (Engineering); Anya Panday† (Engineering|JMHC); Cyrus Kasten Gonzalez† (Engineering); Marteza Hossein Rajabi† (Engineering); Justin Denson Duke‡ (Engineering); Shashaank Sajeethraja‡ (Engineering); Andrew Brandon Underwood‡ (Engineering); William Joseph Buchmeier‡ (Engineering)

Abstract:

Grain engulfment in corn silos occurs when out-of-condition grain sticks together, creating crusts that can collapse and bury farmers. Grain engulfment poses a severe safety hazard for farmers, often leading to suffocation or injury due to internal pressure within the stored grain. To address this issue, our research focuses on developing a robotic drilling device to relieve pressure in corn silos without direct human entry. The long-term goal is to design a motorized drill capable of penetrating dense grain and restoring airflow to relieve dangerous pressure buildups. By integrating robotics and mechanical design, this research seeks to offer a low-risk, industry-scalable solution to a leading agricultural hazard. The development of a motorized pressure-relief machine has the potential to enhance farm safety, reduce fatalities, and promote efficient grain storage management.

Keywords:

Robotics; CAD; Agriculture; Industry; Engineering

Mentor(s):

Saurav Chittal (Science); Kevin T Lee (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9023

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

**Cumulative Defense Strategies against Adversarial Attacks in
Image Classification Machine Learning Models
STEM**

Authors(s):

Keisuke Alexander Nakamura† (Science|JMHC|Graduate); Sharanya
Devgon† (Science)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Zahra Ghodsi (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9024

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

The Impact of Project Scaffolding on Student Success in Engineering Optimization Course STEM

Authors(s):

Neha Naladala† (Science|JMHC)

Abstract:

This Scholarship of Teaching and Learning (SoTL) project investigated the use of project scaffolding to enhance student learning and engagement in an undergraduate optimization course (n = 24). Project scaffolding, which breaks complex tasks into smaller, structured milestones, was implemented through three phases: a project proposal, a project update, and a final project submission. A mixed-methods design was used, including a retrospective post-then-pre survey, a post-course survey, survey comparison to other courses, and open-ended reflection questions. Results showed consistent increases in student confidence and engagement, with self-reported approaches and project-related skills averaging about 4 out of 5. Similarly, most perceptions of the final project experience were also rated around 4, and qualitative reflections highlighted that scaffolding reduced stress, clarified expectations, and supported incremental skill development. Overall, integrating scaffolding into the engineering classroom provided a structured pathway that improved student perceptions of learning and engagement, suggesting that scaffolding is an effective pedagogical strategy for supporting complex, semester-long projects.

Keywords:

[no keywords provided]

Mentor(s):

Lisa B Bosman (Polytechnic)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9025

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

The Self-Reported Impact of Foreign Accents on Speakers of English Social Science

Authors(s):

Mackenzie L Nord†

Abstract:

The relationship between the “thickness” of a foreign accent and its effect on the speaker, whether positive, negative, or neutral, is not necessarily direct. A pilot study examined speakers’ self-rated impact of having foreign accents and found it to be context and situation-specific (Groves, 2023). That study gathered input from speakers of various target languages (language with audible foreign accent) and influencing languages (the accent source), emphasizing the influence of sociolinguistic and sociocultural power imbalances.

The current study refocuses the analysis of quantitative (ratings of accent thickness and perceived impact) and qualitative data (via open-ended responses) of participants whose target language is English, regardless of their influencing language. The results of this new monolingual target language group are then compared to the original multilingual target language group. Focusing on a single target language reduces variability, potentially making patterns more apparent, and enabling a clear comparison with the linguistically varied sample from the preceding study.

Comparing the results of the multilingual target language with the English target language group reveals similarities: Both showed a high relationship between their self-rated magnitude of accentedness and its negative impact on their lives, and neither had the inverse relationship between accent magnitude and positive impact or an inverse relationship between negative and positive impacts. However, the English as a target language group did exhibit an inverse relationship between negative and neutral impacts. Positive impact for both groups appears to be independent of influencing languages, self-rated thickness of accent, or the negative impact of the accent.

Keywords:

Foreign Language Accent; Accentedness; Multilingualism; Accent Modification

Mentor(s):

Naomi Gurevich (Science); Talia A Bugel (Liberal Arts)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9026

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Understanding Emotion Recognition Technology (ERT) in Education Social Science

Authors(s):

Sarah Jessica O Farril-Gonzalez† (Polytechnic|JMHC)

Abstract:

This project investigates perceptions of Emotion Recognition Technology (ERT) in educational settings and explores how audience-focused informational materials can support a more informed understanding of the technology's implications. ERT systems are designed to analyze facial expressions in order to infer emotional states, raising concerns that include surveillance, informed consent, fairness, and student privacy. An interdisciplinary methodology guided the project, beginning with a comprehensive literature review on the technical design of ERT, its ethical implications, and documented effects on marginalized people. Insights from this review informed the development of a public-facing educational website presenting an overview of perspectives on ERT's potential risks and benefits. To better understand the impacts of the informational material on knowledge of and attitudes towards ERT, a survey was distributed to 100 U.S. participants (ages 18 and older), assessing prior knowledge, comfort level, perceived risks, and preferred safeguards related to ERT use in classrooms. Results indicated notable resistance to ERT: 64% expressed discomfort with being the subject of facial movement analysis. Following engagement with the educational website, 47% of respondents reported a clearer understanding of privacy-related issues, and 51% reported increased awareness of emotional implications. Qualitative responses revealed a tension in participant views: while some saw ERT as potentially useful for fostering engagement or helping instructors recognize student struggles, others strongly opposed its use, citing fears of surveillance, bias, and emotional misinterpretation. Key concerns included lack of informed consent (57%) and data privacy risks (56%), with strong support for protective measures such as strict data policies and consent mechanisms (each 60%). Findings point to a disconnect between technological advancement and acceptance, emphasizing the importance of transparency, autonomy, and ethical design in educational technologies. This study was determined to be exempt through the Purdue University IRB (2025-471).

Keywords:

Emotion Recognition Technology; Artificial Intelligence; Privacy; Ethics; Technology

Mentor(s):

Lindsay Weinberg (JMHC)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9027

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Armor Detection with computer vision within the context of a Robomaster competition STEM

Authors(s):

Evan Brent Osborne† (Engineering)

Abstract:

The purpose of this study is to develop an algorithm that detects the armor of an enemy Robomaster robot. Armor Detection is used to aim the bot's guns at the armor plate, scoring points. The armor plate is identified with two light bars colored either blue or red. To detect the Armor, several steps are undertaken. The color space is firstly converted from BGR to HSV and noise is reduced. The color range is then isolated to filter for red and blue on the image. An algorithm for edge detection of the isolated regions is then applied. A contour based on the detection is created with `cv::findContours()`. For each contour, a rotated rectangle is fit to each rectangle. It is then checked to see if the pair of contours represents a light bar pair, and then an armor plate. If all the checks are successful, it draws the contour on the image. The algorithm is successful in tracking the armor plates. Boxes are drawn around the armor plate. It moves with the armor when the bot rotates or moves around. By using computer vision, the robomaster bot can make more accurate calculations regarding targeting decisions and have a more accurate targeting trajectory. This algorithm also removes the need for manual aim, allowing for team members to focus on something else. Outside of Robomaster, armor detection allows for autonomous systems to make better and more dynamic decisions.

Keywords:

[no keywords provided]

Mentor(s):

Zijian He (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9028

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

**Integrating Drive-by-Wire Systems for Autonomous Go-Kart
Control
STEM**

Authors(s):

Aarya Patnaik† (Engineering); Letizia Angelica Echevarria† (Engineering); Aidan Kwan† (Engineering); Martin Ufer Aldana† (Engineering); Jae Hun Oh‡ (Engineering); Mathias Ufer Aldana‡ (Engineering); Yen-Ting Liu‡ (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Drive by Wire; Go Kart; Electronics; Brake by Wire; Steering

Mentor(s):

Andres Felipe Hoyos Moreno (Engineering); Reed Joseph Freer (Engineering); Richard Osita Ajagu (Engineering); Samuel Labi (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9029

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Drones in Commercial Use

Creative

Authors(s):

Tyler Clay Pieszchala† (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

Drone; Commercial; People; Impact; Jobs

Mentor(s):

Steven R Dunlop (DSB); Monika Tomar (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9030

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Accelerating Hardware Verification through Continuous Integration and Docker Optimization STEM

Authors(s):

Alexander Popescu† (Engineering); Abhinav Palivela‡ (Engineering)

Abstract:

As digital system workflows become increasingly complex, establishing reliable and automated testing environments has become essential for verifying design correctness and maintaining efficiency. Continuous integration and deployment (CI/CD) pipelines are widely used in software engineering for this purpose, but they present unique challenges when applied to hardware development. Our project, SoCET-CI, aims to develop a continuous integration framework for the SoCET team at Purdue that automates hardware verification and testing. The workflow integrates tools such as Verilator and FuseSoC, automated through GitHub Actions and validated locally using Act, a tool that simulates GitHub Actions workflows without requiring cloud execution. Our long term goals include fixing non functioning workflows for RISC-V, another repository, and optimizing the docker environment to create efficient build times and build sizes.

Keywords:

Continuous Integration (CI); Hardware Verification; Continuous Deployment (CD)

Mentor(s):

William Rowan Cunningham (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9031

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Reimagining the Stewart Center: A Green Roof Strategy for Stormwater Reduction and Habitat Restoration STEM

Authors(s):

Grace Marie Ryal† (Liberal Arts); Allison Renee Garbert† (Liberal Arts);
Hailey Elizabeth Parkinson‡ (Liberal Arts)

Abstract:

This project explores the potential of installing a green roof system on the Stewart Center to reduce stormwater runoff and restore pollinator and wildlife habitats. On campus, large roof areas create fast runoff that damages drainage systems and increases flooding risks, while limited green space and urban development reduce opportunities for pollinators and biodiversity. This study uses available data and campus context to demonstrate how a green roof reduces runoff and enhances campus ecological health. Precedent research and a site/roof review of the Stewart Center highlight its flat, expansive roof and central location with heavy student usage, making it a compelling candidate for a campus green roof system.

This study evaluates a green roof strategy by exploring stormwater outcomes along with plant and animal species diversity, focusing on how a green roof (1) retains water, (2) supports healthy native plantings, and outlines plant species that benefit pollinators. Practical considerations such as structural capacity, cost, long-term maintenance, and input from campus sustainability staff and local ecology groups are also acknowledged.

Installing a green roof on the Stewart Center creates a healthier, more sustainable campus environment by transforming unused roof areas into ecological and functional spaces that address campus challenges. Additional highlights include (3) potential energy savings, (4) improved air quality, and (5) a more restorative and positive human experience on campus. The overall goal is to show why this sustainable strategy matters for Purdue now and in the future, while encouraging existing campus spaces to be reimagined as resilient living systems.

Keywords:

Green Roof; Sustainable Architecture; Biophilic Design; Stormwater Management; Habitat Restoration

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9032

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Applying and Enhancing New Ways to Educate on FPGA's STEM

Authors(s):

Justin Samuel† (Engineering); Pradyunn Vikram Kale‡ (Engineering)

Abstract:

The number of limited resources for students to learn more about system-on-chip (SoC) design has brought a need for optimization and opportunity. To address this issue, our project ECElabs.io aims to open opportunities for students at Purdue to become well versed in chip design, primarily with Field Programmable Gate Arrays (FPGAs). To make this possible, we provide physical chips hosted through a web platform using an iCE40-HX8K chip in combination with a Raspberry Pi for server needs. While these chips provide an accessible entry point for many students in large classes, the issue becomes scalability—both in terms of computational capacity and the number of students using the boards concurrently. To address this challenge, our team has incorporated a new FPGA platform known as a High Frequency/High Performance Board (HF Board). HF boards offer much larger logic capacity, higher clock speeds, better timing margins, high-speed I/O/transceivers, large and fast external memory, and more. With these enhancements, students are no longer constrained to simple designs—they gain the ability to implement wide parallelism, explore larger datapaths, and test more sophisticated system-level concepts that would otherwise remain theoretical. This access empowers students to push beyond classroom boundaries, experimenting with advanced architectures, real-time processing, and applications that mirror industry-grade challenges. Equally as important is that the HF boards integration simplifies the work of backend developers supporting the platform. The improved performance and memory bandwidth allow for smoother scheduling of multiple users, better resource sharing, and more efficient handling of simultaneous requests. This results in a more stable and scalable environment that can serve larger classes without sacrificing responsiveness. Moving forward, we aim to further enhance ECElabs.io by expanding HF board accessibility, collecting performance metrics from classroom use, and refining the platform to maximize both educational impact and scalability.

Keywords:

FPGA; High-Performance Computing; System-on-Chip (SoC) Design; Scalability

Mentor(s):

Rhea Vashishtha (Engineering); Brett Michael Heckman (Engineering); Junfei Li (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9033

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

USB Host Controller for AFT-series SoCs STEM

Authors(s):

Sandeep Saravanakumar† (Engineering|JMHC); Matthew Yao† (Engineering); Michael Brayden Hudson† (Engineering); Brian Zhuang† (Engineering); Nicholas Zhang‡ (Engineering)

Abstract:

The Universal Serial Bus (USB) is the standard for versatile, high-speed connectivity between devices. Currently, SoCET's AFT-series System-on-Chip (SoC), a student-developed microcontroller, relies on interfaces like SPI and I2C, which are limited in scope and speed. This project implements a USB host controller, which would allow AFT SoCs to connect and communicate with a wider range of peripherals. From a hardware perspective, we will implement NRZI data encoders/decoders, packet formation, bit stuffing, and control logic. Our design will address constraints such as 12 Mb/s cycle timing and handling both asynchronous bulk data and real-time isochronous data. Throughout the process we will use testbenches to validate our designs. While the hardware implements the USB protocol at the physical layer, a software stack is used to interface with the hardware and provide a higher-level abstraction. This implementation leverages TinyUSB, an open-source USB framework that manages device enumeration, data transfer, and host-side communication. The intermediary software layer will provide an API for TinyUSB, allowing the core software to interact with the hardware through ports, interrupts, and endpoints. With three distinct components, the hardware peripheral, a bridging software layer, and core software stack, the design forms a cohesive and modular USB host implementation. This modular design not only simplifies development and maintenance but also enables future expansion to support newer USB standards and higher data rates. Enabling full-speed, standardized communication with many peripherals transforms the SoC from a simple embedded platform into a versatile system ready for modern interfaces.

Keywords:

[no keywords provided]

Mentor(s):

William Rowan Cunningham (Engineering); Devin Singh (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9034

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Ultra-high strength thermoplastic starch film for packaging STEM

Authors(s):

Arjun Sharma† (Engineering); Jonathan Haixin Liu‡ (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Andres Tovar (Purdue University)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9035

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

**Using a High Temperature 3D Printer
STEM**

Authors(s):

James Siadaty† (Engineering); Hassan Saad† (Engineering); Haocheng Huang† (Engineering); Izabella Ann-Marie Celeste-Wade† (Engineering); Triston Douglas Kobielusz* (Engineering)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Jing Zhang (Purdue University)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9036

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

VIP Meta AR/VR
Business Case Study

Authors(s):

Conrad Clifford Soares† (DSB); Timothy Chandrathil Manogurat† (DSB|JMHC); Adam Charles Lundquist† (DSB); Maxwell Sean Trant† (DSB)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Steven R Dunlop (DSB)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9037

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

eV Karts

STEM

Authors(s):

Chloe Elizabeth Staron† (DSB|JMHC)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Steven R Dunlop (DSB); Monika Tomar (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9038

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Adaptive Long Memory

STEM

Authors(s):

Sai Harshith Suram† (Science|JMHC)

Abstract:

Abstract

We introduce Adaptive Long Memory (ALM), a two-knob backbone for unbounded-context modeling that sidesteps the quadratic cost of self-attention and the hard horizons of fixed-window designs. ALM combines (i) a gated recurrent memory cell with decayed state in $O(1)$ time and (ii) a log-time memory routing (LMR) hierarchy supporting $O(1)$ writes and $O(\log n)$ reads. On a Colab/T4 harness, ALM is evaluated across synthetic long-range tasks including Needle-in-Haystack, Context Separation, Flip-Bit, and Multi-Needle benchmarks. It matches a full-attention baseline in accuracy while maintaining near-constant streaming throughput (~ 4 k tok/s) and achieving length-dependent speedups (7–60 $\times$ from 2 K to 16 K tokens). Together, these results demonstrate that ALM provides a memory-efficient alternative to quadratic attention with constant-time writes, empirically logarithmic reads, and hardware-friendly inference on commodity GPUs.

Keywords:

AI; Machine Learning; Algorithm; Mathematics; Computer Science

Mentor(s):

Melissa Kay DeFrench (Liberal Arts)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9039

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Reimagining the Abandoned Mall for Community Sustainability Creative

Authors(s):

Wynne Catherine Swick† (Liberal Arts); Lauren Taylor Beant† (Liberal Arts); Jade Angelina Hill† (Liberal Arts)

Abstract:

Abandoned malls contribute to growing sustainability issues, causing environmental degradation, weakening of communities, and economic loss. Our project addresses this challenge by suggesting how these underutilized structures can be repurposed into a community sustainability center. Once spaces of gathering and consumerism, these buildings now present an opportunity for adaptive reuse that promotes community engagement and educational sustainable practice experiences that are urgently needed. We focus on the Mounds Mall in Anderson, Indiana, analyzing its social, economic, and environmental conditions to create a framework example for other adaptive reuse projects. Rather than proposing a redesign, our project recommends specific strategies that form a practical and transferable framework for reusing abandoned malls that are actively harming our environment and economic systems. Through research, precedent studies, and the analysis of the social, economic, and environmental impacts of an adaptive reuse project, we develop guidelines for others to improve waste reduction and advance community resilience. Our evaluation focuses on the realistic qualities of successfully integrating the framework, how it addresses social, economic, and environmental concerns, and how it encourages the surrounding community to implement practices learned from this project. This project presents a replicable framework for transforming abandoned malls into sustainable community hubs that support social, economic, and environmental resilience. These structures can convert from symbols of decline to positive environmental and community landmarks.

Keywords:

Adaptive Reuse; Community Outreach; Sustainability; Health

Mentor(s):

Genell Wells Ebbini (Liberal Arts)

Other Acknowledgement(s):

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

Virtual Presentation Abstract Number: 9040

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Investigating the Role of Structured Online Discussions in Fostering Learning in Engineering Students STEM

Authors(s):

Trisha Bimal Thakkar† (Science|JMHC)

Abstract:

The purpose of this study is to investigate how structured online discussions, such as homework and activities in engineering courses, influence students' abilities to connect theoretical knowledge with practical application. This study analyzed survey responses from undergraduate engineering students who had to participate in online discussions as part of their coursework. Student reflections were examined by using qualitative coding methods to identify key themes related to learning engagement, critical thinking, and application of theory to real-world contexts. Findings indicate that students perceive online discussions as a resource to clarify complex concepts and collaborate with peers. Some students preferred physical meetings for group projects rather than online discussions. The findings highlight the potential of online learning environments to foster deeper learning and inclusion in engineering education.

Keywords:

Online Discussions; Education

Mentor(s):

Lisa B Bosman (Polytechnic)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9041

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

**Enhancing Collaborative Learning through Immersive AR/VR
Environments**

Business Case Study

Authors(s):

Maxwell Sean Tran† (DSB); Adam Charles Lundquist‡ (DSB); Timothy Chandrathil Manogura† (DSB|JMHC); Conrad Clifford Soares† (DSB)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Steven R Dunlop (DSB)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9042

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Optimization of Percutaneous Leadout Cable Suspension for Chronic Awake EEG Recordings in Rats STEM

Authors(s):

Khai Minh Wall† (Engineering); Ian Michael Scroggs† (Engineering); Zachary Alan Rogers† (Engineering); Ipek Yuzcelik† (Engineering|JMHC); Jiya Patel‡ (Engineering|JMHC); Arturo Ivan Lemus‡ (Engineering); Abdul Rahman Abuhelwa‡ (Engineering); Liam Michael Kennedy‡ (Engineering); Luis David Garza Mendoza‡ (Engineering); James Paul Argentina‡ (Engineering)

Abstract:

Epilepsy is a neurological disorder defined as disturbed electrical neural cell activity in the brain affecting more than 200,000 individuals in the US and more than 5 million people globally each year. Epileptic seizures typically occur randomly but have telltale markers that precede the attack. The markers can be detected using electroencephalography (EEG) with awake rat epilepsy models to understand the mechanism of epileptogenesis. This research builds upon a caging system that enables continuous video and EEG monitoring, to improve consistency by addressing a problem in EEG monitoring and the reliability of the lead out cable. Rats experiencing epilepsy exhibit unpredictable movements which produce a variable force on the percutaneous connector. They also instinctively chew on the headpiece cable. Poor cable management, especially during the attack, could result in damage to the connector, coupling of motion artefacts and disconnecting of the wire at a time when vital data is being collected. This research aims to develop a means to comply with the movements of rats inside the cages while maintaining tension on the cable. Three approaches were developed to counterbalance the weight of the cable and maintain light tension during the animal's movements: 1) A passive gravity driven lever arm system, 2) A spring driven counterbalancing system, 3) A compliant cable. Prototypes will be produced and tested to evaluate each approach in terms of ease of use, rate of movement compliance, and robustness. Following evaluation, refinement and combination of the best features of each design is envisioned.

Keywords:

Epilepsy; Epileptogenesis; Electroencephalogram; Continuous Monitoring; In Vivo Chronic Rat Experiments

Mentor(s):

Ken Yoshida (Purdue University); Katelynn Rose Gallagher
(Engineering); Gavin Wang (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9043

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Design and Characterization of a Precision Bandgap Voltage Reference for CMOS Analog Systems STEM

Authors(s):

Henan Wang† (Engineering)

Abstract:

Accurate voltage references are critical for ensuring the precision and stability of modern analog and mixed-signal systems such as ADCs and DACs. This project focuses on the design and simulation of a CMOS bandgap voltage reference that maintains a stable output over wide temperature and supply variations. By analyzing trade-offs among line regulation, load regulation, temperature coefficient (TC), and long-term drift, the design aims to achieve sub-1 mV variation across -40°C to 125°C . The proposed circuit integrates a PTAT and CTAT compensation network to achieve temperature independence, with additional startup circuitry ensuring reliable operation under low supply conditions. Simulation and layout are performed in Cadence Virtuoso using the gpd45 process, with post-layout verification confirming minimal deviation from the target 1.2 V output. The results demonstrate the potential of optimized bandgap architectures to serve as high-stability on-chip references for low-power CMOS systems.

Keywords:

Analog Design; SoC

Mentor(s):

Seyedehmarzieh Rouhani (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9044

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Effect of Silage Tarps on Early-Season Weed Control in Potato STEM

Authors(s):

Dylan James Whitlow† (Agriculture)

Abstract:

A field study was conducted at the Purdue Student Farm, West Lafayette, IN in 2025 to determine potato (*Solanum tuberosum*) and weed response to silage tarps. Treatments consisted of a two-by-two factorial of silage tarp orientation (white side up or black side up) and tarping duration ("early" or "late" tarp removal). The experimental unit was three rows, each 4 feet apart and 16 feet long. The experiment design was a randomized complete block with four replications. "Early" tarps were removed on May 6 when 50% of potatoes were emerged. "Late" tarps were moved on May 9 when 100% of potatoes were emerged. Weekly data collection included stand counts, percent of potato stand that was etiolated, visual crop injury on a scale of 0% (no injury) to 100% (crop death), and weed count (2 ft²). Potatoes were harvested August 13 and graded into marketable and nonmarketable tubers. Grass weed counts were greatest in the bare ground control at tarp removal (16.5 plants/2 ft²) and 1 and 2 weeks after tarp removal (21.3 and 18.5 plants/2 ft², respectively). Broadleaf weed counts in tarped plots was <1.5 plants/2 ft² in the first two weeks after tarp removal. Marketable and non-marketable potato yield in the bare ground control were 22.86 lb/row and 13.00 lb/row. Despite crop injury immediately tarp removal, potatoes quickly recovered and yield was not affected. Our findings suggest that tarping can be a herbicide-free method of managing weeds in potato.

Keywords:

Weed Management; Tarping; Occulation; Suppression; Etiolation

Mentor(s):

Stephen Lawrence Meyers (Agriculture); Christopher T Adair (Agriculture)

Other Acknowledgement(s):

Jeanine Auxiliador Arana Cordonero (Agriculture); Helen Angelina Nocito (Agriculture); Celia Gisselle Corado Mendoza (Agriculture); Nicolle Julieth Salamanca Mora (Agriculture)

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

Virtual Presentation Abstract Number: 9045

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Matrix Multiplication Accelerator STEM

Authors(s):

Michael Daoming Wu† (Engineering); Soumen Pradhan‡ (Engineering);
Oscar Surendranath‡ (Engineering); Connor Matthew Lai‡ (Engineering)

Abstract:

Matrix multiplication is an integral part of AI and even marginal improvements in computation speed and energy efficiency produce large gains in overall system performance. The purpose of this project is to demonstrate a working design of an 8 bit 2x2 matrix multiplier with minimized compute times while also fitting within a 1000 μm^2 block. In particular, the design performs long multiplication using a Dadda tree. Overall, the multiplication accelerator accepts two matrix inputs via SPI from a microcontroller stores those values and sends individual row and column vectors to an arithmetic logic unit. The ALU implementation accomplishes the multiplication stage using the single cycle Dadda tree – similar to a Wallace tree – which compresses partial products and ultimately accumulates the results of the two multiplications using a ripple carry adder. The result of the multiply accumulate is sent back and stored and the process repeats for each row and column vector. Once the full result matrix is filled the result is returned to the microcontroller and displayed on a seven-segment display. Upon proving the design is functioning as expected, the design will be taped out using TinyTapeout and tested further on an FPGA to validate functionality and timing.

Keywords:

[no keywords provided]

Mentor(s):

Malcolm Lloyd Seib McClymont (Engineering); Mark Johnson (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9046

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Robot Arm Control STEM

Authors(s):

Qinjia Xu† (Engineering)

Abstract:

This project demonstrates a custom control system for a robotic arm using a from-scratch, software-implemented UART protocol ("bit-banging"). By integrating a full kinematic model of the arm's mechanics, the system translates high-level position commands into precise, smooth, and accurate stepper motor movements.

Keywords:

Robot; Robot Arm; Control; Embedded System; Analysis

Mentor(s):

Zijian He (Engineering); Abolfazl Hashemi (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9047

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Hotel Review & Revisit Correlation Analysis

Social Science

Authors(s):

Xiaohan Yu† (Engineering|JMHC)

Abstract:

In restaurant and hotel management, customer feedback is a valuable resource. However, it can be challenging to predict a customer's intention to return based solely on what they write. This project proposes a machine-learning based program that will examine the relationship between a review and a customer's willingness to return to the hotel.

The model goes beyond simply reading and inferring based on human sentiment, as it studies the meaning of individual words and phrases used in a review. The model applies a statistical value to each word or phrase to produce an individualized prediction based on a training data set specific to a hotel, managing contributions by observing the relationship among words and developing a multivariable model.

The outcome is an application, deployed as a web widget, with two primary functions. First, it takes a comment by a user, inputs into the model, and returns the prediction of whether that unique guest would return to the hotel as a percentage. Secondly, the model will look at positive or negative words and phrases (depending on the selection) and returns the most influential (positive or negative) words and phrases for the hotel. Essentially, the app assesses what a customer indicates will bias their decision to return based on a review.

This will provide value to hotel management by providing a data-driven approach for understanding customer sentiment, demonstrating evidence from individual reviews about a hotel's strengths or weaknesses, and serving as a quantitative measure of predicting returning customers.

Keywords:

Machine Learning; Artificial Intelligence; Data Analysis

Mentor(s):

Wookjae Heo (HHS)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9048

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Calculating Image Depth using Focal Split STEM

Authors(s):

Peter Luo Yu† (Science)

Abstract:

[Abstract Redacted]

Keywords:

[no keywords provided]

Mentor(s):

Junjie Luo (Engineering)

Other Acknowledgement(s):

Virtual Presentation Abstract Number: 9049

Presentation Time: Nov. 17-21, 2025 on Fall Expo website

Vision-Guided Autonomous Robotic Drummer Using AprilTag Localization STEM

Authors(s):

Tiffany Yung† (Science|JMHC)

Abstract:

This project focuses on developing an autonomous drumming system using the Baxter research robot, combining robotics, perception, and creative expression through music. Conducted through Purdue's Vertically Integrated Projects (VIP) program, the research integrates AprilTag visual tracking to achieve precise spatial awareness and adaptive performance capabilities. The goal is to enable Baxter to detect and strike drum surfaces accurately using AprilTag markers for localization, allowing real-time recognition of drum positions and orientations. By merging AprilTag computer vision with Baxter's dual-arm manipulation system, the robot dynamically plans and executes striking motions to produce rhythmic patterns with consistent timing and precision.

A camera mounted on Baxter captures AprilTags affixed to each drum surface, and computer vision algorithms process this input to calculate 3D spatial coordinates. These coordinates are translated into joint-space targets through inverse kinematics, enabling timed, accurate strikes. Unlike traditional robotic drummers restricted to fixed positions, this system autonomously recalibrates when drums are moved, demonstrating robustness in dynamic environments.

Beyond technical implementation, the project emphasizes interdisciplinary creativity—bridging mechanical engineering, computer science, and art. Ongoing work includes improving synchronization latency between detection and actuation, optimizing strike velocity for tonal variation, and developing rhythmic adaptability for collaborative drumming with human performers. By leveraging affordable and robust visual localization through AprilTags, this work showcases how intelligent robotic systems can engage in expressive, human-like musical tasks and advances the broader field of vision-guided, creative robotics.

Keywords:

Robotics; Computer Vision; AprilTags

Mentor(s):

Yung-Hsiang Lu (Engineering); Yeon Ji Yun (Liberal Arts)

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