2019 PURDUE FALL UNDERGRADUATE RESEARCH EXPO

NOVEMBER 18, 2019

West Lafayette, Indiana

FALL UNDERGRADUATE RESEARCH EXPO

SCHEDULE OF EVENTS

NOVEMBER 18, 2019

8:30	**—**	**1:30 PM**	**Oral Presentations, STEW 214**
12:45	**—**	**1:30 PM**	**Poster Presenter Set-Up, PMU Flag Lobby**
1:30	**—**	**3:30 PM**	**Poster Symposium, PMU South Ballroom**

Oral presentation session schedule and poster numbers are found later in this program.

Refreshments are available throughout the oral presentations and poster symposium.

We encourage participants to provide feedback to the poster presenters. Oral presentations will receive feedback from a panel of judges.
To submit feedback to poster presenters, please use the QR code or link (bit.ly/2019fallexpo).

ORAL PRESENTATIONS

SESSION 1 : 8:30 am - 9:30 am

Room: STEW 214A

8:30 Therapeutic immunomodulation of the post-injured spinal cord using Î±-gal nanoparticles
Manjari Lokender, Noah Burket
Research Mentor(s): *Jianming Li, Bhavani Gopalakrishnan*

8:50 Using Muons Produced in Neutrino Interactions to Perform Planetary Tomography
Robert Andrew Gustafson
Research Mentor(s): *Dr. Rob Davies*

9:10 Signatures of Selection for Cattle Docility
Kate Watkins
Research Mentor(s): *Dr. Luiz Brito, Amanda Alvarenga, Hinayah Rojas de Oliveira*

Room: STEW 214B

8:30 Increasing Mid-Adult Women's Protection through Vaccination against HPV (IMPROVE HPV)
Allissa Russell
Research Mentor(s): *Dr. Monica Kasting*

8:50 Crowdsourcing Detection of Sampling Biases in Image Datasets
Xiao Hu, Haobo Wang, Anirudh Vegesana, Somesh Dube, Kaiwen Yu, Gore Kao
Research Mentor(s): *Ming Yin, Yung-Hsiang Lu*

9:10 Physiological Adaptation of the Genus Silphium across different Hydrologies
Joshua Randall
Research Mentor(s): *Scott McAdam, Timothy Batz*

Room: STEW 214C

9:10 A Sequence Model Based Approach to Unknown Words Identification
Yi Zhang
Research Mentor(s): *Xiaonan Jing*

SESSION 2 : 9:30 am – 10:30 am

Room: STEW 214A

9:30 Therapeutic immune modulation of microglial cells using alpha gal nanoparticles
August Dunbar
Research Mentor(s): *Jianming Li, Bhavani Gopalakrishnan*

9:50 A method to improve the homogeneity of protein samples intended for high-resolution cryo-electron microscopy
Hannah Pletcher
Research Mentor(s): *Frank Vago, Wen Jiang*

10:10 An Examination of Multilevel Barriers to Hepatitis C Virus Screening among Baby Boomers in Primary Care
Kaitlyn Gabhart
Research Mentor(s): *Dr. Monica Kasting*

Room: STEW 214B

9:30 Global Air Quality Trekkers: Nandi Clean Kitchen Study
Stephanie R Schiavo, Sam Dykhuis, Avalin Senefeld
Research Mentor(s): *Brandon Boor*

9:50 Spaceflight Testing of Small Satellite Micropropulsion Management
Adithye Menon, Daniel Mayper, Anirudh Govindhan, Noah Franks, Samantha KIddy, Jordan Soberg, Benjamin Lumpp, Tristan Shahin
Research Mentor(s): *Alina Alexeenko, Kate Fowee, Steven Pugia*

10:10 AI Powered Video Querying Over Cameras
Bryan Jimenez, Anthony Yu Hou, Wen-Hsiang Shih
Research Mentor(s): *Felix Lin*

Room: STEW 214C

9:30 Anisotropy of Cellulose Nanocrystal Thin Films
Nolan A. Miller
Research Mentor(s): *Chelsea Davis*

9:50 Effects of Varying Confluency on Schwann Cell Alignment in an Electric Field
Mary Lang
Research Mentor(s): *Jianming Li, Spencer Bunn, Bhavani Gopalakrishnan*

SESSION 3 : 10:30 am -11:30 am

Room: STEW 214A

10:30 Real-Time Facial Detector and Encryption on Embedded Devices
Isha Ghodgaonkar, Ziyad Alajmi, Jackson Moffet, Fischer Bordwell, Arnav Ballani
Research Mentor(s): *Dr. Yung-Hsiang Lu*

10:50 A comparative analysis of classifiers within the DP system
Xuan Hu, Paula RodrÃ-guez
Research Mentor(s): *Elena E. Benedicto, Pin-Hsi Chen*

11:10 Genetics of Soybean Leaf Morphology
Jamie Arabshahi
Research Mentor(s): *Karen Hudson, Militza Carrero-Colon*

Room: STEW 214B

10:30 Characterization of neutrophil aging during inflammation using a fluorescent Timer Protein
Mansoorah Kermani
Research Mentor(s): *Ramizah Syahirah, Qing Deng, Alan Hsu*

10:50 Extracellular signal-regulated protein kinases 1 and 2 (ERK1/2) signaling by non-canonical GPCR pathways
Angel Lin
Research Mentor(s): *Richard van Rijn, Mee Jung Ko*

11:10 Complement C3 contributes to status epilepticus induced hippocampal synaptic protein loss
Vishal Bhimarasetty
Research Mentor(s): *Amy L. Brewster, Alexandra L. Sommer*

Room: STEW 214C

10:30 Economic Feasibility of Low-Input Sod Production: A Financial Case Study
Sanchez Philocles
Research Mentor(s): *Ariana Torres*

10:50 Human and Robots in the Operating Room: Collaborating to save patients
David Wu
Research Mentor(s): *Denny Yu, Jackie Cha*

11:10 Fatigue in collegiate aviation
Erik Levin
Research Mentor(s): *Dr. Flavio Mendonca*

SESSION 4 : 11:30 am – 12:30 pm

Room: STEW 214A

11:30 Occupancy Sensing with Chair-Appended Thermocouples
Aayush Mathur, Nhi T. Khuu
Research Mentor(s): *Dr. Brandon E. Boor, Danielle N. Wagner*

11:50 Approximative Commutation of Matrices
Garrett Mulcahy
Research Mentor(s): *Dr. Thomas Sinclair*

12:10 Lightweight RISCV SoC with Dynamic Sparsity Optimizations for ML Applications
Vadim Vadimovich Nikiforov, Wengyan Chan
Research Mentor(s): *Dr. Mark C. Johnson, Dr. Timothy Rogers, Dr. Matthew Swabey*

Room: STEW 214B

11:30 Chemical modification of Reverse osmosis membranes for extended performance
Alyssa McNarney
Research Mentor(s): *John Howarter*

11:50 Devastating Effects of the Bubonic Plague Due to Poor Communication between Officials and the Public
Hetvi Desai
Research Mentor(s): *Caitlin Fendley*

12:10 Effects of Aging on Genes involved in Photoreceptor Survival
Kimaya Bakhle
Research Mentor(s): *Dr. Vikki Weake, Juan Jauregui*

Room: STEW 214C

11:30 Public Engagement after the Most Destructive and Deadliest Wildfire in California's History: Drinking Water and Plumbing Safety
Qi Erica Wang, Tolu Odimayomi, Christian Ley, Yoorae Noh
Research Mentor(s): *Dr. Andrew Whelton*

11:50 Siblings' Role in Infant and Young Child Feeding and Care in Rural Tanzania
Morgan Boncyk
Research Mentor(s): *Nilupa Gunaratna*

12:10 Teaching an Old Drug a New Trick: Repurposing Fenamic Acids to Treat Multi-Drug Resistant N. Gonorrhoeae
Amr Kais
Research Mentor(s): *Dr. Mohamed Seleem*

SESSION 5 : 12:30 pm – 1:30 pm

Room: STEW 214A

12:30 DeepFake Video detection using Convolutional Neural Networks
Austin Chen, Bekbolat Abdikanov, Edmund Chau, Prekshaa Veeraragavan, Tsung Lin Hsia, Tri Van Nguyen
Research Mentor(s): *Edward J Delp, Carla B Zoltowski*

12:50 Earth Remote Sensing
Renaissa Ghosh
Research Mentor(s): *James Garrison, Carla Zoltowski*

1:10 Theoretical Assessment of Surface Waviness on Work Function
Jacqueline Malayer
Research Mentor(s): *Dr. Allen Garner*

Room: STEW 214B

12:30 Survey of Data Ownership and Access in Digital Agriculture Products
Nakul Chhabra, Glaris Lancia Raja Arul
Research Mentor(s): *Ida B. Ngambeki, John Springer, Austin Toombs*

12:50 Symbolism of the Violin in Russian Literature
Caroline Peterson
Research Mentor(s): *Olga Lyanda-Geller*

1:10 Enhancing Energy Efficiency of Membrane Distillation using Nanofluids
Ryan Madhu Jacob, Prashant Menon
Research Mentor(s): *David Warsinger*

Room: STEW 214C

12:30 System on Chip Extension Technologies
Minh Tran, Christopher Priebe, Yupei Cao, Cole Stecyk, Radhika Jain, Vivekanandan Kulumani Rajarajan
Research Mentor(s): *Mark Johnson, Matthew Swabey, Jacob Covey*

12:50 Development and Characterization of Orally Disintegrating Films Loaded with High Levels of Ibuprofen Nanoparticles
Rohit Harapanhalli
Research Mentor(s): *Rutesh Dave, Ph.D., Sawani Talekar, Ph.D., Pal Thangam, Ph.D.*

1:10 Improving Efficience of PhiV10 Production Using Regulatory Genes
Theresa Bottorff
Research Mentor(s): *Bruce Applegate*

SESSION 1

STEW 214A

Time: **8:30:00 AM** :: Life Sciences

Therapeutic immunomodulation of the post-injured spinal cord using Î±-gal nanoparticles

Authors:

Manjari Lokender, College of Science

Noah Burket, College of Science

Abstract:

Spinal cord injury (SCI) affects 17,500 people annually, with medical costs exceeding $10 billion. There is currently no clinically approved treatment for SCI. In our lab, we are investigating the use of novel antigen-presenting nanoparticles to alter the immune response after SCI. Using animal models, our goal is to assess the therapeutic effect of these nanoparticles on functional outcomes. Specifically, we are subjecting mice to a series of controlled compression injuries to mimic clinical presentation of SCI. Afterwards, we use a battery of neurobehavioral tests to evaluate recovery. Results from a balance beam (fine motor skills) show both increased latency speed and average foot slips for all beam sizes in injured mice compared to control uninjured mice. In addition, an open field activity test (locomotor activity) was assessed, and injured mice showed decreased levels of activity and travel distances compared to their controls post-injury. However, mice showed slight improvement in the amount that they explore in the open field. These conclude that the proposed treatment may have some therapeutic benefit, so we are further looking into different time points for data collection. The experimental protocols developed may be translated to other types of injury modalities as well (sciatic nerve, stroke, etc).

Research Mentors:

Jianming Li, College of Veterinary Medicine, Department of Basic Medical Sciences

Bhavani Gopalakrishnan, College of Engineering, Department of Biomedical Engineering

SESSION 1

STEW 214A

Time: **8:50:00 AM** :: Physical Sciences

Using Muons Produced in Neutrino Interactions to Perform Planetary Tomography

Authors:

Robert Andrew Gustafson, College of Science

Abstract:

Neutrinos are weakly interacting, nearly massless particles. While neutrinos at low energies can pass through planets and moons with virtually no chance of absorption, neutrinos around 1 TeV have an interaction probability on the order of a percent. This probability depends on the amount of matter traversed by the neutrino, with higher densities having an increased chance of neutrino interaction. Therefore, a detailed knowledge of the ingoing and outgoing neutrino flux could return the density profile of a planet. Detecting neutrinos directly requires large detectors, forcing the detectors to be Earth based. We suggest a method based on detecting muons, a particle sometimes produced in neutrino interactions, which can be done with smaller and cheaper detectors. These detectors could more easily be sent to other planets and moons. Using muons has drawbacks, including the fact that muons lose energy as they propagate, causing some of the information from the neutrino flux to be lost. Using simulations coded in Python, we have shown that density along a one-dimensional path can still be reconstructed from the observed muon flux, and with a two-dimensional planet, the barrier between a core and mantle can be resolved. Future simulations will be needed to determine if the density can still be determined in less ideal situations, where neutrino flavor oscillations, detector inefficiencies, and backgrounds must be taken into consideration.

Research Mentors:

Dr. Rob Davies, NASA - JPL

SESSION 1

STEW 214A

Time: **9:10:00 AM** :: Life Sciences

Signatures of Selection for Cattle Docility

Authors:

Kate Watkins, College of Agriculture

Abstract:

Temperament has been recently identified as a primary concern for cattle producers in the United States. This is because temperamental cattle diminish product quality, animal performance, and animal welfare as well as pose a greater risk to handlers. Currently, temperament in cattle is assessed based on numerous quantitative and scoring measures. However, these methods are usually subjective and are not a good representation of the biology of the trait due to low or moderate heritability estimates. Our main objective in this study was to better understand the genetic and genomic background of temperament in cattle, with the goal of improving the accuracy and efficiency of temperament selection in breeding programs. This study compared the genomic make-up of 146 worldwide cattle breeds on the basis of single nucleotide polymorphisms, or SNPs, provided by the W.I.D.D.E. database. Individuals in the data set, which represent a myriad of cattle subspecies and wild Bovidae, were sorted based on their known temperament. They were then compared based on a signatures of selection analysis under multiple grouping strategies, such as docile vs anxious, anxious vs aggressive, and wild vs domesticated. This aimed to identify selection signatures due to long-term selection for divergent behavioral traits. After identifying the genomic regions, we searched for candidate genes, which contributed to a better understanding of the biological mechanisms underlying temperament in cattle and indicated phenotypes associated with those genes that could be used as novel traits for genetic selection.

Research Mentors:

Dr. Luiz Brito, College of Agriculture, Animal Sciences

Amanda Alvarenga, College of Agriculture, Animal Sciences

Hinayah Rojas de Oliveira, College of Agriculture, Animal Sciences

SESSION 1

STEW 214B

Time: **8:30:00 AM** :: Social Sciences/Humanities

Increasing Mid-Adult Women's Protection through Vaccination against HPV (IMPROVE HPV)

Authors:

Allissa Russell, College of Health and Human Sciences

Abstract:

Background: HPV is one of the most prevalent STIs in the U.S. The FDA approved the HPV vaccine for use in 27-45-year-olds, resulting in a new population with potential for vaccination. The purpose of this study is to evaluate gynecologists' knowledge, attitudes, beliefs, and current practices regarding vaccinating mid-adult women for HPV to determine feasibility of vaccinating patients in the OB/GYN setting.

Methods: This study is a cross-sectional survey sent to OB/GYNs in the U.S. Survey items included: OB/GYN demographic characteristics, HPV-related vaccination practices, knowledge, attitudes, beliefs, and patient population demographics.

Results: The majority of respondents were non-Hispanic white (61.9%), male (49.8%), and practice in suburban clinics (48.9%). While 85.3% of the respondents believed the HPV vaccine should be incorporated into the clinical care protocol for gynecologic patients, only 62.8% of the respondents believe it should be incorporated into postpartum care with 49.4% indicating they would not vaccinate any postpartum patients. Only 65.4% of the respondents knew women can receive the vaccine while breastfeeding, and 50.2% knew it is a 3 dose series for 15-26 year olds. 90.5% recommended the vaccine for patients 19-26, and 72.3% recommended for patients 27-45. Participants reported similar barriers, regardless of patient age, and the most frequently reported barrier was cost.

Conclusion: Most gynecologists were supportive of vaccinating 27-45 year olds, and recommended it at the same frequency as their younger patients. There were some knowledge gaps present and significant barriers. There are opportunities to increase HPV vaccination rates through education and in-clinic implementation.

Research Mentors:

Dr. Monica Kasting, College of Health and Human Sciences, Public Health

SESSION 1

STEW 214B

Time: **8:50:00 AM** :: Mathematical/Computation Sciences

Crowdsourcing Detection of Sampling Biases in Image Datasets

Authors:

Xiao Hu, College of Science

Haobo Wang, College of Science

Anirudh Vegesana, College of Engineering

Somesh Dube, College of Engineering

Kaiwen Yu, College of Engineering

Gore Kao, College of Engineering

Abstract:

Despite many exciting innovations in computer vision, recent studies reveal a number of risks in existing computer vision systems, suggesting results of such systems may be unfair and untrustworthy. Many of these risks can be partly attributed to the use of a training image dataset that exhibits sampling biases and thus does not accurately reflect the real visual world. Being able to detect potential sampling biases in the visual dataset prior to model development is thus essential for mitigating the fairness and trustworthy concerns in computer vision. In this paper, we propose a three-step crowdsourcing workflow to get humans into the loop for facilitating bias discovery in image datasets. Through two sets of evaluation studies, we find that the proposed workflow can effectively organize the crowd to detect sampling biases in both datasets that are artificially created with designed biases and real-world image datasets that are widely used in computer vision research and system development.

Research Mentors:

Ming Yin, College of Science, Computer Science

Yung-Hsiang Lu, College of Engineering, Electrical and Computer Engineering

SESSION 1

STEW 214B

Time: **9:10:00 AM** :: Life Sciences

Physiological Adaptation of the Genus Silphium across different Hydrologies

Authors:

Joshua Randall, College of Agriculture

Abstract:

The Genus Silphium is composed of two taxa, Silphium and Composita, which are distinguished by the form that they take as either tall sunflower-like or geophytic herbs. Both groups have remarkably sclerenmorphic leaf structure as well as high densities of trichomes. Species in Composita can be found in drier habitats and have been shown to be the older lineage in the genus. The radiation of Silphium into wetter habitats with increased biomass did not come at the expense of leaf toughness, but selection for more vulnerable hydraulic traits could have potentially occurred. Examining the anatomy of both taxa has shown that the number of vascular bundles, their size, and carbon chain accumulation differed between the two and followed the hypothesis of increased hydraulic machinery and decreased lignification in younger Silphium species. In order to determine if differences are present between the vulnerability of the two taxa and the rate of death due to drought, the optical vulnerability method was performed. This supported the hypothesis that younger Silphium species had traded vulnerability to embolism for increasing height and carbon reallocation. Further integration of other species in the genus and carbon accumulation study will be performed to increase strength for the hypothesis that this change occurred before the Composita and Silphium split and allows for carbon reallocation in place of xylem lignification.

Research Mentors:

Scott McAdam, College of Agriculture, Botany and Plant Pathology

Timothy Batz, College of Agriculture, Botany and Plant Pathology

SESSION 1

STEW 214C

Time: **9:10:00 AM** :: Mathematical/Computation Sciences

A Sequence Model Based Approach to Unknown Words Identification

Authors:

Yi Zhang, Polytechnic Institute

Abstract:

Unknown words in natural language texts can bring various problems in NLP tasks, such as affecting the performance in widely used machine learning models. Previous studies on identifying unknown words including pointer network (Gulcehre et al., 2016) which aims at replacing the unknown words in machine translation with the source language, and Named Entity Recognition (NER) which intends to classify entities into predefined categories. However, one limitation of these approaches is the robustness of understanding the unusual or unseen words (Li et al., 2018), neither pointer network or NER is capable of identifying the meaning of the unknown words after recognizing them. Inspired by a linguistics approach in refining the meaning of the unknowns (Taylor & Raskin, 2011), this study proposes a method to "understand" the unknown words, particularly nouns, through a sequence learning model. Pre-trained word embedding features are applied with an RNN family learning model to train and test on a large scale of text data. The trained model is expected to predict a set of candidate words whose meaning is similar to the meaning of providing context for a given unknown noun. This study aims at incorporating semantic information into an automated system to improve on a classic natural language task.

Research Mentors:

Xiaonan Jing, Polytechnic Institute, Computer and Information Technology

SESSION 2

STEW 214A

Time: **9:30:00 AM** :: Life Sciences

Therapeutic immune modulation of microglial cells using alpha gal nanoparticles

Authors:

August Dunbar, College of Agriculture

Abstract:

Spinal cord injury (SCI) is a devastating disease characterized by two phases: primary injury caused by mechanical insult, and secondary injury related to biological cascades that trigger cell death. In secondary injury, a key player is the pro-inflammatory macrophage (M1), which migrates from the blood and is responsible for phagocytizing cellular debris. However, M1 cells also secretes pro-inflammatory cytokines. Recent studies indicate lingering M1 presence post-injury leads to chronic inflammation and inhibits recruitment of pro-healing macrophages (M2), which are integral in repair of damaged tissues. This dysfunctional transition from M1 to M2 may hamper axonal regeneration after SCI. Similarly, resident central nervous system (CNS) macrophages (microglia) may benefit from an orchestrated transition to the M2 phenotype post-SCI. In this work, our goal is to determine if novel Î±-gal nanoparticles may be a useful tool to manage this transition. These nanoparticles are ~200-1000nm in size and express multiple Î±-gal surface epitopes. When the Î±-gal antigen binds to anti-gal in the blood, their interaction produces factors that have previously been shown to recruit M2 cells in wound healing. Here, we are using human microglial cells (HMC3) as an experimental model to mimic the post-SCI response. Early results indicate incubation of activated Î±-gal with HMC3 increases CD68 expression. Additionally, the morphology of the cells show greater elongation, with average area of 13019 compared to control of 5009. Moreover, Î±-gal treatment resulted in an increase of CD206 and arginase expression, suggesting that Î±-gal activates resting HMC3s and may polarize them towards the pro-healing phenotype.

Research Mentors:

Jianming Li, College of Veterinary Medicine, Department of Basic Medical Science

Bhavani Gopalakrishnan, College of Engineering, Department of Biomedical Engineering

SESSION 2

STEW 214A

Time: **9:50:00 AM** :: Life Sciences

A method to improve the homogeneity of protein samples intended for high-resolution cryo-electron microscopy

Authors:

Hannah Pletcher, College of Science

Abstract:

Cryo-electron microscopy (cryo-EM) is a method of structure characterization of proteins that does not require crystals. However, complete structure characterization can be prevented by sample heterogeneity and preferred orientations. Sample heterogeneity prevents the achievement of the highest resolution. The air-water interface can denature samples and induce preferred orientations, which inhibits the reconstruction of a complete three-dimensional structure. The hypothesis of this study is that the negative effects of heterogeneity and preferred orientations could be reduced by the encapsulation of the sample in cage-like proteins. This study suggests using the human norovirus virus-like particle (VLP) to encapsulate cargo-proteins to be imaged under cryo-EM. This system is achieved via molecular cloning into vectors and expression in insect cell lines. The use of the human norovirus viral capsid protein shell for the protein targets could allow for higher resolution of the protein target, reducing the effects of heterogeneity by making the protein more compact and less flexible, and preferred orientations by trapping the protein within the virus shell and preventing contact with the air-water interface.

Research Mentors:

Frank Vago, College of Science, Biological Sciences

Wen Jiang, College of Science, Biological Sciences

SESSION 2

STEW 214A

Time: **10:10:00 AM** :: Social Sciences/Humanities

An Examination of Multilevel Barriers to Hepatitis C Virus Screening among Baby Boomers in Primary Care

Authors:

Kaitlyn Gabhart, College of Health and Human Sciences

Abstract:

Background: Liver cancer rates in the U.S. are rising due, in part, to chronic hepatitis C virus (HCV) infection. The CDC recommends all persons born 1945-1965 (baby boomers) be screened for HCV. However, only 14% of baby boomers have been screened.

Methods: As part of a larger study, we examined multilevel barriers to HCV screening among baby boomers in primary care. We conducted semi-structured qualitative interviews with primary care providers (PCPs). Interviews were audio-recoded, transcribed, and analyzed using inductive content analysis. Our study was guided by the Competing Demands Model, which proposes three domains that influence uptake of preventive services: provider, patient, and clinic/systems-level domains.

Results: Participants (n=9) were 56% female, 67% White, and averaged 11.0 years in practice. At the provider-level, the most common barrier was lack of time to discuss HCV screening. Most PCPs did not feel comfortable treating HCV, and would only do so if it was absolutely necessary. PCPs reported the most common facilitator at the patient-level was increased awareness due to recent media coverage. The most commonly reported patient-level barrier was concern about cost of the screening. At the clinic/systems-level, the EMR was a major key in facilitating screening as reported by the provider.

Conclusions: Most providers agreed the barriers were not at the patient-level and future research should focus on increasing provider awareness of screening guidelines and delivering an effective recommendation.

Research Mentors:

Dr. Monica Kasting, College of Health and Human Sciences, Public Health

SESSION 2

STEW 214B

Time: **9:30:00 AM** :: Innovative Technology/Entrepreneurship/Design

Global Air Quality Trekkers: Nandi Clean Kitchen Study

Authors:

Stephanie R Schiavo, College of Engineering

Sam Dykhuis, College of Engineering

Avalin Senefeld, College of Engineering

Abstract:

Indoor air pollution is a widespread problem in Sub-Saharan Africa and is the leading cause of premature death in many Sub-Saharan African countries. This pollution is primarily caused by the burning of biomass fuels inside an enclosed kitchen in order to provide heat for cooking. Global Air Quality Trekkers is an undergraduate engineering team within the EPICS department at Purdue, and our goal is to create a kitchen design that utilizes natural ventilation to mitigate the amount of air pollutants present in these kitchens, specifically in Nandi, Kenya. This year, our goal is to analyze the ability of 9 different kitchen designs to reduce the amount of air pollution present. After this semester, the team will be traveling to Nandi, a community that has already begun to use these modified kitchens. After conducting research this semester on our West Lafayette test kitchen, we will be able to determine the most effective kitchen designs and share this with our project partners in Nandi. Additionally, we will be analyzing the effectiveness of different types of kitchens in Nandi, conducting surveys within the community regarding the new kitchen designs, and teaching an engineering module at the Tumaini school in Nairobi, Kenya. Overall, our hope is that these new kitchen designs will be adopted by more members of the community. These designs have the potential to save the lives of women and children, who become victim to diseases such as COPD and pneumonia after many years of smoke inhalation. Ultimately, our goal is for these designs to spread to all areas of Kenya and Africa, and improve the health of the people who live there.

Research Mentors:

Brandon Boor, College of Engineering, Civil Engineering

SESSION 2

STEW 214B

Time: **9:50:00 AM** :: Innovative Technology/Entrepreneurship/Design

Spaceflight Testing of Small Satellite Micropropulsion Management

Authors:

Adithye Menon, College of Engineering; Daniel Mayper, College of Engineering

Anirudh Govindhan, College of Engineering; Noah Franks, College of Science

Samantha KIddy, College of Engineering; Jordan Soberg, College of Engineering

Benjamin Lumpp, College of Engineering; Tristan Shahin, College of Engineering

Abstract:

The increasing ubiquity of small satellites demands highly optimized active attitude control systems . Micropropulsion, such as electrospray or resistojets, presents a compact, high-efficiency method of active attitude control compared to chemical propulsion systems . The Film Evaporation MEMS Tunable Array (FEMTA) thruster has an advantage over these forms of attitude control due to its low mass, volume, and power requirements while maintaining suitable thrust characteristics for small satellite operation. FEMTA generates thrust by inducing film-boiling of ultra-pure deionized water in a micron-scale water capillary. Due to the behavior of fluids in microgravity, a specialized tank was developed to deliver the propellant at a constant rate to the FEMTA thruster in orbit. To meet these requirements, the propellant management system utilizes passive vaporization of an ether to inflate a diaphragm, allowing the water to remain in contact with the micronozzle. Using the vapor pressure to inflate the diaphragm allows for a more compact propulsion system by eliminating the need for external pressurization and power . Validation of these concepts has been demonstrated in the lab but is yet to be verified under space-flight conditions. This validation shall be accomplished through a suborbital flight, scheduled for Spring 2021, on a Blue Origin New Shepard. In preparation for this spaceflight, the propellant management system will be tested to ensure operation at a constant pressure and flow rate without the generation of gas pockets. The thrust generation of the FEMTA device itself will be evaluated by measuring the vapor pressure differential within a containment chamber during firing. Success criteria include the verification of FEMTA thruster integrity and observable thrust generation, the operation of the propellant management system at constant back pressure and flow rate under space-flight conditions .

Research Mentors:

Alina Alexeenko, College of Engineering, School of Aeronautics and Astronautics

Kate Fowee, College of Engineering, School of Aeronautics and Astronautics

Steven Pugia, College of Engineering, School of Aeronautics and Astronautics

SESSION 2

STEW 214B

Time: **10:10:00 AM** :: Mathematical/Computation Sciences

AI Powered Video Querying Over Cameras

Authors:

Bryan Jimenez, Purdue University

Anthony Yu Hou, Purdue University

Wen-Hsiang Shih, Purdue University

Abstract:

HYPER CAM is a systematic approach to perform video querying on zero streaming cameras. This system works by deploying lightweight neural network operators onto the camera which assigns confidence scores on each video frame and then sends only the frames with high confidence scores to the cloud. The cloud then performs a more expensive and accurate computer vision algorithm to detect the desired object which then gets outputted to the user. HYPER CAM offers the ability to use low-cost cameras while at the same time improving the performance of the system. However, even though HYPER CAM has many advantages due to its ability to outperforms competitive alternative designs, the current system is missing some vital sub systems which hinders the overall system. In this project, we will be focusing on improving the overall functionality by implementing these subsystem into HYPER CAM's design as well as adding layers onto the object detection to allow users to detect a wide range of objects and allow users to filter results based on their specifications. As a result, this platform will allow remote users to easily query videos stored on zero streaming cameras in a fast, accurate and privacy preserving manner.

Research Mentors:

Felix Lin, College of Engineering, ECE

SESSION 2

STEW 214C

Time: **9:30:00 AM** :: Physical Sciences

Anisotropy of Cellulose Nanocrystal Thin Films

Authors:

Nolan A. Miller, College of Engineering

Abstract:

Abstract retracted.

Research Mentors:

Chelsea Davis, College of Engineering, Material Science and Engineering

SESSION 2

STEW 214C

Time: **9:50:00 AM** :: Life Sciences

Effects of Varying Confluency on Schwann Cell Alignment in an Electric Field

Authors:

Mary Lang, College of Engineering

Abstract:

Schwann cells are peripheral nervous system glia that are responsible for producing myelin. After PNS injury, Schwann cells also play important roles in tissue repair and are involved in guiding regenerating axons. Previously, we have shown that Schwann cells are highly responsive to DC electric fields. Application of fields as low as 75 mV/mm caused them to align perpendicular to the field vector. However, such experiments were conducted with very low cell densities as to reduce the interaction effects from neighboring cells. In this work, we sought to understand the effect of cell density on cellular alignment in the same DC fields. We hypothesized that higher cell density would result in higher overall degree of cell alignment due to the reinforcing effect of the alignment of the neighboring cells. Experimental results showed at 500 mV/mm and 16,000 cells/cm^2, 40% of cells align at an angle greater than 80°, which is consistent with our previous work. At a lower cell density of 2,000 cells/cm^2, only 28% of cells aligned at greater than 80°. There was a statistically higher degree of alignment with both increasing cell confluency and field strength. These results were consistent with our hypothesis. These signify that with increased cell density, the effect of DC electric fields is more pronounced. This result may be exploited to attract and realign Schwann cells at the site of injury. For example, this finding could be used to optimize the degree of alignment of implanted Schwann cells in therapies involving electric field stimulation.

Research Mentors:

Jianming Li, College of Veterinary Medicine, Basic Medical Science

Spencer Bunn, College of Engineering, Biomedical Engineering

Bhavani Gopalakrishnan, College of Engineering, Biomedical Engineering

SESSION 3

STEW 214A

Time: **10:30:00 AM** :: Mathematical/Computation Sciences

Real-Time Facial Detector and Encryption on Embedded Devices

Authors:

Isha Ghodgaonkar, College of Engineering; Ziyad Alajmi, College of Engineering

Jackson Moffet, College of Engineering; Fischer Bordwell, College of Engineering

Arnav Ballani, College of Engineering

Abstract:

The surveillance industry produces large amounts of data with increasingly better camera technology and ubiquity. However, this data contains identifiable information, which leads to privacy concerns. This paper presents an architecture where encryption of identifiable information, such as faces, is performed at the source rather than the cloud to protect privacy by disallowing personal information from leaving the camera. This also allows data analytics to be performed on large scene images in the context of safety, such as safety glasses and other PPE (personal protective equipment) being worn.

Many state-of-the-art object detection methods such as YOLO and SSD exist, as well as face detection datasets and standard encryption methods. There is not yet, however, a system that integrates an efficient face detection algorithm on an embedded system complete with encryption at the source.

We aim to repurpose networks suited for object detection to perform face detection on embedded systems, which have computational power constraints. Our method also combines symmetric and asymmetric encryption for the purposes of key management. Additionally, we aim to test different key lifecycles to further protect the security of the network.

The facial detection models would be evaluated on the WIDERFACE dataset, as only the region above the shoulders is of concern. The paper aims to detect 80% of faces in large scene images, comparable to the state-of-the-art methods. This paper also aims to achieve one frame per second rate of detection and encryption. Both metrics are evaluated on NVIDIA Jetson Nano.

Research Mentors:

Dr. Yung-Hsiang Lu, College of Engineering, Electrical and Computer Engineering

SESSION 3

STEW 214A

Time: **10:50:00 AM** :: Social Sciences/Humanities

A comparative analysis of classifiers within the DP system

Authors:

Xuan Hu, College of Liberal Arts

Paula RodrÃ-guez, College of Liberal Arts

Abstract:

As an extension of a larger project, this research evaluates the hypothesis proposed by Benedicto (2003, 2018). That analysis assumes that classifiers are the realization of an [Î±-class] feature bundled up together with a functional head forming a complex functional head. The output will determine the syntactic behavior associated with a classifier across a wide range of language systems. Utilizing a typological approach, we specifically expand Benedicto's proposal to the functional heads within the DP system, namely nouns, possessives, quantifiers and numerals. We present some evidence predicted by the hypothesis via examples of indigenous languages and minority languages. We also discuss cases which will require an extension of the theory.

This research is aimed at describing how these languages set up the syntactic distribution of the different types of classifiers by inference via morphological properties and syntactic construction of classifiers. Exploring lesser-known and indigenous languages contributes to the understanding of how languages convey the way in which their speakers perceive the real world on classification and measurement.The research also contributes to cross-linguistic studies by investigating the relations between typologically and genetically different languages worldwide and brings up the relevance of these indigenous languages through linguistic analyses.

Research Mentors:

Elena E. Benedicto, College of Liberal Arts Linguistics, English

Pin-Hsi Chen, College of Liberal Arts, Linguistics

SESSION 3

STEW 214A

Time: **11:10:00 AM** :: Life Sciences

Genetics of Soybean Leaf Morphology

Authors:

Jamie Arabshahi, College of Engineering, College of Agriculture

Abstract:

Soybeans are a globally important crop for protein and oil. The typical soybean has three leaflets per leaf. While several genes controlling leaflet number are known in other plant species, genetic control of leaflet number in soybeans has been linked to two distinct loci. Mutation at these loci cause extra leaflets in soybean plants. Ten accessions from the USDA Soybean germplasm collection have been observed for expression of the leaflet number phenotype. In addition, two new mutants in the Williams-82 genetic background with extra leaflets were obtained. We attempted to sequence candidate genes in lines with the extra leaflet phenotype and preliminary genetic mapping of the extra leaflet trait. The understanding of the control of leaflet number may allow for the adjustment of photosynthetic productivity of soybean plants.

Research Mentors:

Karen Hudson, College of Agriculture, Agronomy

Militza Carrero-Colon, College of Agriculture, Agronomy

SESSION 3

STEW 214B

Time: **10:30:00 AM** :: Life Sciences

Characterization of neutrophil aging during inflammation using a fluorescent Timer Protein

Authors:

Mansoorah Kermani, College of Science

Abstract:

Customarily upon infection and tissue injury, neutrophilic inflammation acts as the first line of defense. Neutrophils are a type of white blood cell that are important to the innate immune system. While attempting to protect the body, they can also cause collateral damage upon over-inflammation. Currently, careful evaluation of the role that neutrophil subtypes play in terms of aging in response to infection and injury is lacking. On that account, our novel project uses an animal model system, the Zebrafish (*Danio rerio*), to elucidate neutrophil aging and activity upon infection as well as tissue injury.

The basis for this project is that differences in the ages of neutrophils, whether they be ‘young’ or ‘old’, may respond differently to induced inflammation in the zebrafish model. Inflammation is induced in zebrafish via tail wounding and infection, specifically ear and blood infection, using *Pseudomonas aeruginosa*, an infectious pathogen. This novel project defines young and old neutrophils based on a color change exhibited within neutrophils using a fluorescent timer, a mutant of the red fluorescent protein DrFP583, also known as fluorescent Timer. To create a fluorescent timer fish line, the timer protein sequence with a nuclear localization sequence (NLS) is cloned using a neutrophil promoter LyzC. This is a plasmid that is then injected into the zebrafish embryos at the one-cell stage. Once the plasmid is expressed within the neutrophils, the fluorescent timer changes color with time, labeling younger neutrophils green and older ones red. Using this tool, the differences in neutrophil behavior and its localization in zebrafish upon induced inflammation in young and old neutrophils can be elucidated.

Research Mentors:

Ramizah Syahirah, College of Science, Molecular Biology

Qing Deng, College of Science, Molecular Biology

Alan Hsu, College of Science, Molecular Biology

SESSION 3

STEW 214B

Time: **10:50:00 AM** :: Life Sciences

Extracellular signal-regulated protein kinases 1 and 2 (ERK1/2) signaling by non-canonical GPCR pathways

Authors:

Angel Lin, College of Health and Human Sciences

Abstract:

Introduction: G-protein-coupled receptors (GPCRs) play diverse roles in the pathophysiology of human neurological disorders. Upon activation of GPCRs via extracellular stimuli, GPCRs transduce downstream pathways through two distinct pathways: canonical G-protein and non-canonical Î²-arrestin pathways. Phosphorylation of ERK1/2 is a major downstream of both GPCR signaling pathways and contributes to cell proliferation, survival, and gene expression. Despite evidence supporting ERK activation by G-protein or Î²-arrestin pathways, there is limited information regarding potential differences between Î²-arrestin isoforms in the spatial (cytosol vs. nuclear) temporal profile of ERK1/2 activity in cells. Therefore, we proposed to investigate whether activation of Î²-arrestin-1 produces distinct patterns of ERK1/2 phosphorylation compared to Î²-arrestin-2.

Methods: We utilized interdisciplinary approaches including pharmacological, cellular, and biochemical methods. We used G-protein-biased (TAN67) or Î²-arrestin-biased (SNC80) Î´-opioid GPCRs (Î´OR) selective agonists that display opposing effects on the modulation of mood behaviors. Following administration of these drugs, cells were collected at different time points and separated into cytosolic and nuclear fractions and ERK1/2 activation was measured by Western blot analysis.

Results: Our results indicated a trend of a transient cytosolic ERK1/2 activation by SNC80 and TAN67 in Î²-arrestin-2- and Î´OR-expressing Chinse Hamster Ovarian cells, whereas a trend of a weak and persistent cytosolic ERK1/2 activation by SNC80 and TAN67 were observed in Î²-arrestin-1 and Î´OR-expressing Osteosarcoma Epithelial cells. However, the ERK1/2 phosphorylation patterns in the nucleus were difficult to identify. Our finding suggests that the two Î²-arrestin-1 and -2 isoforms may differentially impact the spatiotemporal profile of cellular ERK1/2 signaling.

Research Mentors:

Richard van Rijn, College of Pharmacy, Department of Medicinal Chemistry and Molecular Pharmacology

Mee Jung Ko, College of Pharmacy, Department of Medicinal Chemistry and Molecular Pharmacology

SESSION 3

STEW 214B

Time: **11:10:00 AM** :: Life Sciences

Complement C3 contributes to status epilepticus induced hippocampal synaptic protein loss

Authors:

Vishal Bhimarasetty, College of Health and Human Sciences

Abstract:

Authors: Vishal N. Bhimarasetty, Alexandra L. Sommer, Nicole D. Schartz and Amy L. Brewster

Rationale: Epilepsy is a neurological disorder that consists of seizures and comorbid cognitive dysfunctions. Hippocampal injury and cognitive deficits are common in temporal lobe epilepsy and can be exacerbated by prolonged seizures (status epilepticus; SE). Furthermore, an episode of SE can trigger the development of epilepsy in an otherwise healthy system. SE triggers hippocampal dendritic and synaptic loss, microgliosis, and complement (C1q-C3) hyperactivation. Seizure frequency and cognitive deficits parallel increases in complement C3 protein levels. Thus, we hypothesized that SE-induced C3 activation may alter hippocampal function thereby promoting memory deficits.

Methods: To test the hypothesis, we used the complement inhibitor cobra venom factor (CVF) in male Sprague Dawley rats to eliminate C3. Rats were injected with pilocarpine (300-350mg/g, i.p.) to induce SE (controls were given saline). One week after SE, rats were injected with CVF (100ng/g, i.p.) or equal volume saline. There were 4 treatment groups for rats (Veh-C, Veh-SE, CVF-C, CVF-SE). At two weeks after SE, rats were perfused with saline and hippocampi were sub-dissected for western blotting. Antibodies against the following synaptic markers were used: anti-PSD95, VGAT, and VGlut.

Results: Behavioral seizure severity was scored using the Racine scale. SE results in loss of hippocampal protein levels of PSD95, VGAT, and VGlut1 in the Veh-SE group compared to Veh-C. However, levels of these synaptic proteins were significantly higher in the CVF-SE group compared to the Veh-SE group.

Conclusion: Taken together, these data suggest that the SE-induced reduction of hippocampal synaptic proteins was attenuated with blocking C3 activation with CVF. This finding indicates that SE-induced complement C3 activation contributes to hippocampal synaptic remodeling and suggest that the C3 may be a potential therapeutic target for the memory comorbidities that correlate with synaptic loss in epilepsy.

Research Mentors:

Amy L. Brewster, Psychological Sciences

Alexandra L. Sommer, Biomedical Engineering

SESSION 3

STEW 214C

Time: **10:30:00 AM** :: Innovative Technology/Entrepreneurship/Design

Economic Feasibility of Low-Input Sod Production: A Financial Case Study

Authors:

Sanchez Philocles, College of Agriculture

Abstract:

The turfgrass industry in the U.S has experienced a tremendous growth during the last 40 years, from its nascent state in the 60s to a substantial economic force in several areas of the country today. Sales of sod in Indiana accounted for almost 8.5 million in 2017, generating a total of 169 jobs, a relatively low value comparing to the top producer states like Florida, Alabama, and Texas. The study aims to create a financial feasibility tool for sod producers using the case of Tennessee as a reliable enterprise budget. This tool will determine, first, the initial investment to start operations with sod and, second, estimate the cost of production for the first year of production and opportunities to reduce costs. This tool develops a profit, cost structure, sensitivity, and break even analyses to understand the economic performance of adopting low-input sod varieties. The startup investment for sod production was $ 227,500, costs were categorized as variable, fixed, and labor costs representing, 66%, 25%, and 9%, respectively, from the total costs. Sensitivity analysis showed that increasing price by 10% (up to $0.125), can increase profits to $500. Breakeven analyses illustrated that the minimum yield to cover first year production costs should be 3,814 square yards, while the minimum price per square yard to cover all costs was $1.19.

Research Mentors:

Ariana Torres, College of Agriculture, Horticulture Landscape Architecture

SESSION 3

STEW 214C

Time: **10:50:00 AM** :: Physical Sciences

Human and Robots in the Operating Room: Collaborating to save patients

Authors:

David Wu, College of Engineering

Abstract:

Objective: Effective teamwork in healthcare is critical for high-quality and safe patient care. Communication failures have led to adverse events and medical errors. The introduction of robotic technology adds additional complexity that likely increases the need and importance of communication across the team; however, there are limited studies done on robotic surgeries. This study aims to answer communication issues the during different phases of robotic surgery to improve patient outcome.

Method: Twelve robotic surgeries were video recorded. For each case, the video was divided into the five major phases of robotic surgery: docking (setting up the Da Vinci Robot), pre-critical, critical phase of the surgery, post-critical, and pre-undocking (removing the robot). For each interaction, the sender, recipient, goal (i.e. request, question, confirmation), and response type (verbal or non-verbal) was analyzed. Each interaction was annotated as a call-out (sender initiating a conversation), check-back (response to previous message), or closed-loop (sender ending the communication).

Result: The surgeon communicated with the assistant more than any other team member. Surgeon directed 30%, 80%, 69%, and 58% of call-outs to the assistant during the docking, pre-critical, critical, post-critical, and pre-undocking phase respectively. The critical phase saw the least amount of case-irrelevant interactions at 7% compared to 10 % during docking and pre-critical phase, 20% and 14% during post-critical, and pre-undocking phase respectively.

Conclusion: Understanding how surgical teams interact in different phases of robotic surgery involving the Da Vinci system will help improve how teams interact with complex technology in the operating room.

Research Mentors:

Denny Yu, College of Enginnering, Industrial Engineering

Jackie Cha, College of Enginnering, Industrial Engineering

SESSION 3

STEW 214C

Time: **11:10:00 AM** :: Innovative Technology/Entrepreneurship/Design

Fatigue in collegiate aviation

Authors:

Erik Levin, Polytechnic Institute

Abstract:

The purpose of this study is to investigate how collegiate aviation students identify and mitigate the deleterious effects of fatigue during flight training, and consequently improve aviation safety. This major research project follows a four-phase research project conducted by Purdue researchers in the School of Aviation and Transportation Technology (SATT). The project is currently in its fourth phase. During this phase researchers will investigate the collegiate aviation pilots' subjective level of sleepiness and fatigue at particular times during the day using the Karolinska Sleepiness Scale and the Samn-Perelli Scale. The participants, who are all pilots in different stages of training, will rate their sleepiness using the Karolinska Sleepiness Scale (KSS), and their level of fatigue using the Samn-Perelli Fatigue Scale (SPS). The evaluation will occur four times daily for one week during four consecutive months. Participants will either use their mobiles or fill out a paper format to submit their KSS and SPS scores. The data will then be de-identified and registered into an excel spreadsheet. Implications of this study include opportunities for quantitative analysis of students' peak performance times as well as insight into students' fatigue and sleepiness levels throughout the school year.

Research Mentors:

Dr. Flavio Mendonca, Polytechnic Institute, School of Aviation and Transportation Technology

Dr. Julius Keller, Polytechnic Institute, School of Aviation and Transportation Technology

SESSION 4

STEW 214A

Time: **11:30:00 AM** :: Innovative Technology/Entrepreneurship/Design

Occupancy Sensing with Chair-Appended Thermocouples

Authors:

Aayush Mathur, College of Engineering

Nhi T. Khuu, College of Engineering

Abstract:

Humans are an active source of volatile organic compounds (VOCs), carbon dioxide (CO2), and bioaerosols in indoor environments. These emissions change the chemical and biological composition of air inside enclosed spaces and are strongly linked to the number of human occupants. Thus, developing a means of sensing occupancy is essential in determining the quality of air in these spaces. Current means of detecting occupancy using CO2 or door-entry sensors are both inaccurate and wholly unable to determine spatial distributions of occupants. This study aims to evaluate a new means of detecting spatiotemporal patterns in occupancy by using chair-appended thermocouples.

Twenty K-type thermocouples were mounted to chairs in the Living Laboratories at Purdue University's Herrick Laboratories. Each chair's surface temperature was recorded to portable USB data loggers at 15-second intervals. An algorithm was developed to convert this data to occupancy at each seat. A spatial distribution of occupancy at each seat was then generated, neglecting standing occupants. This occupancy was summed to find the total occupancy in the room at a 15-second time resolution.

The occupancy data was integrated with real-time measurements of VOC, CO2, and bioaerosol concentrations to determine per-person emission factors of each species. Daily and weekly trends in occupancy were found, and spatial maps of occupancy patterns were generated to visualize emission sources. Chair-appended thermocouples were found to be a viable means of detecting occupancy, being most accurate for spaces in which occupants remain seated for most of the time, such as open-plan offices and classrooms.

Research Mentors:

Dr. Brandon E. Boor, College of Engineering, Civil Engineering

Danielle N. Wagner, College of Engineering, Civil Engineering

SESSION 4

STEW 214A

Time: **11:50:00 AM** :: Mathematical/Computation Sciences

Approximative Commutation of Matrices

Authors:

Garrett Mulcahy, College of Science

Abstract:

John von Neumann's "Approximative Properties of Matrices of High Finite Order"(1941) explores the asymptotic behavior of matrices as dimension increases but remains finite. Essentially, von Neumann ventured to explore the neglected middle ground between finite and infinite dimensional analysis. The major result of this paper is a proof of the existence of "big, bad matrices"- that is, matrices of large dimension that possess "bad" qualities. von Neumann's proof was nonconstructive, making use of what he called a "volumetric" argument. We utilize computational techniques in a quest to find a construction of these matrices; discovering what the matrices look like will potentially have applications to data science and the theory of random matrices.

Research Mentors:

Dr. Thomas Sinclair, College of Science, Mathematics

SESSION 4

STEW 214A

Time: **12:10:00 PM** :: Mathematical/Computation Sciences

Lightweight RISCV SoC with Dynamic Sparsity Optimizations for ML Applications

Authors:

Vadim Vadimovich Nikiforov, College of Engineering; Wengyan Chan, College of Engineering

Abstract:

Lightweight microcontrollers are increasingly cheaper, smaller, and more powerful, making them suitable candidates for remote and distributed sensing applications like structural health monitoring and wildfire detection. For microcontrollers to make sense of sensor data more effectively, machine learning algorithms are deployed to make inferences locally. This comes with high energy and performance costs.

To improve performance on the architectural level, we implemented a hardware extension for our RISC-V System-on-chip (SoC) to exploit sparsity (the presence of zero values in data), a phenomenon that commonly occurs in machine learning algorithms. At initial runtime, we store a table containing regions of instructions that could become redundant if there are zeros in the registers and dynamically determine if they are skippable in the runtime environment. This method has been proven in simulation to skip between 25% to 60% of computations for several DNN benchmarks due to dynamic sparsity. This significantly reduces computation time and energy consumption while requiring minimal architectural changes. Identifying sparsity dynamically can have massive improvements over optimizations implemented purely in software that can only detect static sparsity in the coefficients of a model.

We have implemented the extension as a memory-mapped peripheral as opposed to requiring instruction set extensions to improve compiler support. Currently, we are also developing benchmarks to evaluate the performance of various configurations of our table's cache-like storage structure in preparation for tapeout. Our optimizations would allow proven machine learning software techniques to be implemented on embedded devices with minimal algorithmic changes while presenting greater energy savings.

Research Mentors:

Dr. Mark C. Johnson, College of Engineering: Electrical and Computer Engineering

Dr. Timothy Rogers, College of Engineering: Electrical and Computer Engineering

Dr. Matthew Swabey, College of Engineering: Electrical and Computer Engineering

SESSION 4

STEW 214B

Time: **11:30:00 AM** :: Physical Sciences

Chemical modification of Reverse osmosis membranes for extended performance

Authors:

Alyssa McNarney, College of Engineering

Abstract:

Abstract retracted.

Research Mentors:

John Howarter, College of Engineering, Material Science and Engineering

SESSION 4

STEW 214B

Time: **11:50:00 AM** :: Social Sciences/Humanities

Devastating Effects of the Bubonic Plague Due to Poor Communication between Officials and the Public

Authors:

Hetvi Desai, College of Engineering

Abstract:

When epidemics strike, they cause significant fear and panic in the hearts of the general public. Such anxiety has many devastating social and cultural consequences. The third bubonic plague epidemic, for example, began in China in 1855 and soon spread to the rest of the world, leaving its mark for over a century. It caused many people to flee their homes due to unreasonable fears. Most people did not have an understanding of how the plague actually spread; thus, they were not able to take proper measures to protect themselves from contracting the disease. Orientalis, as it is called, also resulted in large scale discrimination against the people of Chinatown in San Francisco, California, because the residents of Chinatown did not realize that the lack of hygiene in the community contributed to the fast-paced spreading of the plague. The people outside of Chinatown began to harbor feelings of resentment towards the people of Chinatown, essentially blaming them for contributing to the epidemic on purpose. Orientalis also caused general hysteria, and not many knew how to stop it from spreading. This was mainly due to an inefficient communication system between public health officials and the general public and a lack of trust between them. I believe that it is crucial to develop a more efficient and trustworthy relationship between the professionals and the masses as well as create a better communication system for when such society disrupting incidents arise.

Research Mentors:

Caitlin Fendley, College of Liberal Arts, History

SESSION 4

STEW 214B

Time: **12:10:00 PM** :: Life Sciences

Effects of Aging on Genes involved in Photoreceptor Survival

Authors:

Kimaya Bakhle, College of Agriculture

Abstract:

Abstract retracted.

Research Mentors:

Dr. Vikki Weake, College of Agriculture, Biochemistry

Juan Jauregui, Biochemistry

SESSION 4

STEW 214C

Time: **11:30:00 AM** :: Social Sciences/Humanities

Public Engagement after the Most Destructive and Deadliest Wildfire in California's History: Drinking Water and Plumbing Safety

Authors:

Qi Erica Wang, College of Engineering

Tolu Odimayomi, College of Engineering

Christian Ley, College of Engineering

Yoorae Noh, College of Engineering

Abstract:

California's November 2018 Camp Fire was the 6th deadliest wildfire in U.S. history. The fire destroyed more than 14,000 structures and displaced more than 30,000 people. Multiple public water systems became chemically contaminated, some with hundreds to thousands of parts per billion of benzene and other volatile organic chemicals (VOC). Six months after the fire, residents were still confused about drinking water and home plumbing contamination. To assist residents with their water safety decisions, a team of experts designed and conducted a public education event in Paradise, California. The June 2019 event involved four hands-on activities. Activities helped attendees understand basic concepts of water testing, sampling, and plumbing. Physically damaged water system materials were onsite so that residents could see and feel first-hand the effect of fire on home plumbing. The activities were called: The Plumbing Zoo, Ask the Experts, Water Sampling for Quality Testing, and Plumbing Damage. The event was wellreceived, subsequently shared through community groups, and reported by the media. Results have relevance to other disasters where utilities and health officials need to provide residents with guidance on drinking water and plumbing safety.

Research Mentors:

Dr. Andrew Whelton, College of Engineering, Civil Engineering and Division of Environmental and Ecological Engineering

SESSION 4

STEW 214C

Time: **11:50:00 AM** :: Social Sciences/Humanities

Siblings' Role in Infant and Young Child Feeding and Care in Rural Tanzania

Authors:

Morgan Boncyk, College of Health and Human Sciences

Abstract:

The role of sibling engagement in infant and young child feeding (IYCF) and care practices in a rural, developing region is currently unknown. We examined the role older children and adolescents play in IYCF and care in rural Tanzania as part of a cluster-randomized trial, Engaging Fathers for Effective Child Nutrition and Development in Tanzania (EFFECTS; ClinicalTrials.gov: NCT03759821). The study aims (1) to illustrate older children's role in IYCF and care; (2) to recognize determinants for sibling involvement in IYCF and care; and (3) to identify specific contributions siblings have in caregiving. Interviews on purposively sampled mothers (n=12), fathers (n=12), grandmothers (n=4), and siblings (n=3; 7-17yrs) were conducted July-August 2018. Qualitative analysis was used to develop themes that guided the creation of two quantitative questionnaires. These were administered, December 2018-May 2019, to mothers (n=958) and older children (n=452) aged 7-17 years old (61% female). Preliminary results showed older children and adolescents play a large role in IYCF and care (e.g., 88% playing, 85% responding to cries). Gender differences were observed, with girls more engaged in feeding or providing drink (84%, p-value=0.004), food preparation (60%, p-value<0.001), and hygiene practices (69%, p-value<0.001). We will explore whether siblings' care is associated with morbidity of the index child and parents' and especially mothers' time use. This study is the first to develop and evaluate a survey tool to assess siblings' role in childcare in a low-resource setting. Future nutrition interventions should account for the role of various family members when targeting child nutrition.

Research Mentors:

Nilupa Gunaratna, College of Health and Human Sciences, Public Health

SESSION 4

STEW 214C

Time: **12:10:00 PM** :: Life Sciences

Teaching an Old Drug a New Trick: Repurposing Fenamic Acids to Treat Multi-Drug Resistant N. Gonorrhoeae

Authors:

Amr Kais, College of Science

Abstract:

Neisseria gonorrhoeae infects 106 million people worldwide each year and the wide-spread of multidrug-resistant strains of *N. gonorrhoeae* has sparked an urgent demand for new drugs. However, the current process of drug-discovery is resource-intensive and time-consuming, requiring at the minimum 10 - 15 years of preclinical evaluation and clinical trials prior to receiving approval. To address this urgency, we utilized a drug repurposing strategy, screened 4,000 FDA-approved drugs, and identified three clinically approved anti-fenamic acids inflammatory drugs (tolfenamic, flufenamic, and meclofenamic acids) with potent anti-gonococcal activity. Drug repurposing, evaluating previously approved drugs for an alternative disease, represents a novel strategy to overcome the dilemma of de novo antibiotic drug development. All three drugs exhibited antibacterial activity ranged from 4 to 16 µg/mL with low frequency of resistance <2.4 10-10. A time-kill assay revealed that all three drugs were capable of reducing a high inoculum of *N. gonorrhoeae* within 12 hours. Interestingly, the fenamic acids did not disrupt Lactobacillus spp., one of the major inhabitants of the healthy female genital microbiota. Furthermore, tolfenamic and flufenamic acid were far superior to the drug of choice, ceftriaxone, in reducing the burden of intracellular *N. gonorrhoeae* with a 99% reduction. Finally, fenamic acids and other structurally related derivatives were evaluated to ascertain a more in-depth structure activity relationship (SAR) that revealed N-phenylanthranilic acid as a novel anti-gonorrheal scaffold. In conclusion, this study has revealed fenamic acids as a potential new addition to the limited treatment options available for gonococcal infections and warrants further investigation.

Research Mentors:

Dr. Mohamed Seleem, College of Veterinary Medicine

SESSION 5

STEW 214A

Time: **12:30:00 PM** :: Mathematical/Computation Sciences

DeepFake Video detection using Convolutional Neural Networks

Authors:

Austin Chen, College of Engineering

Bekbolat Abdikanov, College of Engineering

Edmund Chau, College of Engineering

Prekshaa Veeraragavan, College of Engineering

Tsung Lin Hsia, College of Engineering

Tri Van Nguyen, College of Engineering

Abstract:

The objective of this research is to present a robust DeepFake video detection solution in response to rising threats in cybersecurity where morphed faces are used to falsely represent public figures. This paper describes the methods that utilize a Convolutional Neural Network (CNN) to detect DeepFake videos, using a publicly available data set. The features of the system include facial landmark detection and frame-by-frame analysis of key parameters in the video. Integrating these methods allows the user to detect anomalies in DeepFake videos. Observations of DeepFake datasets indicate that flickering effects appear on almost every sample video. The two key features of these effects are the abnormal displacement of facial features in the video (e.g., nose, eyebrows, face edges) and the illumination around these elements. A frame-by-frame approach was used to find the rate of displacement of the facial landmarks. The average brightness of areas above eyebrows or around fake faces themselves has sudden changes during videos. These two behaviors can be combined to detect fake faces. There are serious threats to the trustworthy distribution of media today. Proliferation of DeepFakes online is one such problem, which can be limited by using CNN to filter out the tampered videos. An efficient and robust CNN can be developed for DeepFake detection by focusing on anomalies in spacing between landmarks on the faces, and the discrepancies in lighting on the edges of the faces in the sample videos.

Research Mentors:

Edward J Delp, College of Engineering, Electrical and Computer Engineering

Carla B Zoltowski, College of Engineering, Electrical and Computer Engineering

SESSION 5

STEW 214A

Time: **12:50:00 PM** :: Innovative Technology/Entrepreneurship/Design

Earth Remote Sensing

Authors:

Renaissa Ghosh, College of Engineering

Abstract:

The project is about the satellite remote sensing, harnessing it to work and improvise in the field of agriculture and Coastal Altimetry. With data for the 5-point moving average filter and the transfer function provided, I worked on 1-D digital filters using MATLAB, each measuring the number of samples on a 5-point interval. The moving average filter is a simple low-pass filter used for smoothing an array of sampled data/signals. It takes samples of input at a time and takes the average of those and produces a single output point. Overall, the 5-point moving average filter multiplies the input data by the coefficients of the transfer function to produce the output data. The 2-D filter is phase-shifted compared to the 1-D filter. I worked on the signal reading and spectrum code that Eric Smith gave me. According to the MATLAB code given, first, we defined the variables. We read the data from the file. We set every other part of the data to the real and complex parts of the signal. We used the ‘pwelch’ function to plot the power spectral density. According to the two-channeled sample data that has been displayed by the MATLAB code, the two plots are the power spectral density. A horizontal line along the time axis at some frequencies (channel frequencies in ORBCOMM) is expected. The line is seen at the channel frequency that implies the signal from the ORBCOMM satellites. A longer recording time implies a shift in the Doppler effect. If more than one satellite is visible, then there may be more than one signal.

Research Mentors:

James Garrison, College of Engineering, AAE

Carla Zoltowski, College of Engineering, ECE

SESSION 5

STEW 214A

Time: **1:10:00 AM** :: Physical Sciences

Theoretical Assessment of Surface Waviness on Work Function

Authors:

Jacqueline Malayer, College of Engineering

Abstract:

Predicting gas breakdown for micro- and nanoscale dimensions increases in importance as devices continue to shrink. A recent study derived a single universal theory to predict breakdown voltage for any gas and pressure for breakdown characterized by Townsend avalanche or field emission at microscale [1]. At microscale, the gas breakdown model more strongly depends on the electrode conditions, such as work function and field enhancement, than geometric or gas parameters [2]. Thus, more accurately predicting breakdown voltage requires further elucidating how physical electrode parameters, such as surface waviness, may alter the work function. This presentation theoretically examines the impact of sinusoidal surface waviness, specifically its amplitude and period, on work function [3]. A model is derived based on scanning Kelvin probe microscopy and the limiting behavior of the model is assessed. The derived limiting behavior provides important design considerations for nanoscale technology.

Work supported by the Office of Naval Research under Grant No. N00014-17-1-2702.

[1] A.M. Loveless and A.L. Garner, “A Universal Theory for Gas Breakdown from Microscale to the Classical Paschen Law,” Phys. Plasmas, vol. 24, 2017, art. no. 113522.

[2] S.D. Dynako, A.M. Loveless, and A.L. Garner, “Sensitivity of Modeled Microscale Gas Breakdown Voltage due to Parametric Variation,” Phys. Plasmas, vol. 25, 2018, art. no. 103505.

[3] W. Li and D. Y. Li, “On the correlation between surface roughness and work function in copper,” J. Chem. Phys., vol. 122, 2005, art. no. 064708.

Research Mentors:

Dr. Allen Garner, College of Engineering, Nuclear

SESSION 5

STEW 214B

Time: **12:30:00 PM** :: Innovative Technology/Entrepreneurship/Design

Survey of Data Ownership and Access in Digital Agriculture Products

Authors:

Nakul Chhabra, Polytechnic Institute

Glaris Lancia Raja Arul, Polytechnic Institute

Abstract:

Digital or precision agriculture is a developing field that utilizes specialized applications of technology like sensors, drones, and the Internet of Things (IoT) devices to advance farming practices. As this area continues to grow and farmers and other producers switch over from traditional methods to computer integrated technologies, there is a need to examine the security and privacy implications of these new types of data collection as it is currently understood. This study compiled information on 192 products developed by companies in the agriculture and software sectors to investigate what types of data are being collected, who owns the data, who has access to the data, and how the data is processed. A survey was then conducted with 57 farmers in Indiana to provide a deeper contextual understanding of how the questions of privacy and data access played out in practice. Analysis of the data found that 60% of the products investigated did not provide details about data ownership but where details were provided the majority of companies believed both they and the farmers co-owned the data. Approximately 70% of companies failed to disclose data access policies. The data also revealed that 82% of farmers believed they were the primary owners of the data, 38% of farmers did not know who else had access to the data, and that 80% of farmers did not feel the gains from digital agriculture were worth the risks to their privacy. These findings demonstrate that there is limited transparency in digital agriculture regarding who owns and has access to the data generated. This lack of transparency is detrimental to both security and privacy.

Research Mentors:

Ida B. Ngambeki, Polytechnic Institute, Computer Information Technology

John Springer, Polytechnic Institute, Computer Information Technology

Austin Toombs, Polytechnic Computer Information Technology

SESSION 5

STEW 214B

Time: **12:50:00PM** :: Social Sciences/Humanities

Symbolism of the Violin in Russian Literature

Authors:

Caroline Peterson, Purdue

Abstract:

My research examines the role of the violin in Russian and Soviet literature based on close readings of a wide variety of works, from Pushkin to Orlov, where the violin plays a prominent role. I argue that the violin in many of these works represents something different than other musical instruments featured in Russian and Soviet literature: when a character in this literature plays a violin, the instrument becomes a medium of transformation for both the player and those who hear the music. I studied a range of works that feature a violinist character in order to make this claim, including Tolstoy's Kreutzer Sonata, Chekhov's Rothschild's Violin, Pushkin's Mozart and Salieri, and Orlov's Danilov the Violist.

In addition to studying these works of literature, I studied the history of the violin - drawing primarily from musical historians David Schoenbaum and David Boyden - in order to determine if the special role that I argue the instrument plays in this country's literature has any basis in historical fact. My review of the violin's history revealed that this instrument has two sets of ancestors that merged to create the instrument we know today: fiddles, part of the folk tradition, and viols, predecessors to the classical tradition. My research uses the confluence of the instrument's two pedigrees as a starting point for speculation about why these Russian and Soviet authors have chosen to make the violin (and not some other instrument) so central to their stories.

Research Mentors:

Olga Lyanda-Geller, Liberal Arts, German and Russian Department

SESSION 5

STEW 214B

Time: **1:10:00 AM** :: Innovative Technology/Entrepreneurship/Design

Enhancing Energy Efficiency of Membrane Distillation using Nanofluids

Authors:

Ryan Madhu Jacob, College of Engineering

Prashant Menon, College of Engineering

Abstract:

Membrane distillation (MD) is a thermal desalination process that involves heating the feed solution (input sea water) to high temperatures (below boiling). The feed water is separated from the pure water (cold side) by a hydrophobic membrane which allows only water vapor to pass through it leaving behind the salt. Higher feed water temperature is required to enhance the vapor flux passing through the membrane and the overall energy efficiency. MD systems mostly use waste heat sources to heat the feed. The study here focuses on enhancing the energy efficiency of the MD system by improving the heat transfer from the waste heat source to the saline feed. To do so nanoparticles of high thermal conductivity like Multiwalled Carbon Nanotubes (MWCNT) and copper oxide (CuO) are added to the feed. With proper dispersion of the nano particles in the feed, the thermal conductivity of the resulting nanofluid can be enhanced by about 15% (experimental data) compared to the normal feed. To achieve this, Nanofluids with different nanoparticle concentrations , surfactants, ultra-sonication durations are prepared and tested for their particle sizes and thermal conductivity enhancements. Nanofluid solutions with particle size below 100nm and thermal conductivity enhancements of 2% is been achieved. The goal is to achieve 15% enhancement of thermal conductivity, while maintaining a particle size below 100nm. This thermal conductivity enhancement will help in enhancing the energy efficiency of the MD system which is tested in an actual MD module.

Research Mentors:

David Warsinger, College of Engineering, Department of Mechanical Engineering

SESSION 5

STEW 214C

Time: **12:30:00 PM** :: Innovative Technology/Entrepreneurship/Design

System on Chip Extension Technologies

Authors:

Minh Tran, College of Engineering

Christopher Priebe, College of Engineering

Yupei Cao, College of Engineering

Cole Stecyk, College of Engineering

Radhika Jain, College of Engineering

Vivekanandan Kulumani Rajarajan, College of Engineering

Abstract:

The System-on-Chip Extension Technologies (SoCET) group is a student led organization modelled after industry in the process of iteratively improving, prototyping, fabricating, and testing an SoC. SoCET divides chip development into digital design, verification, analog/physical design, software design and printed circuit board development subteams. Currently the team is working towards taping out AFTx05 on December 1st the 5th SoC produced by SoCET. AFTx05 is a general-purpose RISC-V based SoC which utilizes machine learning optimizations to more efficiently handle sparsity.

Research Mentors:

Mark Johnson, College of Engineering, Electrical and Computer Engineering

Matthew Swabey, College of Engineering, Electrical and Computer Engineering

Jacob Covey, College of Engineering, Electrical and Computer Engineering

SESSION 5

STEW 214C

Time: **10:50:00 AM** :: Physical Sciences

Development and Characterization of Orally Disintegrating Films Loaded with High Levels of Ibuprofen Nanoparticles

Authors:

Rohit Harapanhalli, Exploratory Studies

Abstract:

Despite having been studied for over 30 years, and their benefits outweighing those of conventional oral dosage forms, there are only six FDA-approved orally disintegrating films (ODFs) to date. The main reason behind this backlog is limitations of adequate drug loading on reasonably-sized ODF. This is evident from the fact that all approved ODFs to date have dosages from 200 mcg to 12.5 mg per film, resulting in only high potency drugs being available in said form. The goal was to develop a novel type of ODF that not only yields much higher dosage required for low-potency drug, but also to ensure such a heavy-loaded film retains expected physico-mechanical properties. Ibuprofen was used as model drug to develop the film via solvent evaporation nano-emulsion process. Nanoparticle development is highly sought after for its ability to enter the bloodstream efficiently via the buccal cavity capillaries, resulting in faster onset of action and higher bioavailability of loaded medicine. In addition, experiments were conducted to optimize strength and flexibility of films using physico-mechanical tests including tensile strength, disintegration time, dissolution time, drug content uniformity, Particle Size Distribution, Confocal Raman Spectroscopy, and Scanning Electron Microscopy. Results indicated that 7x7cm^2 of film contained 101.5 mg of Ibuprofen, had tensile strength of 1.9-2.2 N/mm^2, disintegration time less than 30 seconds, dissolution time of 40 minutes, uniform distribution of Ibuprofen nanoparticles with minimal aggregation, and D50 of 410 nm. This work will aid in the development of low-potency drugs in ODF form and their future widespread usage.

Research Mentors:

Rutesh Dave, Ph.D., Long Island University, Division of Pharmaceutical Sciences

Sawani Talekar, Ph.D., Pal Thangam, Ph.D., Long Island University, Division of Pharmaceutical Sciences, Exploratory Pharma

SESSION 5

STEW 214C

Time: **1:10:00 AM** :: Life Sciences

Improving Efficience of PhiV10 Production Using Regulatory Genes

Authors:

Theresa Bottorff, College of Science

Abstract:

Abstract retracted.

Research Mentors:

Bruce Applegate, College of Agriculture, Food Science

POSTER SYMPOSIUM

POSTERS ORDERED BY FIRST AUTHOR'S LAST NAME

1 Improving Liquor Sales through Uplift Modeling
Sayyid Muhammad Hariz Ab Latiff, Lindsey Prommer, Temirlan Amir, Madelin Warsito
Research Mentor(s): *Matthew A. Lanham*

2 Determining the Role of a Methyl Transferase Enzyme in Regulating a Heat Shock Chaperone
Daniel Adeniji
Research Mentor(s): *Tony Hazbun, Panyue Chen*

3 VIP Aerial Robotics
Dhruv Aggarwal, Ayushi Roy
Research Mentor(s): *Samuel Midkiff*

4 High Energy Muon Spallation
Michael Agrillo, Maheep Brar, Hetvi Desai
Research Mentor(s): *Abigail Kopec, Rafael Lang*

5 Earthquake NLP VIP 2019 - DASC
Aanis Ahmad, Dhruv Chagi Gowd
Research Mentor(s): *Mohammad Reza Jahanshahi, Tarutal Ghosh Mondal*

6 Deep Freight
Olamidotun Akinnola, Austin Sale
Research Mentor(s): *Vaneet Aggrawal*

7 Discovering Genetic Risk Factors in Autoimmune Disorders: A Meta-analysis of Genome-wide Association Studies For Autoimmune Diseases in European Populations
Zaid Al Haddadin
Research Mentor(s): *Peristera Paschou, Apostolia Topaloudi*

8 User Interface Design for an On-camera Video Analytics Engine
Sabriya Alam
Research Mentor(s): *Felix Lin, Mengwei Xu*

9 Implementing Vision for The Hummingbird Robot
Yamuna Ambalavanan
Research Mentor(s): *Dr. Xiyan Deng, Dr. Zhan Tu*

10 Non-invasive Detection of Autonomic Dysreflexia in Rats
Zada Anderson
Research Mentor(s): *Shruthi Suresh, Jianming Li, Bradley S. Duerstock*

11 Where are the optimal solar energy locations based on multi-faceted factors?
Keita Arakawa
Research Mentor(s): *Lisa Bosman*

12 Purdue Nexus Project
Mridul Arora
Research Mentor(s): *David S. Ebert, Calvin Yau*

13 Autonomous Systems Against Space Meteorites and Space Debris - electronics abstract
Tremael Arrington, Edward Pedroza, Ruochong Wu
Research Mentor(s): *Leonardo Facchini*

14 Discrete Wavelet Transform for Quantifying Surgeon's Fatigue
Dongwei Bai
Research Mentor(s): *Jackie Cha, Dr. Denny Yu*

15 Identifying the involvement of miR-4435 in the acquisition of Erlotinib-resistance in Non-small Cell Lung Cancer
Manvir Bains
Research Mentor(s): *Andrea Kasinski, Arpita Pal*

16 H-1B Visa Petition Fluctuation in the United States
Pablo Balcazar, Daniel Farrell
Research Mentor(s): *Linda Renzulli*

17 Improving DeepPool Simulator's Expected Time of Arrival Predictions Using Real-Time Traffic Conditions
Aarushi Banerjee, Daniyaal Rasheed
Research Mentor(s): *Vaneet Aggarwal, Ashutosh Singh*

18 Foreign Assistance Data Visual Analytics tool
Eric Bankert
Research Mentor(s): *Jieqiong Zhao, Jingjing Guo, Audrey Reinert*

19 Autonomous Land Vehicle
Pratik Bansal, Sarthak Kathuria, Ashley Maddock, Somesh Dube, Sean Hwang, Sanghoon Han, Arpan Adhikari
Research Mentor(s): *Samuel Midkiff*

20 Overexpression of PGC-1Î± in human skeletal muscle cells increases regulators of exosome production and secretion
Logan Barber
Research Mentor(s): *Dr. Timothy Gavin*

21 Causes of Post-Intracranial Surgery Delirium
Alaina Bartfeld, Sahana Rayan, Juliet Aygun
Research Mentor(s): *Zhan Pang*

22 Motivation and Physical Activity for Older Adults
Margaret Becker
Research Mentor(s): *Dr. Libby Richards, Dr. Melissa Franks*

23 Comparing Speed Distribution of Micro-Mobility Modes
Jack Bell
Research Mentor(s): *Darcy Bullock, Jijo Mathew*

24 Purifying the CDC14 Catalytic Domain of Claviceps Purpurea
Dominique Bennett
Research Mentor(s): *Dr. Sandra Rossie*

25 Large-Scale Dataset Ensembling for Unsupervised Domain Adaptation
Fischer Bordwell, Ashley Kim, Shuhao Xing, Kirthi Sivamani
Research Mentor(s): *Yung-Hsiang Lu*

26 Estimating Vehicular Traffic Intensity with Deep Learning and Semantic Segmentation
Logan Bradley-Trietsch
Research Mentor(s): *Dr. Xiao Wang*

27 Color Space Conversion Using Neural Network
Davis Bradstreet, Insoo Hyun, John Oliver Krefta
Research Mentor(s): *Baekdu Choi*

28 Muon Track Reconstruction in XENON1T
Ben Bressette, Lucca Carvalho, Madelyn Sumner, Keller Swartzentruber
Research Mentor(s): *Amanda Depoian, Rafael Lang*

29 Optimizing Energy Efficiency of Desalination via Batch Reverse Osmosis
Katie Brodersen, Yi Xie
Research Mentor(s): *Prof. David Warsinger, Sandra Patricia Córdoba Renteria*

30 Teacher-Parent Communication: An Analysis of Early Elementary Classroom Newsletters
Kristen Burger
Research Mentor(s): *Laura Bofferding, Nadine Dolby*

31 Quantifying Changes in Muscle Force in the Presence of Fatigue
Emily Bywater
Research Mentor(s): *Eric Nauman*

32 Predicting Energy Usage to Better Estimate and Market Efficiency Upgrades to Customers
Brian Cain, Brendan Gillenwater, Shiv Patel, William Ho, Xiaoping Zhu
Research Mentor(s): *Matthew A. Lanham*

33 Automated Pipeline to Facilitate Geospatial Data Analysis
Jeremy Chang
Research Mentor(s): *Rajesh Kalyanam, Carol Song*

34 The Effect of Intimate Partner Violence on Emotional Reactivity to Idiographic Stimuli
Lehar Chellani
Research Mentor(s): *Dr. Susan South, Dr. Dan Foti, Samantha Ingram*

35 A Predictive Analytics Approach to Estimate Home Loan Risk and Allocate Loans
Jinyu Chen, Bharat Agarwal, Esteban Molina, Isha Sharma, Alejandro Hoyos Orozco
Research Mentor(s): *Matthew A. Lanham*

36 Lifiting Risk Estimation Using Computer Vision Technology
Nan Chen, Lohith Roy Chittineni, Guoyang Zhou, Hamed Asadi
Research Mentor(s): *Denny Yu*

37 Haptic Feedback Sensor Arrays
Wei-Jen Chen, Ruili Ding, Yi Zhou, Ruili Ding, Yi Zhou
Research Mentor(s): *Xinyang Deng, Jesse Roll*

38 Molecular Dynamics on Graphene in Water
Jia Lin Cheoh, Yuhang Fang
Research Mentor(s): *Prof. David Warsinger*

39 Image Processing and Analysis - Media Forensics
Yu Chieh Chiu, Aryan Tyagi, Zac Robinson, Ayomide Sonoiki
Research Mentor(s): *Edward Delp, Carla Zoltowski*

40 Virtual Reality Application
Wilson Chow
Research Mentor(s): *Tarutal Ghosh Mondal*

41 Measuring Thermal Conductivity for CMS Detector Upgrades
Justin Copenhaver, Berkley Weyer, Grace Roberts
Research Mentor(s): *Abraham Koshy, Rafael Lang*

42 Investigating Inhibition of Apoptosis as a Novel Treatment for Retinitis Pigmentosa using a Transgenic Zebrafish Model.
Emre Coskun
Research Mentor(s): *Yuk Fai Leung, Logan Ganzen*

43 Optimus: A Software Bot For Automated Code Review
Noah Curran, David Wood, Connor Chadwick, Akhil Chinnakotla, Ryan Firestone, Esteban Gorostiaga, ZhiFei Chen, Weiqing Huang
Research Mentor(s): *Yung-Hsiang Lu, George Thiruvathukal*

44 Determinants of Successful and Unsuccessful Movies Based on Worldwide Box Office Revenue
Francesca De Simone, Lucia Quintero, Jaron Fay, Varun Gauba
Research Mentor(s): *Matthew A. Lanham*

45 Generation of an Endogenous Dominant Negative Allele of chd5 Using a Novel Homologous Recombination Strategy to Reveal the Role of chd5 in Tumor Suppression and Neural Differentiation
Ellen Denning
Research Mentor(s): *Joseph Ogas, Ph.D., Erin Sorlien, Ph.D.*

46 Selective Condenser for Collection of Glucose from Exhaled Breath
Aditya Desai, Divya Tankasala, Divya Tankasala
Research Mentor(s): *Dr. Jacqueline Linnes, Divya Tankasala*

47 Toddler Sleep Regularity and Language Skills
Myia Dorsey
Research Mentor(s): *A.J. Schwichtenberg, Ashleigh Kellerman*

48 Muon Spallation in XENON1T
George J. Ecconomou II, Tara R. Y. Harmon, Alex Huynh
Research Mentor(s): *Amanda L. Depoian, Rafael F. Lang*

49 Automation & AI in the Classroom
Elliot Edmunds, Wenbo Wei, Tanvi Bhardwaj, Shu Hwai Teoh, Po Yu Huang, Chieh-En Li, Chien-Hung Wang, Young Jin Jung, Luis Fernando Materon Botelho
Research Mentor(s): *Mithuna Thottethodi*

50 Efficacy of Activated Carbon Pitcher Filters in Elevated Benzene Removal
Ethan Edwards
Research Mentor(s): *Andrew Whelton*

51 Reinforcement Learning and Uncertainty Quantification
Kadir Efecik, Kok Xin Tan, Brett Weyer, Feny Patel
Research Mentor(s): *Guang Lin*

52 The Interacting Effect of Youth and Parent Substance Use on Parent-Child Relationship Quality
Alishia Elliott
Research Mentor(s): *Dr. Kristine Marceau, Emily Rolan*

53 Visualization of Opioid Use Disorder and Harm Reduction Availability in the US
Soyol Enkh-Amgalan
Research Mentor(s): *Vetria Byrd*

54 Department Specific Graduate Teaching Assistance Manual: Investigation of Best Practices
Charles R. Enlow, Ahmad H. Alfoudari
Research Mentor(s): *Franziska K. Lang*

55 Effects of Salinity on Invasion Success in Freshwater Communities
Brittany Farmer
Research Mentor(s): *Catherine Searle*

56 Efficiency of Gun Legislation Internationally and the American Gun Culture
Dana Fennell
Research Mentor(s): *Ellen Rochford*

57 Scaling up Thermal Imaging for High-throughput Phenotyping
Grace Filley
Research Mentor(s): *Dr. Keith Cherkauer, Stuart Smith*

58 Isotopic Analysis of Sugar-Starch Extractions
Jared Foeppel
Research Mentor(s): *Dr. Jani Sparks, Dr. Lisa Welp*

59 Neural Sensitivity to Reward among Individuals with Non-clinical Psychosis
Davis Giffin
Research Mentor(s): *Dr. Dan Foti, Sam Buck, Tim Stump, Keisha Novak*

60 Professional Golf Analytics: Predicting & Improving Player Performance
Theo Ginting, Nathan Ebikwo, Matthew Kusno, Dawson Mcmahon, Anirudh Suresh
Research Mentor(s): *Matthew Lanham*

61 Improving Design Lab Safety using Computer Vision
Ethan Glaser, Moiz Rasheed, Seungjoon Rhie, Taher Dohadwala,Amogh Shanbhag,Xiangyu Zhang,Wenxi Zhang
Research Mentor(s): *Dr. Yung-Hsiang Lu, Dr. David Barbarash*

62 Using Predictive Analytics to Find Forever Homes for Sheltered Pets
Nicolas Glesing, Mark Schneider, Jacob Watkins, Julianne Hughes, Yaonan Deng
Research Mentor(s): *Matthew A. Lanham*

63 A MATLAB-based 5G Wireless Channel Simulator Based on NYUSIM
Alexander Gokan, Godfrey Walker, Benjamin Holewienko
Research Mentor(s): *Chih-Chun Wang, James Krogmeier, David Love, Borja Peleato*

64 Standing Pattern Affect on Surgeon Pain Development
Magdalena Ann Haas, Hussain Saifuddin
Research Mentor(s): *Hamed Asadi*

65 CORONA Georectification and Landcover Classification across the Arequipa Region, Peru
Nicholas Hamp-Adams
Research Mentor(s): *Zachary Brecheisen, Darrell Schulze*

66 Annual Modulation of Muons in XENON1T
Jiaxuan Han, Tim Houston, Siwen Hu, Marco Iacobucci
Research Mentor(s): *Abigail Kopec, Rafael Lang*

67 Dynamic Sparsity Optimizations for Embedded Compilers
Nicholas Haythorn, Brian Helfrecht, Alan Gregorian, Atif Niyaz
Research Mentor(s): *Dr. Mark Johnson, Dr. Sam Midkiff*

68 Learning Predictive Analytics From The NFL Big Data Bowl
Parker Hedrick, Vineel Devalapalli, Conor Sheridan, Zhuoyuan Li
Research Mentor(s): *Matthew A Lanham*

69 Automatic Music Transcription of Monophonic Audio Recordings
Brian Helfrecht
Research Mentor(s): *Chih-Chun Wang*

70 Predicting Season Ticket Renewals for a Professional Sports Team
Griffin Herdegen, Kyle Betelak, David Day, Alejandro Isaac
Research Mentor(s): *Matthew A. Lanham*

71 Reconstitution of Flavivirus Envelope Proteins into SMA Nanodiscs
Hannah Himes
Research Mentor(s): *Dr. Richard Kuhn, Conrrad Nicholls*

72 Development of Low-Cost, Simplified Humanoid Head
Yuta Hoashi
Research Mentor(s): *Wonse Jo, Byung-Cheol Min*

73 Ranavirus Increases Vulnerability to Predation by Altering Tadpole Behavior
Hailea Howard
Research Mentor(s): *Jason Hoverman*

74 Virtual Teaching Assistant
Shreya Ilango, Chayaphon Pugkhem
Research Mentor(s): *Mithuna Thottethodi*

75 Neutron Multiple Scatter Events in Xenon
Gozde Iloglu, Nicole Osborn, Ben Gruber
Research Mentor(s): *Juehang Qin, Rafael Lang*

76 Drone Video Imaging
Rufat Imanov, Justin Qualley, Avanish Subbiah,Katherine Sandys,Oduduabasi Victor
Research Mentor(s): *Yung-Hsiang Lu*

77 A Business Analytics Approach to Identify and Grow Customer Loyalty
Jacob Irvin, Cameron Kwieciak, Jonathan Leung Alberto Navarro, Spencer Rose
Research Mentor(s): *Matthew A. Lanham*

78 Neural Network based stable/unstable classification
Meige Jia, Peiyuan Li
Research Mentor(s): *Guang Lin*

79 A Market Basket Analysis Product Recommendation System for Online Retailers
Zoe Jordan, Arika Flickinger, Michael Buchalo, Zhonghui Wu, Erica Liu
Research Mentor(s): *Matthew A. Lanham*

80 The Effects of Environmental Copper Exposure on Developing Zebrafish
Christina Kaucic
Research Mentor(s): *Dr Jennifer Freeman*

81 Effects of Direct Fed Microbial on Calf Growth and Health Parameters
Morgan Keirn, Becca Klopp
Research Mentor(s): *Jacquelyn Boerman*

82 Commitment Penalty: An Experimental Test of The Effects of Organizational Policies on Parental Leave
Navni Kharde, Natalia Lillie Torrez
Research Mentor(s): *Trenton Mize*

83 Autonomous Aerial Vehicle (AAV) Abstract
Young Sun Kim, Ho Jung Ryoo, Minjun Song, Jongwon Min
Research Mentor(s): *Samuel Midkiff*

84 A Study on the Impact of Movements and Audiovisual Feedback of Swarm Robots on Users
Jaeeun Kim
Research Mentor(s): *Byung-Cheol Min, Wonse Jo*

85 Scoping Review of Objective Measurements of Non-Technical Skills in Surgery
Ian Kletch
Research Mentor(s): *Denny Yu, Jackie Cha*

86 The Historical Recreation of Omaha Beach in a Virtual Environment
Matthew T Konkoly
Research Mentor(s): *Sorin Adam Matei*

87 Toxicity of Lead and Atrazine Mixture Using the Larval Zebrafish Model System
Anusha Kotapalli
Research Mentor(s): *Dr. Jennifer Freeman*

88 2D Microscopy Image Analysis and Segmentation
Kalika Lacy, Rui Wang, Shutao Wang
Research Mentor(s): *Edward Delp, Carla Zoltowski*

89 Earth History Visualization-Data Mining Abstract
Eric Langbert
Research Mentor(s): *Abdullah Khan Zehady, James Ogg, Aaron Ault*

90 Partial NMDAR Agonist D-Cycloserine Does Not Facilitate Safety Discrimination or the Acquisition and Consolidation of Fear Extinction
Caitlin Lee, Abraham Escobedo
Research Mentor(s): *Dr. Susan Sangha*

91 Reflectance and Transmittance Simulator Development for Multi-Layer Thin Film Structures.
Changkyun Lee
Research Mentor(s): *Peter Bermel, Ze Wang*

92 Examining Proton-Proton Collisions with Final Dilepton States
Daniel Bruce Senter III, Nolan Kruger, Yao Chen
Research Mentor(s): *Amandeep Singh Bakshi, Rafael Lang*

93 Genetic Control of Flowering Time in Interspecific Grapevine Families
Hannah Levengood
Research Mentor(s): *Bruce I. Reisch, Avinash Karn*

94 Effect of a Human Microbial Consortium Grown with Complex Fibers on the Mouse Gut Microbiome
Laura Libera
Research Mentor(s): *Steven Lindemann, Tianming Yao*

95 Catalytic Diazocine Synthesis Using a Dinuclear Nickel Catalyst
Jianheng Ling
Research Mentor(s): *Christopher Uyeda, John Andjaba*

96 Personality Profiles of Women in Relationships Involving Men with Pathological Personality Features
Katherine Lucas
Research Mentor(s): *Susan South, Doug Samuel*

97 Milk Fatty Acid Changes through the Transition Period in Dairy Cows
Emilee Ludwick
Research Mentor(s): *Dr. Jacquelyn Boerman, Tabitha Steckler*

98 Developing/Implementing Training Tools/Videos to Help Users Learn Web-based Systems
Sara Lynch, Ruoxi Zhang
Research Mentor(s): *Dan Ferguson, Matthew W Ohland*

99 Dislocation Velocity in Fe-Cr-Al Using MD
Raven Maccione
Research Mentor(s): *Anter El-Azab, Sanjoy Kumar Mazumdar*

100 Developing a Growth Mindset in Purdue Underclassmen With Respect to Professional Development
Kushaal Manchella, Motinuolu Orederu, Obinna Udoyeh
Research Mentor(s): *Carla Zoltowski*

101 Muon Spallation in the XENON1T Experiment
Christopher Manilla, Donovan Trzybinski
Research Mentor(s): *Juehang Qin, Rafael Lang*

102 Data Analysis and Visualization on Delayed and Cancelled Flights
Natalie McGuckin
Research Mentor(s): *Dr. Vetria Byrd*

103 GUI and Report Creation for the ADEPT-m MATLAB Toolbox
Kathleen McLarty, Yoonkyu Na, Litao Xu, Ruby Wellen, Can Zhang, Jagan Krishnasamy
Research Mentor(s): *Jeffery Gray*

104 Provider/Patient Shared Decision-Making and Opioid Prescribing
Leroy Medrano
Research Mentor(s): *Cleveland Shields*

105 Characterizing the Interactions of an Abiotic-Stress Related Protein in Arabidopsis thaliana.
Marina Mehling
Research Mentor(s): *Dr. John Dyer*

106 Exploring Maternal Responsivity within Parent-mediated Interventions for Children with Elevated Autism Risk
Megan Morris, Allyson Broadstreet
Research Mentor(s): *AJ Schwichtenberg, Carolyn McCormick, Ashleigh Kellerman*

107 Edge Effects on Urban and Rural Forests
Breanna Motsenbocker, Benjamin McCallister
Research Mentor(s): *Brady Hardiman*

108 Annual Modulation
Daniel Nguyen, Viraj Mantri, Ethan Cho
Research Mentor(s): *Juehang Qin*

109 Optimizing a Real-Time Feature Indexing Storage System on Live Video Streams
Vina Nguyen, Ethan Lee
Research Mentor(s): *Yung-Hsiang Lu*

110 Tetherless Remote Control for Bio-Inspired Aerial Robotics
BINH NGUYEN, Sebastian Quesada
Research Mentor(s): *Prof. Xinyan Deng, Zhan Tu, Fan Fei*

111 Highly Flexible and Transparent Conductor for Solar Cell
Thao Nguyen
Research Mentor(s): *Letian Dou, Blake Finkenauer*

112 SADD Structures Team Abstract
Saketh Nibhanupudi, Xianyu Pan
Research Mentor(s): *Vikas Tomar, Leonardo Facchini*

113 Carcass and Meat Quality Traits of Market Weight Gilts Exposed to Gestational Heat Stress
Mariah Nondorf, Jacob Tuell, Jacob Maskal
Research Mentor(s): *Dr. Brad Kim, Jay Johnson*

114 Declining Birthrates and the Rising Age of First Time Mothers in the United States of America
Katherine O'Brien
Research Mentor(s): *Dr. Vetria Byrd*

115 Design and Synthesis of Pyrazole-Based SHP2 Inhibitors
Lauren Orr
Research Mentor(s): *Brenson Jassim*

116 Implementing Design for Test Techniques for System on Chip Extension Technologies
Fredric Owens, Cole Nelson, Xianmeng Zhang, Karthik Maiya
Research Mentor(s): *Dr. Mark Johnson, Dr. Matthew Swabey*

117 Older Drivers' Self-perception on Manual Driving: A Systematic Review
Jun Woo Park
Research Mentor(s): *Gaojian Huang*

118 Nutrient Value Quantification and Evaluation of the Food Pantry Environment
Catharine Pickford
Research Mentor(s): *Dr. Heather Eicher-Miller*

119 Characterization of Iron and Manganese Nanoparticles in the Spark Discharge System to Simulate Welding Fumes
Kaushal Arvind Prasad, Mishael Theis
Research Mentor(s): *Dr. Jae Hong Park*

120 Co-Op Research VIP
Jason Qian, Megan Kodati
Research Mentor(s): *Dr. Carla Zoltowski*

121 Virtual Reality Environment Optimization based on Real Environment Constraints
Varun Ramakrishnan, Krishna Suresh
Research Mentor(s): *Christos Mousas*

122 Pothole Detection
Nazura Ramli, Aidan Abbott, Krystian Misiewicz
Research Mentor(s): *Mohammad Reza Jahanshahi*

123 Maternal Stress and Parent-mediated Interventions for Children at Elevated Risks for Autism
Chetana Rao
Research Mentor(s): *A.J. Schwichtenberg, Ph.D., Ashleigh Kellerman, M.S.*

124 Detection of Wheat Spikes using Masked RCNN in a High Throughput system
Miguel Rodriguez, Hsiang-En Hsu, Zhengsen Fu
Research Mentor(s): *Yang Yang, Augusto Souza, : Mohsen Mohammadi*

125 Recommended Reads: Diversity in Indiana's Classroom Literature
TJ Rosa
Research Mentor(s): *Christina Wessel-Powell*

126 Understanding Global Carbon Cycle through Leaf Decomposition
Nur Adilah Rosli
Research Mentor(s): *Dr. Jon Rienstra-Kiracofe*

127 Image and Printing Group - Minimum Optimal Resolution subteam
Cameron Ruggles, Zicong Wang, Runjia Shen
Research Mentor(s): *Litao Hu, Jan P. Allebach*

128 Identifying Drivers of Student Success Using Predictive Analytics
Aaron Rush, Norman Chan, Cat Stouffer, Daniela Mendia-Rodriguez
Research Mentor(s): *Matthew Lanham*

129 Hockey Analytics: The Science of Player Performance
Nikolai Saporoschetz, Logan Barr, Cam Wilson, Danielle Lange, Andrew Scheidt
Research Mentor(s): *Mathew Lanham*

130 Hummingbird Robot Power Driver Integration
Bryce Sasser, Carel van der Merwe, Aaryan Raj Rathi, Charlie Geraci, Lander Greulich
Research Mentor(s): *Xinyang Deng, Zhan Tu*

131 Characterizing Histone Post-translational Modifications in Anaerobic Gut Fungi
Makayla Schacht
Research Mentor(s): *Dr. Kevin Solomon, Casey Hooker*

132 Effective Mass Determination of InAs/InP Quantum Well with a Variable AlInAs Top Barrier
Matthew Schulz
Research Mentor(s): *Prof. Michael Manfra*

133 High-throughput Screening for Novel Therapeutics of Epilepsy via Inhibition of Veratridine-induced Nav1.2 Activation in Dye-loaded HEK293 Cells
J. Marshall Shafer, Maria Olivero
Research Mentor(s): *Dr. Yang Yang*

134 Efficiency of MobileNet & MorphNet Algorithms
Enes Shaltami
Research Mentor(s): *Rih-Teng Wu*

135 Estimation of Tree Diameter at Breast Height Using Close Range Stereo Photogrammetry
Yezhi Shen, Nick Ellopoulos
Research Mentor(s): *Yung-Hsiang lu, Keith E. Woeste*

136 A Role of Microgliosis in the Neuropathology of Prolonged Seizures
Kevin Shim
Research Mentor(s): *Season K. Wyatt-Johnson M.S., Alexandra L. Sommer M.S., Stephanie Lam B.S., Amy L. Brewster Ph.D*

137 Promoting Reading Motivation in an After-School Program
Megan Smit
Research Mentor(s): *Jason Ware*

138 Earth Remote Sensing of Soil Moisture using I-Band Signals of Opportunity on a UAV
Eric Smith, Leo Li, Grace Ulmer, Ji Woon Nam, Nadeem Siddique, Renaissa Ghosh, Joeseph Bushagour, Kai Wilson
Research Mentor(s): *James Garrison, Jared Covert*

139 DAC
Hyunoh Song
Research Mentor(s): *Jacob Covey*

140 Software Implementation of Alamouti Codes for Wireless Multiple-input/Multi-output (MIMO) Communication Systems.
Locchanan Sreeharikesan, Liren Wang
Research Mentor(s): *Chih Chun Wang*

141 Generation of Physically Accurate Virtual Image Dataset for Detection of Unsafe Behaviour in an Indoor Environment
Siddharth Srinivasan, Uday Thapar, Youngsik Yoon, Andrew Liu, Alex Xu, Nobelle Tay, Peter Huang, Vaastav Arora
Research Mentor(s): *Prof. Yung Hsiang Lu, Ryan Dailey*

142 Utilization of a Sensitive Î²-lactamase Reporter Assay to Screen for Drugs which Inhibit Ebola Entry
Hongyu Su, Caroline B Plescia
Research Mentor(s): *Robert V Stahelin*

143 Analysis of Open-source Dataset for Plant Classification Using Convolutional Neural Networks
Hardi Sura
Research Mentor(s): *Dr. Dharmendra Saraswat, Benjamin Hancock*

144 Image Processing For Bacterial Colony Count
Yuichiro Suzuki, Ryan Madden, Anirudh Gupta, Shutao Wang, Shreyas Iyengar
Research Mentor(s): *Eui Won Bae*

145 Deep Reinforcement Learning with Transfer Learning
Julia Taylor, Tessca Almeida, Tim Zhou, Abbey Vincent
Research Mentor(s): *Guang Lin, Lusine Kamikyan*

146 Evaluating the Utility of WGANs in High Volume Particle Physics Data
Trevor Teague, Haoxuan Yu, Dominic Seidita, Austin Beasley
Research Mentor(s): *Andrew Wildridge, Rafael Lang*

147 GRIN Lens Imaging of *In Vivo* Neurons to Quantify Modulation of Stimuli Responses
Alexander Tesmer
Research Mentor(s): *Denis Burdakov, Paulius Viskaitis*

148 Automated Language Sampling for Children with Social Communication Difficulties
Kelsie Thacker, Emily Garza
Research Mentor(s): *Dr. A.J. Schwichtenberg, Ashleigh Kellerman*

149 Preparation and Use of Economical, Insensitive Energetic Precursors: Potassium Nitroformate and 3,6,7-Triamino-[1,2,4]triazolo[4,3-b][1,2,4]triazole
Michael Thoenen
Research Mentor(s): *Davin Piercey, Matthew Gettings*

150 A Review of Financial Aid Policies Across Institutions
Nicholas Tomlin
Research Mentor(s): *Hassan Al Yagoub*

151 A Review of Standards for English as a Second Language for Post-Secondary Applicants
Nicholas Tomlin
Research Mentor(s): *Hassan Al Yagoub*

152 Commitment Penalty: An Experimental Test of The Effects of Organizational Policies on Parental Leave
Natalia Torrez, Navni Kharde
Research Mentor(s): *Trenton Mize*

153 Food and Energy Farms Simulation Tool
Hans Torsina
Research Mentor(s): *Peter Bermel, Allison Perna*

154 Characterizing Donor-Specific T cells in Islet Transplant Recipients Using scRNA-seq
Reed Trende
Research Mentor(s): *Sabarinathan Ramachandran, Bernhard Hering, Amar Singh, Anders Matson*

155 Developing a Growth Mindset in Purdue Underclassmen With Respect to Professional Development
Obinna Udoyeh, Motinuolu Orederu, Kushaal Manchella
Research Mentor(s): *Carla Zoltowski*

156 A Python and MATLAB Simulation Testbed for Error Correction Codes (ECC) and Orthogonal Frequency Division Multiplexing (OFDM)
Alfred Krister Ulvog, Jacqueline Renee Malayter, Fangrui Qin
Research Mentor(s): *Chih-Chun Wang*

157 Hummingbird Robot Power Driver Integration
Carel van der Merwe, Charlie Geraci, Aaryan Raj Rathi, Bryce Sasser, Lander Greulich
Research Mentor(s): *Xinyang Deng, Zhan Tu*

158 EHV Geology Website
Prithvi Velpuri, Yuzheng Qian
Research Mentor(s): *Aaron Ault*

159 Image Reconstruction
Mimansa Verma, Dung Nguyen, Robert Sego, Hannah Pike
Research Mentor(s): *Edward Delp, Carla Zoltowski*

160 Physiological Sensing for a Better Surgeon
Ryan Villarreal
Research Mentor(s): *Jackie Cha, Juan A Barragan Noguera, Dr. Denny Yu*

161 An Anomaly Detection Model to Identify Changes in Student Classroom Performance
Xinyu Wang, Pengcheng Fu, Andy Yao
Research Mentor(s): *Matthew A. Lanham*

162 Earth History Visualization Research Group Timescale Project
Yuanhao Wang
Research Mentor(s): *James G. Ogg*

163 User Experiences of Persons with Disabilities on CATME Web Interface
Jiaxin Wang, Zhibo Hou, Jia Lin Cheoh, Siqing Wei, Behzad Beigpourian
Research Mentor(s): *Prof. Daniel Ferguson, Prof. Matthew Ohland*

164 Phase-Locked Loop Design for SoC Applications
Evelyn Ware, Matthew Olinde
Research Mentor(s): *Mark Johnson, Matt Swabey, Jacob Covey*

165 New England Aquarium Necropsy Sampling Techniques for Use in Marine Mammals
Gabrielle Weinert
Research Mentor(s): *Katie Pugliares*

166 Testing of Physics Informed Neural Networks
Daniel Weld, Praneeth Medepalli, Zachery Berg, Niharika Bhardwaj
Research Mentor(s): *Guang Lin*

167 Investigating Place-Making at Northend Community Center or MatchBOX
Abagail Westbrook
Research Mentor(s): *Dr. Austin Toombs*

168 Annual Modulation of Muons in XENON1T
Alan Wright, Emily Kincaid, Steve Zhou, Ian Bowyer
Research Mentor(s): *Amanda Depoian, Rafael Lang*

169 Enhancing Sustenance through Food Quality Monitoring via Smart Tupperware
Qinglan Wu
Research Mentor(s): *Sangjun Eom*

170 Autonomous System Against Space Meteorites and Space Debris
Ruochong Wu, Edward Pedroza, Tremael Arrington
Research Mentor(s): *Vikas Tomar*

171 Bio-inspired Aerial Robots
Yunlei Yan, Yuan-Cheng Chen, Nail Tarcon Gul,Yongling Li,Harim Song,Neha Priyadarshini
Research Mentor(s): *Xinyan Deng, Fan Fei*

172 SMART Abstract
Yingning
Research Mentor(s): *Luke Synder*

173 Integer-Only Machine Learning Benchmark for Low-Resource Devices
James Zampa, Tucker Swan
Research Mentor(s): *Mark Johnson*

174 Building and Running a Customer Support Function
Ruoxi Zhang, Sara Lynch
Research Mentor(s): *Dan Ferguson, Ohland, Matthew*

175 Pagewide Printer Characterization and Simulation
Lanqing Zhao, Shikai Zhou, Matthew Wen
Research Mentor(s): *Yafei Mao, Jan Allebach*

176 Region of Interest Extraction for Image Quality Assessment
Yitong Zhao, Adrian Calderon
Research Mentor(s): *Runzhe Zhang, Jan P. Allebach, Yin Wang*

177 Census Data Visualization
Allen Zheng
Research Mentor(s): *Dr. Vetria Byrd*

178 Investigating Gender Bias in First-year Engineering Classroom
Chuhan Zhou
Research Mentor(s): *Behzad Beigpourian*

Poster Number: **1** :: Innovative Technology/Entrepreneurship/Design

Improving Liquor Sales through Uplift Modeling

Authors:

Sayyid Muhammad Hariz Ab Latiff, Krannert School of Management

Lindsey Prommer, Krannert School of Management

Temirlan Amir, Madelin Warsito, Krannert School of Management, Krannert School of Management

Abstract:

This project focuses on understanding how uplift models pertaining to marketing can better predict consumer behaviors, as compared to traditional classification models. Uplift modeling outperforms classification modeling because it allows for testing within a specific product; this cannot be done at a product or customer level using traditional classification models. Using the historical sales data from a liquor retailer, an AB test was conducted in order to determine churn favors that identified people who are receptive to marketing efforts and are likely to become customers. The goal of this study is to build an uplift model in order to show the effect of varying alcohol marketing tactics on customer churning. For our workflow, we first studied the data carefully and performed exploratory data analysis along with feature engineering to clean the data for improved effectiveness of our model and determined input variables that were statistically significant to our model. We then conducted multiple analysis such as classification regressions, k-NN, and clustering. This allows us to identify features about the liquor that will lead to better effects on sales.

Research Mentors:

Matthew A. Lanham, Krannert, Management

Poster Number: **2** :: Life Sciences

DETERMINING THE ROLE OF A METHYL TRANSFERASE ENZYME IN REGULATING AN HEAT SHOCK CHAPERONE

Authors:

Daniel Adeniji, Pharmacy

Abstract:

The yeast Translation Associated Element 1 (TAE1) gene is homologous to the human enzymes, NRMT1/2, involved in protein N-terminal methylation. These enzymes have been marginally studied for their involvement in post-translational modifications resulting in protein N-terminal methylation. TAE1 was proposed to be involved in protein synthesis and its deletion affects the ribosome profile. Further on, our functional investigation of the N-terminal methyltransferome identified a consensus N-terminal sequence with the initiating methionine removed (XP[K/R]) on a potential substrate, Hsp31. The motif is vital to the functionality of TAE1. Pressingly, not all 45 potential TAE1 substrate in yeast carrying this sequence have yet to be established as methylated. Thus, this investigation sought to utilize this consensus sequence to understand its vitality to TAE1 functionality - potentially leading to the discovery of the enzyme's multiple downstream functions. In addition, phenotypic screenings with different compounds (abrogating steps in protein synthesis) were conducted using TAE1Î" strain for a deeper understanding of TAE1 function. Using site-specific genomic mutagenesis, we are generating N-terminal mutations in Hsp31. These N-terminal mutations will alter the levels of methylation at the Hsp31 N-terminus and allow for the elucidation of the function of this post-translational modification. Using the yeast model system will provide insight into the functions of this enzyme family in human diseases including cancer.

Research Mentors:

Tony Hazbun, Pharmacy, Medicinal Chemistry and Molecular Pharmacology

Panyue Chen, Pharmacy, Medicinal Chemistry and Molecular Pharmacology

Poster Number: **3** :: Innovative Technology/Entrepreneurship/Design

VIP Aerial Robotics

Authors:

Dhruv Aggarwal, Engineering

Ayushi Roy, Engineering

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Abstract:

The Purdue Aerial Robotics VIP team is responsible for design and building the rogallo wing. This wing is designed to be in flight for a couple of seconds on its own, along with being able to navigate properly. This wing is meant for research in simulated search. Since this is the first semester we are working on this project, this teams main purpose this semester has been to establish a design that will work best for multiple scenarios. The first scenario is the most basic in which we throw it off and it sustains flight. The second scenario we add on the navigation aspect. The third and most complicated scenario is one in which we can roll up the wing in say a rocket, and then launch it and release it.

The wing is composed of glued wooden dowels and table cloth with calculated weight so that it can sustain flight. We also want to attach a raspberry pi to it so that we eventually get it so that it can navigate. We created the wing with the weight of the raspberry pi along with 4 motors in mind. We kept this in mind when creating our prototype. So the exact specifications for our wooden dowels is that they are quarter inch thick and they are 3 feet long. We will use 5v DC motors at each corner to power the wing. The raspberry pi will be the 3B+ model that weighs about 11 ounces.

After testing the wing that we currently have, we dropped it from about a 100 ft and it sustained flight for about 6 seconds before hitting the ground. Our goal is to end navigation and motors by the end of this semester so that we successfully complete the design and build of the rogallo wing. Our team is split up so that some of us are working on the research and design of the wing, while others are working on the python script for the navigation. We have learned a lot of about designing a device from scratch since there was no research conducted before this. We have rough ideas from online but the implementation was all our idea and our thoughts. We hope to achieve our goal of successfully creating this device by the end of this semester.

Research Mentors:

Samuel Midkiff, Engineering, ECE

Poster Number: **4** :: Physical Sciences

High Energy Muon Spallation

Authors:

Michael Agrillo, Physics

Maheep Brar, Computer Science

Hetvi Desai, Engineering

Abstract:

The XENON1T Detector, located at the Italian Gran Sasso National Laboratory, is focusing its research on the detection of weakly interacting massive particles (WIMPs), a well-motivated dark matter particle candidate. In order to have a purer data set, events from cosmic muons, and events directly afterward, mostly caused by muon spallation, are filtered out. Muon spallation creates many unknown chain reactions which may leak into the data the dark matter research scientists are trying to analyze: nuclear recoils caused by WIMPs. By looking at high S2 energy events related to spallation, and analyzing anomalies in that data, a better filtration process can be created for the overall data. The benefit of the new system will be a more significant and useful set of data to observe along with a better understanding of the long term effects of muon spallation.

Research Mentors:

Abigail Kopec, Physics

Rafael Lang, Physics

Poster Number: **5** :: Innovative Technology/Entrepreneurship/Design

Earthquake NLP VIP 2019 - DASC

Authors:

Aanis Ahmad, Engineering

Dhruv Chagi Gowd, Engineering

Abstract:

Abstract retracted.

Research Mentors:

Mohammad Reza Jahanshahi, Engineering, Industrial Engineering

Tarutal Ghosh Mondal, Engineering, Industrial Engineering

Poster Number: **6** :: Innovative Technology/Entrepreneurship/Design

Deep Freight

Authors:

Olamidotun Akinnola, Engineering

Austin Sale, Engineering

Abstract:

The purpose of this project is to research how reinforcement learning can be used to create model that effectively controls autonomous fleet shipping management in order to minimize the amount of resources consumed during shipping fulfillment. In this project, previous published research that dealt with reinforcement learning in ride sharing fleet management was used as a foundation to develop the project. From this foundation the models will be modified to fit the scope of the new problem. Additional research with regards to efficient shipping management, such as platooning will be integrated into the developing model for improved results. At the end of the semester we plan on having a working simulator that models shipments between real world Amazon Fulfillment centers and also have a Deep reinforcement learning model. The results of this project can be applied to shipping related industries. The effective implementation of the model in industry will help to reduce the effective cost seen by the distributor through a reduction of necessary vehicles for transportation as well as minimization of energy consumption during transport.

Research Mentors:

Vaneet Aggrawal, Engineering

Poster Number: **7** :: Life Sciences

Discovering Genetic Risk Factors in Autoimmune Disorders: A Meta-analysis of Genome-wide Association Studies For Autoimmune Diseases in European Populations

Authors:

Zaid Al Haddadin, College of Science

Abstract:

The purpose of this study was to find the common genetic variants in single nucleotide polymorphisms (SNPs) contributing to the expression of different autoimmune diseases and disorders; patients suffering from one diagnosed autoimmune complication may be suffering from other underlying autoimmune complication(s). This study examined for common genetic risk factors in Myasthenia Gravis (MG), Systemic Lupus Erythematosus (SLE), and Rheumatoid Arthritis (RA) in European populations. Meta-analysis genome-wide association scans were performed with publicly available datasets for the autoimmune diseases and disorders. The genetic correlation between pairs of diseases were determined using LD-score regression. Meta-analysis was performed with ASSET software, which corrected for any sample overlaps between the datasets and calculated the meta-analysis p-value of each SNP. METASOFT software was then used to determine the effect each study had on every significant SNP from the meta-analysis. Initial scans showed an overlap in the genetic variants with significant meta-analysis p-value scores, indicating that a number of autoimmune diseases and disorders share common genetic risk factors. The findings of common genetic risk factors can help in understanding the common genetic mechanisms and pathways that are shared among the studied autoimmune diseases and disorders.

Research Mentors:

Peristera Paschou, College of Science, Department of Biological Sciences

Apostolia Topaloudi, College of Science, Department of Biological Sciences

Poster Number: **8** :: Innovative Technology/Entrepreneurship/Design

User interface design for an on-camera video analytics engine

Authors:

Sabriya Alam, Engineering

Abstract:

Artificial intelligence powered video analytics shows high promise in making our society smarter. Harnessing large amounts of video data, however, requires the development of processing systems demonstrating high performance and high efficiency. To this end, I have been contributing to a video analytics system powered by AI for object detection and recognition. Rather than streaming all the video frames captured by a camera to the cloud, the system analyzes images on-camera and only returns those of interest to the cloud. To make the system usable, I developed a web user interface for receiving user queries (including parameters such as camera geolocations, video timespan, and object class of interest) and presenting the relevant query results. This web-interface will make our video analytics system more accessible to domain experts, e.g. those in law-enforcement, healthcare, or environmental monitoring.

Research Mentors:

Felix Lin, Engineering, Electrical and Computer Engineering

Mengwei Xu, Engineering, Electrical and Computer Engineering

Poster Number: **9** :: Innovative Technology/Entrepreneurship/Design

Implementing Vision for The Hummingbird Robot

Authors:

Yamuna Ambalavanan, College of Engineering

Abstract:

The Hummingbird Robot by the Bio Robotics Lab has the ability to mimic the hummingbird by its decoupled wings, flapping wing aerodynamics, and flight control. To further enable the robot for practical applications like navigating through areas inaccessible to humans, vision is extremely important for the robot. Compared to the traditional aerial vehicle, implementing onboard vision on such a flapping wing robot presents unique challenges, such as image stabilization issue due to the reciprocating wing motion induced severe body oscillations. This poster explores such challenges that could be faced when implementing visual sensors on the Hummingbird Robot. A Mini-Spy Camera is used as the primary visual sensor during the flight. We first implemented such a camera on a small-sized quadrotor. The visual feedback in its hovering flight will serve as the baseline result upon which we will explore possible solutions to improve the visual sensing performance in flapping flight. The poster also explores the possible solutions for challenges faced when implementing vision on the robot and the reasoning behind those solutions.

Research Mentors:

Professor Xiyan Deng, Mechanical Engineering

Dr Zhan Tu, College of Engineering, Mechanical Engineering

Poster Number: **10** :: Life Sciences

Non-invasive detection of Autonomic Dysreflexia in Rats

Authors:

Zada Anderson, Engineering

Abstract:

Autonomic dysreflexia is a disorder of the autonomic nervous system and can develop in people with spinal cord injuries. If not managed properly, it is dangerous and possibly lethal. It occurs when there is a trigger below the level of injury including a normal bodily function, infection, pain, or an irritant. These problems trigger an automatic response- blood pressure increases, and heartbeat may become irregular. The goal of this study was to find non-invasive ways to detect autonomic dysreflexia early. Currently electrodes and tail cuffs are used to measure the heart's electrical activity and the blood pressure of the rat both before and after spinal cord injury. We are working on incorporating electrodes on the front paws of the rats to measure skin conductivity. The rat's response due to stimuli are recorded using these measurements which helps us understand how the sympathetic response changes pre and post-surgery. To ensure that these measurements are not affected by factors such as stress, acclimation of the rat to its surroundings are crucial. This includes acclimation to the handlers, the restraint and the sensors. We developed a systematic approach to ensure that the rats' recordings were truly a reflection of autonomic dysreflexia, not other confounders.

Research Mentors:

Shruthi Suresh, Engineering , Weldon School of Biomedical Engineering

Jianming Li, Bradley S. Duerstock, College of Veterinary Medicine Department of Basic Medical Sciences, College of Engineering Weldon school of Biomedical Engineering and school of Industrial Engineering

Poster Number: **11** :: Innovative Technology/Entrepreneurship/Design

Where are the optimal solar energy locations based on multi-faceted factors?

Authors:

Keita Arakawa, Polytechnic Institute

Abstract:

According to Dr Fatih Birol, the execute director at the International Energy Agency, in 2018, solar-produced energy accounted for 1.6% of the electricity generated in the U.S., an increase of 0.11% in 2012. By 2023, International Energy Agency forecasts suggest solar-produced energy will account for 4% of U.S. generated electricity. With the increased adoption of solar energy comes new product development, startup formation, and economic development related to the solar energy industry. Currently it is difficult to know appropriate channels or locations for solar energy marketing campaigns. In response, solar energy related companies will research mass marketing, local expositions, and library research databases for market analysis. There is a gap created by a limited target approach. By looking at high electricity costs, solar irradiation and regions with optimal net-metering policies, campaigns can optimize target current and potential solar panel owners. The goal of this research is to develop and showcase a visual tool to assist companies with their solar energy campaigns. The first step was the data collection using credible and reliable sources including the National Renewable Energy Laboratory (NREL), the Database of State Incentives for Renewable and Efficiency (DSIRE), and Energy Information Administration (EIA). After manipulating the data on electricity costs from the EIA, net-meter policies from DSIRE and solar irradiation from NREL, maps were created using Microsoft Excel's map chart tool. Using statistical calculations such as z-scores, a summation equation was used to combine the factors and create new maps. The resulting maps can be used as a tool for solar energy campaigns, in particular for new business startups to increase the likelihood of attracting new customers.

Research Mentors:

Lisa Bosman, Polytechnic Institute

Poster Number: **12** :: Mathematical/Computation Sciences

Purdue Nexus Project

Authors:

Mridul Arora, Engineering

Abstract:

The purpose of our project is to support the Purdue Nexus Project using visual analytics to help them better manage collaborations between multiple projects lead by independent teams who could benefit from each other's work.The Purdue Nexus Project works on a motive towards getting a deeper picture of the projects and to analyze those projects to maintain efficiency and sustainability. Our project develops a web application which supports the Nexus Project as it uses the given data for each project and visualize that for a better understanding of the shared resources of the project by the end user. The web application consists of three views: a Map View, Convergence table and a Gantt chart. The map view visualizes the resources used by each project. The convergence view offers an idea of how the project uses different components towards respective tasks or activities. The Gannt chart provides a detailed timeline view for each projects along with their components.It uses features like sorting and highlighting that further helps better visualize each project and compare them with others. One challenge with the current system is that currently there are no components in the web application that gives a summary of the projects . This would be useful to the user when considering and comparing several projects.The task is to incorporate a word cloud- which is a type of visualization that displays the most commonly used words in a paragraph to highlight high frequency terms . Having a togglable word-cloud for each project would help the user compare each project based on the teams a project belongs to and the goal of the project. The Implication of having the word-clouds on the gantt chart is to have a broader overview for consideration and comparison purposes all present in one view.

Research Mentors:

David S. Ebert, School of Electrical and Computer Engineering ,

Calvin Yau, College of Science , Computer Science

Poster Number: **13** :: Innovative Technology/Entrepreneurship/Design

Autonomous Systems Against Space Meteorites and Space Debris - electronics abstract

Authors:

Tremael Arrington, Purdue University

Edward Pedroza, Purdue University

Ruochong Wu, Purdue University

Abstract:

Small space debris orbiting Earth poses a significant threat to humanity's space ambitions. This debris, some as small as specks of dust, travel at speeds upwards of 7 km/s and can cause massive damage to spacecraft. The objective of this project is to design a smart electronic system that can protect and preserve spacecraft that are at risk of debris strikes. The system will include measures to detect and avoid debris using cameras equipped with debris and spacecraft tracking software, capable of detecting and tracking the position of nearby small debris and spacecraft. This ground-based system allows computers on the ground to communicate when an impact is imminent and instructs the spacecraft to deploy its avoidance maneuver. If avoidance fails, the system will use damage detection circuitry woven into satellite shielding to determine damage sustained. Damage information will be processed by ARM Cortex-M0 microcontrollers and used to trigger self-healing/redundant components controlled by circuits using programmable logic devices such as FPGA's or PLDS to perform self-reconfiguration autonomously. Satellite designs implementing such a system will see higher satellite lifetimes, and reduced need for backup satellites, offsetting the costs for such a system. Furthermore, the reduction of damaged satellites in space will lead to a cleaner and safer space for the future.

Research Mentors:

Leonardo Facchini, Purdue University

Poster Number: **14** :: Life Sciences

Discrete Wavelet Transform for Quantifying Surgeon's Fatigue

Authors:

Dongwei Bai, College of Engineering

Abstract:

In contrast to open and laparoscopic surgeries, robotic-assisted surgery (RAS) allows the surgeon to operate seated at a console that controls the surgical robot. Although this suggests potential benefits in surgeon ergonomics, surgeons continue to report muscular fatigue on upper body and discomfort during surgery. Limited studies have assessed muscle fatigue in the operating room, as a main challenge is our ability to measure muscle fatigue in surgical work and demonstrating its association with fatigue. The purpose of this study was to measure surgeons' upper body muscle fatigue in the operating room. Specifically, we measured muscle activity during key surgical steps to identify patterns of muscle fatigue. Six electromyography (EMG) sensors were placed on surgeons performing 29 procedures on their left and right biceps, forearms, trapezius, and neck. Discrete wavelet transform was used to decompose the EMG data to better understand muscle activity over time. The power of the signals was then calculated of each sensor and then used to identify muscle fatigue of surgeons during an operation. Findings of this work can not only increase the efficiency of surgeons but also improve longevity of surgeons' career and improve the safety of patients.

Research Mentors:

Dr. Denny Yu, College of Engineering, Industrial Engineering

Jackie Cha, College of Engineering, Industrial Engineering

Poster Number: **15** :: Life Sciences

Identifying the involvement of miR-4435 in the acquisition of Erlotinib-resistance in Non-small Cell Lung Cancer

Authors:

Manvir Bains, College of Science

Abstract:

Lung cancer is the leading cause of cancer-related deaths, world-wide. Non-small cell lung cancer (NSCLC) accounts for 85% of lung cancer cases and is categorized by causal mutations driving the cancer. Approximately 15-40% of NSCLC cases are attributed to mutations in the Epidermal Growth Factor Receptor (EGFR), a protein that signals normal growth. In NSCLC patients, EGFR is constitutively activated. Such patients are administered with an EGFR inhibitor, Erlotinib, which binds and inhibits its downstream signaling, however, Erlotinib-resistance (ER) is acquired through secondary mutations or bypass pathways. There remains a subset of mechanisms that is incompletely understood. Since microRNAs (miRNAs), small RNAs that regulate protein-coding transcripts, are intimately involved in regulating some bypass pathways, they can contribute to ER upon perturbation. Through an overexpression or a knockout screen, ER mediated by miRNAs or protein-coding genes was identified. From the overexpression screen, miR-4435 emerged as a candidate miRNA that drives ER, while SUV420H2, an epigenetic regulator that produces a repressive H4K20me3 mark, was identified from the knockout screen. Further, through bioinformatic analyses, miR-4435 has been predicted to bind SUV420H2 at the 5'UTR rather than the canonical 3'UTR. A luciferase assay was conducted to verify the effects of miRNAs from the overexpression screen. Following this, overexpression of miR-4435 was performed in NSCLC cells and reduced levels of SUV420H2 transcript and the downstream H4K20me3 mark were observed, suggesting SUV420H2 is a bona fide target of miR-4435. Future work will elucidate the non-canonical binding site of miR-4435 on SUV420H2 transcript and identify additional targets of miR-4435, loss of which lead to ER.

Research Mentors:

Dr. Andrea Kasinski, College of Science, Biology

Arpita Pal, College of Science, Biology

Poster Number: **16** :: Social Sciences/Humanities

H-1B Visa Petition Fluctuation in the United States

Authors:

Pablo Balcazar, Liberal Arts

Daniel Farrell, Liberal Arts

Abstract:

The H-1B Visa program, created by the Immigration Act of 1990 under the 101st United States Congress, allows employers to hire uniquely skilled foreign nationals on a temporary basis to perform services in a specialty occupation. The federal government allows the United States Citizenship and Immigration Service to approve a certain number of new H-1B petitions each federal fiscal year. However, there is a cap on how many of the visas may be issued annually for certain industries (this is referred to as “CAP-Subject”). Currently, the H-1B visa cap rests at 65,000 and has been such since 2004, when it was reduced from 115,000.

Our research consists of analyzing statistics on H-1B denials released by the United States Citizenship and Immigration Services (USCIS), while also creating a concurrent timeline of policies enacted as well as comments made during the after the Obama and Trump administrations. We will use this data to compare the fluctuation in total H-1B petitions, as well as the percentage of petition denials.

The H-1B has been radically altered and criticized since its original implementation and purpose and will likely continue to be modified to suit the wants of any given executive administration or Congress. While this project serves as an introduction to how the H-1B visa has shifted in recent years, it is imperative that further comprehensive research on a grander scale is conducted in order to better understand the fluctuations of H-1B acceptance and denials, as well as their effects.

Research Mentors:

Linda Renzulli, Sociology

Poster Number: **17** :: Innovative Technology/Entrepreneurship/Design

Improving DeepPool Simulator's Expected Time of Arrival Predictions Using Real-Time Traffic Conditions

Authors:

Aarushi Banerjee, College of Science

Daniyaal Rasheed, College of Engineering

Abstract:

Abstract retracted.

Research Mentors:

Vaneet Aggarwal, College of Engineering, School of Industrial Engineering and the School of Electrical and Computer Engineering

Ashutosh Singh, College of Engineering, Industrial Engineering-Operations Research

Poster Number: **18** :: Mathematical/Computation Sciences

Foreign Assistance Data Visual Analytics tool

Authors:

Eric Bankert, Engineering

Abstract:

The US Department of Foreign Aid assists (USAID) countries by providing funding for internal development and humanitarian assistance. The department has accumulated a large set of aid transactions and offers this information to the public. In addition, The World Bank Group, a third-party data source, offers 17,299 standardized indicators of development information for 189 countries. Representatives from USAID narrowed down this list to 1,287 indicators to compare with the funding data. Currently, USAID is hosting a tool on their website that allows users to view and make simple comparisons between some of the data. We are looking to improve the capabilities of the analysis tool available on the existing website and add the third-party information from The World Bank Group. The outcome for this project is to create an intuitive and detailed analytical tool to select, visualize, and analyze funding and impact data. We are developing a method to create a relationship between the third-party information and the funding data. We are using the existing categories with the third party and funding data to create a meaningful relationship between the data sets and are looking for ways to improve this relationship. This tool will allow users to select a data point and suggest a few related points to compare. It will enable the users to analyze impact funding is having in regions and enable the users to make better decisions on where to provide funding.

Research Mentors:

Jieqiong Zhao, Engineering, Electrical

Jingjing Guo, Audrey Reinert, Electrical Engineering, Electrical Engineering

Poster Number: **19** :: Innovative Technology/Entrepreneurship/Design

Autonomous Land Vehicle

Authors:

Pratik Bansal, College of Engineering

Sarthak Kathuria, College of Engineering

Ashley Maddock, Somesh Dube, Sean Hwang, Sanghoon Han, Arpan Adhikari, College of Engineering

Abstract:

The demand for the autonomous land vehicle industry has been increasing tremendously, and continues to grow. Through the Autonomous Land Vehicle (ALV) team, students develop both the hardware and software to create a low cost and scalable autonomous vehicle. An autonomous pilot has been developed that can drive the vehicle in real time. The purpose of this pilot is to generate vehicle control commands that will direct the vehicle from the initial position to the destination without hitting obstacles. The vehicle was made autonomous by implementing steering logic based on a stream of data from three different modules: a GPS module providing the direction of vehicle towards the destination, image recognition via a camera. and ultrasonic distance sensors for avoiding obstacles that cannot be seen by the camera system. The system validates the inputs from the three interfaces by first taking a heading from the GPS module, followed by checking the ultrasonic sensor data for low lying objects and finally using the camera to plan a path and avoid obstacles. The information is processed in real time to allow accurate and reliable decisions to be taken by the car. The team has strategized that the use of the Nvidia Jetson Nano would be the best candidate to function as the computer for the project due to its efficiency in decoding video streams and ability to run neural nets in real time. A PCB has been designed and manufactured to house the electrical connections from the ultrasonic sensors to the Jetson Nano to ensure stable electrical connections. The final assembly includes the completed board that is mounted to the central panel of the car to consolidate all major wiring and contribute to a robust design. Lastly, the project could be improved with a wider variation of testing in less controlled environments.

Research Mentors:

Samuel Midkiff, College of Engineering - ECE

Poster Number: **20** :: Life Sciences

Overexpression of PGC-1Î± in human skeletal muscle cells increases regulators of exosome production and secretion

Authors:

Logan Barber, Health and Human Sciences

Abstract:

Introduction: Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1Î±) is a transcriptional coactivator and master regulator of mitochondrial biogenesis. Oxidative skeletal muscle has higher mitochondrial content compared to glycolytic muscle and oxidative muscle produces more exosomes than glycolytic muscle. Exosomes are small (50-150 nm), secreted extracellular vesicles containing proteins, lipids, mRNA, and miRNA; and are important for cell-to-cell communication. Once taken up by target cells, exosomes can alter several cellular pathways and functions. It was hypothesized PGC-1Î± regulates exosome production in skeletal muscle. Methods: Human skeletal muscle satellite cells (hSkMC) were isolated from vastus lateralis biopsies and differentiated into myotubes. On day 4 of differentiation, myotubes were transfected with virus containing PGC-1Î±. On day 6, myotube media was replaced with exosome-free differentiation media and conditioned media was collected on day 8 for determination of exosome content. On day 8, RNA was isolated from control and PGC-1Î± treated myotubes for analysis of components of the endosomal sorting complexes required for transport (ESCRT) and Rab GTPase pathways, key regulators of exosome production and secretion. Results: Preliminary results suggest overexpression (OE) of PGC-1Î± in skeletal muscle increases regulators of exosome production and secretion: Alix, CD63, TSG-101, and Rab27b mRNA. Conclusions: Pilot study results suggest PGC-1Î± regulates skeletal muscle exosome production and secretion. Further experiments will confirm pilot study findings and determine exosome content in conditioned media from control and PGC-1Î± OE human myotubes.

Research Mentors:

Dr. Timothy Gavin, HHS, HK

Poster Number: **21** :: Mathematical/Computation Sciences

Causes of Post-Intracranial Surgery Delirium

Authors:

Alaina Bartfeld, Krannert School of Management

Sahana Rayan, College of Science

Juliet Aygun, College of Science

Abstract:

Post-operative delirium primarily occurs in the Intensive Care Unit (ICU) that can be caused by a combination of intracranial surgery and the introduction of new drugs, such as painkillers, or when drugs are not administered correctly. This study examines the major factors that influence post-operative delirium based on data collected at different stages of pre- and post-intracranial surgery. This study uses principal component analysis to summarize correlations of variables and to understand the total variance of the data set. Scatter plots were also employed to understand each individual relationship between two different variables to better visualize which variables pulled more weight when a patient contracted delirium. We found that age is an important factor in determining if a patient will contract delirium in the ICU or not. Another important variable to consider is the Richmond Agitation Sedation Score (RASS) when examining whether a patient will contract delirium in the ICU. This tells us that old age and a high RASS are linked to delirium in the ICU and so, medical experts should be more mindful of the psychological effects of drugs in the ICU for old-age and high RASS patients.

Research Mentors:

Zhan Pang, Krannert School of Management, Supply Chain and Operations Management

Poster Number: **22** :: Social Sciences/Humanities

Motivation and Physical Activity for Older Adults

Authors:

Margaret Becker, Health and Human Sciences

Abstract:

Abstract retracted.

Research Mentors:

Dr. Libby Richards, Nursing

Dr. Melissa Franks, HDFS

Poster Number: **23** :: Mathematical/Computation Sciences

Comparing Speed Distribution of Micro-Mobility Modes

Authors:

Jack Bell, Engineering

Abstract:

In the past two years dockless electric scooters, shared bikes, and electric skateboards have risen in popularity and are being integrated into the urban transportation ecosystem. As these micro-mobility devices increase in prevalence, several cities have raised concerns about their safe operating speeds and interaction with pedestrians and vehicles. This study collected travel speeds for pedestrians, bicycles, electric scooters (e-scooters), skateboards, and electric skateboards (e-skateboards). A total of 754 travel speeds were recorded using a laser speed gun setup on bike paths, sidewalks, and streets. Results show that around 90% of e-scooter and bicycle speeds recorded were below 15 miles per hour (mph). Interestingly, more than 70% of e-skateboard speeds were above 15 mph, with 7% above 20 mph. Statistical tests were also performed to compare the mean speeds of all the modes. There was statistically significant difference in speeds between all of the above mentioned transportation modes, with the exception of bicycle and scooter speeds.

Research Mentors:

Darcy Bullock, Engineering, Civil Engineering

Jijo Mathew, Engineering, Civil Engineering

Poster Number: **24** :: Life Sciences

Purifying the CDC14 catalytic domain of Claviceps Purpurea

Authors:

Dominique Bennett, Agriculture

Abstract:

Abstract retracted.

Research Mentors:

Dr. Sandra Rossie, Agriculture, Biochemistry

Poster Number: **25** :: Mathematical/Computation Sciences

Large-Scale Dataset Ensembling for Unsupervised Domain Adaptation

Authors:

Fischer Bordwell, College of Engineering

Ashley Kim, College of Engineering

Shuhao Xing, College of Engineering

Kirthi Sivamani, College of Engineering

Abstract:

Deep neural networks often require a large amount of labeled data in order to improve model accuracy. One way to improve the accuracy of the networks without labels is to train them with data from different distributions as a source domain. If the source domain is dissimilar to the target domain, this may lead to adverse effects as data from dissimilar distributions might not effectively transfer features during domain shift. In order to address this issue, many methods aim to match distributions between source and target using unsupervised domain adaptation. However, simply matching the distributions cannot ensure that the networks will learn target-specific representations. In this paper, we propose an unsupervised dataset ensembling method that ensembles a source domain from a set of different datasets which has more similarity to the target than any of the individual datasets. We use this ensembled source domain in order to pre-train a network that can pseudo-label data from the target. With the ensembled source domain along with the pseudo-labeled target data, the network learns target-specific information from both domains without any training labels from the target. We evaluate our method extensively on large-scale datasets as well as digits datasets. Our proposed method achieves state-of-the-art performance on digit recognition tasks and broadens the scope of the applications of domain adaptation by evaluating and improving usage on large-scale datasets. In particular, for SUN as a test set, using ensembled dataset as a source domain produces a result that is 11.1% higher than the next highest result in this scenario.

Research Mentors:

Yung-Hsiang Lu, Engineering, Computer Engineering

Poster Number: **26** :: Mathematical/Computation Sciences

Estimating Vehicular Traffic Intensity with Deep Learning and Semantic Segmentation

Authors:

Logan Bradley-Trietsch, College of Science

Abstract:

The computer vision task semantic segmentation, which involves assigning a label to each pixel in an image, has many applications to vital topics such as medical imaging or autonomous driving. This project uses the semantic segmentation deep learning architecture Deeplabv3+ to analyze traffic video in order to quantify and make inferences about the intensity of vehicular traffic. This unique approach to traffic estimation may have advantages over traditional methods like object detection in its ability to more accurately account for both large and small vehicles that each affect traffic differently. We define a metric to quantify the traffic intensity and visualize it in a time series plot. In addition, we fit a Holt-Winters model to forecast traffic intensity for the next sixty seconds. This project and its methods are one step toward the "smart city", i.e., a city that has a traffic system based on artificial intelligence that can adapt to traffic in real-time with the end goal of mitigating gridlock traffic and improving driver and pedestrian safety.

Research Mentors:

Dr. Xiao Wang, Department of Statistics

Poster Number: **27** :: Innovative Technology/Entrepreneurship/Design

Color Space Conversion Using Neural Network

Authors:

Davis Bradstreet, Engineering

Insoo Hyun, Engineering

John Oliver Krefta, Engineering

Abstract:

This project aims to develop a model for color space conversion. Specifically, the plan is to develop a neural network that can determine the CMY values for a given color in the YyCxCz color space. The CMY values determine the amount of cyan, yellow, and magenta inks that are used to represent a given color on a particular device - in this case a particular printer. The research problem that we are trying to solve is that currently, when converting from YyCxCz to CMY, interpolation is used. However, it was suggested that using a neural network to model this relationship could more accurately model the nonlinear relationship, thus producing more accurate printed colors. The goal of the team is to explore neural network to find a better method of interpolating CMY values. Using a neural network, YyCxCz color space points will be converted into CMY color space that can then be printed on the printer. 729 data points are used to train the network. Many different parameters for the network will be changed and tested individually, including loss function, optimizer, number of hidden layers, epochs, etc. until an accurate conversion is made.

Research Mentors:

Baekdu Choi, ECE

Poster Number: **28** :: Physical Sciences

Muon Track Reconstruction in XENON1T

Authors:

Ben Bressette, Purdue College of Science

Lucca Carvalho, Purdue College of Engineering

Madelyn Sumner, Keller Swartzentruber, Purdue College of Science, Purdue College of Science

Abstract:

The universe is primarily comprised of non-luminous matter, termed dark matter (DM). It has been concluded that there is five times more DM in the universe than baryonic matter. The XENON1T experiment uses a dual-phase liquid xenon time projection chamber (TPC) in order to measure nuclear and electronic recoils from dark matter interacting with xenon. The TPC is made out of two arrays of photo-multiplier tubes (PMT) installed at the top and bottom of the TPC. It is designed to detect the scintillation light and ionization charge via proportional gas scintillation. The TPC is within a 10m by 10m water tank, referred to as the muon veto system (MVS), equipped with 84 PMTs. Muons will emit Cherenkov radiation in the water tank, which is received by the PMTs. Even though muons can be identified by the Cherenkov radiation that they emit; there have been difficulties in reconstructing their paths in the MVS. We are trying to determine the degree of accuracy of which muons paths can be reconstructed using data from the XENON1T experiment. Currently, whenever a muon moves through the detector, the data acquisition system flags all data of the muon event as unusable. By applying muon tracking it will be possible to use previously ignored data to search for irregularities in muon events. In addition, the muon track reconstruction can be later applied to the tracking of plank-mass dark matter particles.

Research Mentors:

Amanda Depoian, Purdue University, Physics

Rafael Lang, Purdue College of Science, Physics and Astronomy

Poster Number: **29** :: Innovative Technology/Entrepreneurship/Design

Optimzing Energy Efficiency of Desalination via Batch Reverse Osmosis

Authors:

Katie Brodersen, College of Engineering

Yi Xie, College of Engineering

Abstract:

As the demand for water security expands globally, sustainable desalination technologies become more critical. Traditionally, continuous reverse osmosis (RO) requires that a constant high pressure must be applied to the system to overcome the osmotic pressure. Closed-circuit reverse osmosis (CCRO) recirculates brine into the feed line, increasing the pressure of the system with each pass. This project investigates batch reverse osmosis, which varies the applied pressure over time to closely follow the osmotic curve, conserving the excess energy that is used to maintain a continuous RO system. Unlike CCRO, batch RO avoids the exergy generated when brine and feed are mixed by using a variable-displacement cylinder (VDC), into which brine output from the RO membranes recirculates. As the system reacts to increasing brine concentration with each “batch”, the pressure of the system increases. Batch RO has been modeled to achieve the lowest specific energy consumption per volume of water desalinated. This team is currently integrating the batch RO model as a hydraulic system to demonstrate these expected results. The hydraulic system is operated by a control system using pH and conductivity sensors to track the salinity over time, as well as pressure and flow sensors which interface with a variable frequency drive that sets the flow rate of the pump. Solenoid valves are used to switch direction of the recirculating brine stream from one side of the VDC to the other with each pass.

Research Mentors:

Prof. David Warsinger, College of Engineering, Mechanical Engineering

Sandra Patricia Córdoba Renteria, College of Engineering, Mechanical Engineering

Poster Number: **30** :: Social Sciences/Humanities

Teacher-Parent Communication: An Analysis of Early Elementary Classroom Newsletters

Authors:

Kristen Burger, Education

Abstract:

Teacher-parent communication is imperative to the success of students but can be hard to maintain. Many teachers attempt communication with parents through classroom newsletters. We coded and analyzed newsletters from nine K-2 classroom teachers using a parent involvement framework. Our goal was to determine how teachers were using their newsletters to communicate with parents and what these newsletters demonstrate about teachers' beliefs of parents in education. Findings indicate a newsletter focus on calendar events and progress updates and that teachers' use of language can indicate what role teachers envision parents should have in their child's education.

Research Mentors:

Laura Bofferding, Education, Curriculum and Instruction

Nadine Dolby, Education, Curriculum and Instruction

Poster Number: **31** :: Innovative Technology/Entrepreneurship/Design

Quantifying Changes in Muscle Force in the Presence of Fatigue

Authors:

Emily Bywater, Engineering

Abstract:

When athletes exert their bodies to their physical limits in practice and competition, there is often a great injury risk. A better understanding of the muscle and joint contact forces should lead to more effective injury prevention techniques. The Human Injury Research and Regenerative Technologies (HIRRT) Lab has derived a constitutive law relating force in a muscle to voltage (EMG), contraction velocity and a muscle constant. The constant for each muscle can be calculated through a series of exercises and used to predict forces in other settings. Through motion tracking and the collection of ground reaction forces and EMG data points, the muscle constants are identified by iterating through eighteen different equations based on Euler's second law about the ankle. To expand upon this framework, fatigue in runners will be quantified from a pre- and post-run comparison of muscle constants. Ten members of Purdue's Run Club (five male, five female) will perform a series of calf raises before and after three fatiguing endurance (ex: >60 minutes) or high intensity (ex: at 10k race pace) runs, each with a week of normal training in between. It is hypothesized that the muscle constants and consequently the muscle forces themselves will decrease with fatigue as energy is depleted. The severity to which changes occur, the contrast between constants for men and women and the shift in the constants over time will all be calculated. Later, muscle constants and forces may be used in combination with tissue mechanics to help prevent injuries in athletes.

Research Mentors:

Eric Nauman, Engineering, Mechanical and Biomedical

Poster Number: **32** :: Innovative Technology/Entrepreneurship/Design

Predicting Energy Usage to Better Estimate and Market Efficiency Upgrades to Customers

Authors:

Brian Cain, Krannert School of Management

Brendan Gillenwater, Krannert School of Management

Shiv Patel, William Ho, Xiaoping Zhu, Krannert School of Management, Krannert School of Management, Krannert School of Management

Abstract:

This study estimates energy efficiency for various types of buildings and energy usages such as chilled water, electricity, hot water, and steam meters using predictive analytics. The motivation of this study is that being able to accurately predict energy usage would allow companies to better estimate the value of energy efficient upgrades and market those savings to customers. These energy efficient improvements would lead to cost savings to customers, as well as positive environmental impacts. While research has been performed in this area, we focus on developing models that lead to the most accurate predictions which allow companies more precise estimates of efficiency gains.

Research Mentors:

Matthew A. Lanham, Krannert, Management

Poster Number: **33** :: Mathematical/Computation Sciences

Automated pipeline to facilitate geospatial data analysis

Authors:

Jeremy Chang, College of Science

Abstract:

Geospatial data analysis provides solutions for global food-water-energy sustainability challenges. Due to the complexity of geospatial data (e.g., diverse data sources, formats, sizes, resolutions, domain-specific metadata, and so on), researchers and stakeholders need concrete and reproducible methods of obtaining and analyzing this data. The project aims to create a pipeline that facilitates this process, specifically for data from the Food and Agriculture Organization of the United Nations (FAO). Our FAO connector implementation includes downloading and analyzing all associated files specified by the scientist. This solution provides concrete methods to reproducing the data analysis as well as ensuring the same datasets are used, making it easier to validate results and reducing errors.

Research Mentors:

Rajesh Kalyanam, Research Computing (RCAC)

Carol Song, Research Computing (RCAC)

Poster Number: **34** :: Social Sciences/Humanities

The Effect of Intimate Partner Violence on Emotional Reactivity to Idiographic Stimuli

Authors:

Lehar Chellani, Health and Human Sciences

Abstract:

Intimate partner violence is a pertinent problem that affects many people. It is known to be linked with the occurrence of mood disorders such as PTSD in those that are victims of it. The current study seeks to examine the effect of intimate partner violence on neural reactivity to idiographic stimuli (i.e., the partner's face). Data will come from an ongoing study examining neurobiological correlates of mood disorder for people in close relationships. As part of the study, participants are asked to complete a self-report measure that assesses the frequency of perpetration and victimization of psychologically and physically abusive acts and injuries. Participants also complete an image viewing task that includes their partner's face while an EEG records their brain activity. Event-related potential data collected from the EEG indicate the participant's level of affective reactivity to the stimuli. A correlation between the scores on the IPV measure and ERP amplitude will be tested. It is hypothesized that the findings will replicate previous work in the area that demonstrated a blunted neural response to emotional stimuli. It is also known that intimate partner violence victimization is associated with mood disorders. The current study will also attempt to replicate this finding within the sample by correlating scores on the partner violence measure and a self-report measure that assesses basic symptom dimensions underlying depression and anxiety disorders.

Research Mentors:

Dr. Susan South, HHS, Psychological Sciences

Dr. Dan Foti, Samantha Ingram, HHS, Psychological Sciences, HHS, Psychological Sciences

Poster Number: **35** :: Mathematical/Computation Sciences

A Predictive Analytics Approach to Estimate Home Loan Risk and Allocate Loans

Authors:

Jinyu Chen, Krannert

Bharat Agarwal, Krannert

Esteban Molina, Isha Sharma, Alejandro Hoyos Orozco, Krannert, Krannert, Industrial Engineering

Abstract:

We develop a predictive model that home lending institutions could use to estimate and evaluate riskiness and creditworthiness for their customers. Our approach is novel in that it uses sophisticated machine learning algorithms to accurately predict if a customer will default on their loan or not. We also show how the lender could use a model to better rank customers on whom should get priority over another customer and justify this approach with respect to actual historical default performance using a probability calibration plot. The motivation for this research is our interest among the intersection of quantitative finance and predictive analytics to develop solutions that provide intelligent decision-support for financial decision-making. Estimating risk can be done from various perspectives with competing goals. Our research shows how one can do this accurately, but also in a visually interpretable way that is fair to the lender and customer, and not completely based on some statistical evaluation metric.

Research Mentors:

Matthew A. Lanham, Krannert, Management

Poster Number: **36** :: Innovative Technology/Entrepreneurship/Design

Lifiting Risk Estimation Using Computer Vision Technology

Authors:

Nan Chen, Polytechnic Institute

Lohith Roy Chittineni, Engineering

Guoyang Zhou, Hamed Asadi, Engineering,Engineering

Abstract:

Abstract retracted.

Research Mentors:

Denny Yu, Industrial Engineering

Poster Number: **37** :: Innovative Technology/Entrepreneurship/Design

Haptic Feedback Sensor Arrays

Authors:

Wei-Jen Chen, Ruili Ding, Yi Zhou, Purdue University, Electrical and Computer Engineering

Ruili Ding,

Yi Zhou, zhou823@purdue.edu

Abstract:

The purpose of haptic project is to make a wearable haptic feedback device that can give feedback to skin of users. It used single actuator haptic oscillators to make multiple actuator haptic array. Each haptic oscillator was made by magnets and wires that can control the force of vibration through currents independently. For now, we divided the project into three groups, one is dealing with simulation model, another one is making a physical model of magnetic field with many parameters, and the other one is to do the experiment to test the materials of real haptic feedback device. For the simulation group, we are writing some MATLAB scripts based on the physics model we created to simulate the actuation force of our Haptic Oscillator Actuation. On the other hand, the experiment part is working on a real Haptic Oscillator Actuation, measuring its actuation force and comparing to the model we created. Our final goal is the result of the experiment and model should counterpart with each other.

Research Mentors:

Xinyang Deng, Purdue University, Associate Professor of School of Mechanical Engineering

Jesse Roll, Purdue University, School of Mechanical Engineering

Poster Number: **38** :: Mathematical/Computation Sciences

Molecular Dynamics on Graphene in Water

Authors:

Jia Lin Cheoh, Science

Yuhang Fang, Engineering

Abstract:

Recent literature has heavily explored the potential of graphene membranes like carbon nanotube in water purifications due to their excellent ion exclusion properties. We built several molecular dynamics model, separating layers of water to study the effect of various properties on the flow rates and the permeation rates. We regard the occurrence of permeation as when water flows through the entire length of the membrane, from the beginning to the end. On the other hand, net water flow is when a water molecule is transferred, there is a net flow of one water molecule. Our molecular dynamics model enables us to manipulate with different conditions to locate the optimum setup that will contribute to the field of water desalination.

Research Mentors:

Prof. David Warsinger, Purdue University

Poster Number: **39** :: Mathematical/Computation Sciences

Image Processing and Analysis - Media Forensics

Authors:

Yu Chieh Chiu, ECE

Aryan Tyagi, ECE

Zac Robinson, Ayomide Sonoiki, FYE, FYE

Abstract:

Imaging technology and conveniently accessible tools for media manipulation have become ubiquitous and freely available to the majority of the digitally aware world. The dark side of this increasing control over media manipulation is that it can be used with malicious motives such as doctoring videos/images to spread misinformation/propaganda. The purpose of this project is to examine media authenticity with respect to copy-move forgery of images. The team aims to detect the type and localization of the modifications made to an image. The detection testing process will be carried out using the COVERAGE dataset, which contains copy-move forged (CMFD) images and their respective pristine images. The team's CMFD process involves implementing the SIFT (Scale Invariant Feature Transform) algorithm to extract image keypoints that are invariant to scaling, rotation and translation changes. The extracted image keypoints are then matched using the nearest neighbor method to detect the duplicated region within the copy-move forged image. The success of this project has several practical applications of detecting forged images in political campaigns, maintaining the integrity of media, and authentication of image originality.

Research Mentors:

Edward Delp, ECE

Carla Zoltowski, ECE

Poster Number: **40** :: Innovative Technology/Entrepreneurship/Design

Virtual Reality Application

Authors:

Wilson Chow, Engineering

Abstract:

Abstract retracted.

Research Mentors:

Tarutal Ghosh Mondal, Civil Engineering

Poster Number: **41** :: Physical Sciences

Measuring thermal conductivity for CMS detector upgrades

Authors:

Justin Copenhaver, College of Science

Berkley Weyer, College of Science

Grace Roberts, College of Science

Abstract:

The compact muon solenoid (CMS) detector at CERN is currently undergoing numerous upgrades to improve its luminosity and granularity. In order to ensure the new detector works as intended, temperatures must be kept below about -25°C during operation. Meeting this requirement will require building the detector's support structures out of materials with high thermal conductivities so that the heat generated is able to flow out of the detector as quickly as possible. To this end, our group has experimentally measured the thermal properties of materials to be used in the CMS using a steady-state design. In particular, carbon fiber and graphene-epoxy samples have been thoroughly tested. As thermal conductivity is an anisotropic property for many materials, it is necessary to measure both the in-plane and through-plane thermal conductivities of our samples using two different apparatuses. The temperature readings measured by the apparatuses are then analyzed to determine in- and through-plane thermal conductivities.

Research Mentors:

Abraham Koshy, College of Science; Department of Physics & Astronomy

Rafael Lang, College of Science; Department of Physics & Astronomy

Poster Number: **42** :: Life Sciences

Investigating Inhibition of Apoptosis as a Novel Treatment for Retinitis Pigmentosa using a Transgenic Zebrafish Model.

Authors:

Emre Coskun, College of Science

Abstract:

Retinitis pigmentosa (RP) is the most common cause of night blindness, and it affects 1 in 3,500 people around the world. RP can be inherited through many mutations, including the Q344X mutation in the human rhodopsin gene. This mutation causes the truncation of the rhodopsin and causes rod degeneration. To discover a treatment for RP, we use a transgenic Q344X zebrafish model. The Q344X larvae show onset of rod degeneration at 5 days post fertilization (dpf) which progresses significantly by 7 dpf. The extent of diminished vision in the 7 dpf Q344X larvae is assessed with a Visual-Motor Response (VMR) assay. The VMR assay acclimates the Q344X larvae to dim light within larval rod range preceding a dark flash, which does not induce a significant behavioral response. Therefore, the behavioral phenotype of Q344X is due to rod degeneration. Previous studies indicate that degenerating rods undergo apoptosis. Inhibition of apoptosis to decrease rod degeneration is investigated with our model by screening the Selleckhem anti-apoptotic compound library with the VMR assay. The Q344X larvae are treated with these compounds between 5 - 7 dpf. Compounds that decrease rod degeneration would be expected to show an increased behavior in the VMR. All compounds in the library have been screened and analyzed with the VMR assay, and 8 showed an increase in behavior. In the future, the extent of apoptosis in rods will be verified using TUNEL staining of retinal cryosections. Drugs that produce consistent results can be reimplemented toward an operational treatment for RP.

Research Mentors:

Yuk Fai Leung, Biological Sciences, Development and Disease

Logan Ganzen, Biological Sciences, Integrative Neuroscience

Poster Number: **43** :: Innovative Technology/Entrepreneurship/Design

Optimus: A Software Bot For Automated Code Review

Authors:

Noah Curran, College of Science

David Wood, College of Science

Connor Chadwick, Akhil Chinnakotla, Ryan Firestone, Esteban Gorostiaga, ZhiFei Chen, Weiqing Huang, Exploratory Studies, College of Engineering, College of Engineering, College of Engineering, College of Engineering, College of Science

Abstract:

During the software engineering life cycle, code review consumes large amounts of time due to its repetitive nature. Because of this, there is potential for parts of code review to be automated. An existing solution for automated code review, Diggit, currently relies on historical repository mining to determine where defects may exist. Unfortunately, on open source software repositories, only around 51% of code Diggit determined to have an error was changed in subsequent versions. We believe the data Diggit used to determine defects was ineffective, so our solution to this problem is our software bot, Optimus. Rather than using repository mining, Optimus collects user reported defects. This allows the user to customize the specific kind of defects they want the bot to be responsible for finding. In future work, Optimus will look to utilize the data it has collected to train itself to locate code similar to its collected defective code. Furthermore, Optimus has other features that intend to save code reviewers time, including a code style checker and an organized table of code reviewer responsibilities.

Research Mentors:

Yung-Hsiang Lu, Purdue University College of Engineering, Department of Electrical and Computer Engineering

George Thiruvathukal, Loyola University Chicago Department of Computer Science

Poster Number: **44** :: Innovative Technology/Entrepreneurship/Design

Determinants of Successful and Unsuccessful Movies Based on Worldwide Box Office Revenue

Authors:

Francesca De Simone, Krannert

Lucia Quintero, Krannert

Jaron Fay, Varun Gauba, Krannert, Krannert

Abstract:

This study develops predictive models to identify the drivers of success and failure for movies based on worldwide box office revenue. The motivation for this study is that movies are big business and business analytics can help decision-makers design, staff, and create movies that are most likely to be successful. In 2018, the film industry made an estimated $41.7B worldwide, but it is expected more revenue could be gained if resources went into creating the movies most people want to see. Using movie features from 7,398 movies from The Movie Database (TMDB) we developed predictive models that were accurate at predicting revenue, but also interpretable to explain the drivers of successful outcomes, as well as negative outcomes. We discuss our recommendations to movie makers from a business perspective.

Research Mentors:

Matthew A. Lanham, Krannert, Management

Poster Number: **45** :: Life Sciences

Generation of an Endogenous Dominant Negative Allele of *chd5* Using a Novel Homologous Recombination Strategy to Reveal the Role of *chd5* in Tumor Suppression and Neural Differentiation

Authors:

Ellen Denning, College of Agriculture

Abstract:

Chromodomain/ Helicase/DNA-binding (CHD) proteins play several roles in vertebrate development, and loss of CHD5 causes failure of proper expression in a cohort of genes involved in neural development. CHD5 plays a critical role in tumor suppression in humans, and loss of CHD5 contributes to the formation or progression of numerous cancers. To understand how CHD5 plays a role in tumor suppression, it is necessary to understand how CHD5 contributes to normal development and how its normal functions are misregulated during tumor progression. Our lab is establishing zebrafish as model system in which to study the role of *chd5* dependent processes.

We have engineered *chd5* knockout fish using CRISPR-Cas9 technology. The resulting fish do not exhibit any overt developmental phenotypes, and do not produce tumors during adulthood. We hypothesize that the closely related remodelers *chd3/4* function redundantly with *chd5*, and propose to use a novel knock-in approach to generate zebrafish carrying a dominant negative mutation.

To engineer a dominant negative allele of *chd5* we have engineered a homologous recombination (HR) strategy that uses piggyBac transposase technology. This two-step design first introduces a homologous donor carrying the mutation of interest and a fluorescent marker for easy identification. Second, the HR positive fish will be bred with piggyBac expressing fish to seamlessly excise the exogenous sequences, thus leaving only the desired genome modification. We will be able to use PBac to control when and where we express the dominant negative allele of *chd5* and score the resulting fish for developmental and tumor phenotypes.

Research Mentors:

Joseph Ogas, Ph.D., College of Agriculture, Department of Biochemistry

Erin Sorlien, Ph.D., College of Agriculture, Department of Biochemistry

Poster Number: **46** :: Innovative Technology/Entrepreneurship/Design

Selective Condenser for Collection of Glucose from Exhaled Breath

Authors:

Aditya Desai, Engineering

Divya Tankasala,

Divya Tankasala,

Abstract:

Diabetes is a metabolic disease that affects over 29 million people in the United States. The current gold standard for blood glucose management is using a blood glucometer. The painful nature of finger-prick blood collection deters over 67% of patients from checking their blood sugar frequently, leading to complications. Measurement of glucose through exhaled breath is a promising non-invasive diagnostic strategy because of the tight physiological regulation of glucose between lung fluid and blood. Thus, there exists a need for a non-invasive collection device to detect glucose through exhaled breath to improve patient compliance and promote enhanced glycemic control. Simultaneously, findings from this research effort will disseminate new knowledge about lung physiology related to glucose transport in diabetic versus non-diabetic patients. Existing commercial devices that collect exhaled breath condensate to do not separate deep lung air from dead space air, further diluting the measurable glucose in collected condensate. Therefore, selective collection of deep lung air may allow a greater fraction of glucose to be collected from exhaled condensate. The focus of the project was to create a new mechanism to selectively capture deep lung air. This objective was separated into three major sections 1) redesign of the existing device body and valve (originally utilized benchtop air regulator and required a nearby pressurized air source), 2) elimination of sensor output error, and 3) improved condensate fluid collection. The primary objective was to replace the pneumatic valve with an electronically controlled mechanism that was more portable but equally effective. These efforts enable us to characterize the EBC glucose in specific regions of the respiratory tract and determine if differences exist between diabetic and non-diabetic patients.

Research Mentors:

Dr. Jacqueline Linnes, Engineering, Biomedical Engineering

Divya Tankasala, Engineering, Biomedical Engineering

Poster Number: **47** :: Social Sciences/Humanities

Toddler sleep regularity and language skills

Authors:

Myia Dorsey, Health and Human Sciences

Abstract:

Previous studies document a positive relationship between sleep regularity and academic grades in college students and the importance of sleep for language learning in school-age children. However, less is known about how sleep regularity is associated with language learning in early childhood. Previous research highlights several factors can influence early language skills (i.e., gender, maternal education) but it is unclear if the biosocial process of sleep is also a contributing factor.

The present study examined whether sleep regularity contributes beyond the influence of gender and maternal education on receptive and expressive language scores in early childhood. As part of a prospective developmental monitoring study, 47 toddlers completed the Mullen Scales of Early Learning to index receptive and expressive language skills at 24-months. Parents reported infant gender, maternal education, and other demographic details. Actigraphy recorded sleep/wake states (for a minimum of 3 consecutive 24-hour periods) were used to generate Sleep Regularity Index (SRI) scores.

Linear regression (with terms for gender and maternal education) were used to assess the relations between SRI and language scores. SRI scores were not associated with language scores. The covariates of gender ($\hat{I}^2 = .467$, $p < .05$) and maternal education ($\hat{I}^2 = .265$, $p < .05$) accounted for most of the model variance. Overall, the study replicated previous language development research with respect to gender and maternal education. It did not find a robust developmental role of sleep regularity in language development. SRI scores were lower in this young sample and may have contributed to the null findings.

Research Mentors:

A.J. Schwichtenberg, Health and Human Sciences, Human Development and Family Studies

Ashleigh Kellerman, Health and Human Sciences, Human Development and Family Studies

Poster Number: **48** :: Physical Sciences

Muon Spallation in XENON1T

Authors:

George J. Ecconomou II, Science

Tara R. Y. Harmon, Science

Alex Huynh, Science

Abstract:

Our objective is to identify muon spallation in the XENON1T experiment in order to improve the accuracy of detecting dark matter events. Muon spallation is the event in which muons, particles emitted from cosmic ray collisions with the atmosphere, collide with xenon nuclei in the detector, creating large energy deposits in the detector as well as stray neutrons, which go on to further interact with other nuclei. As of now, spallation events are considered background since they may emulate false dark matter detection, which slows our progress of detecting dark matter and impedes the purpose for which the XENON1T experiment was designed. Research into the background caused by these muon spallation events is important because it would presumably allow researchers using the XENON1T detector to more easily differentiate between muon spallation and non-muon spallation events. To make such a criteria for distinguishing muon spallation from other forms of data, the researchers intend to investigate what unique features the energy signatures from muon spallation might contain.

Research Mentors:

Amanda L. Depoian, Science

Rafael F. Lang, Science

Poster Number: **49** :: Innovative Technology/Entrepreneurship/Design

Automation & AI in the Classroom

Authors:

Elliot Edmunds, Engineering

Wenbo Wei, Engineering

Tanvi Bhardwaj, Shu Hwai Teoh, Po Yu Huang, Chieh-En Li, Chien-Hung Wang, Young Jin Jung, Luis Fernando Materon Botelho, Engineering

Abstract:

With the growing size of classes in universities and the increasing demand for online courses, professors and teaching assistants are noticing an increasing burden due to trivial classroom tasks. The goal of this project is to automate these trivial classroom tasks with artificial intelligence. We achieve automatic attendance, engagement, and participation tracking in classrooms by leveraging state-of-the-art facial recognition and pose recognition techniques. Typical users for this system would be higher-level educators with small-medium classroom sizes.

Our end goal is for every classroom to have a webcam attached to a raspberry pi running a lightweight client. All the processing will be done on a powerful server, and the results will be returned to the client once they are available. We accumulate data from a class for the teaching staff to easily view later.

We have been able to correctly and quickly take attendance and identify participation among small class sizes (4-5 students), and are currently working on improving the run-time of server for large classes and large images.

To strengthen the evaluation of participation and engagement level of the students during the class period, the team is also researching various ways to detect the engagement level of students to provide insight to the instructors as to when or in which part of his/her lecture the students show the least interest.

We are working to create a robust client-server infrastructure as the team has transitioned to a client-server model for our product. The goal for this semester has been to design and develop APIs for multiple users to upload selfie videos for training.

We have trained and tested our model with a 16-people dataset and got 97.64 % accuracy for face recognition. We will keep testing our model with a bigger dataset to decide whether we should tune the parameters of the SVM classifier in our model to raise the accuracy rate of face recognition.

Research Mentors:

Mithuna Thottethodi, Engineering, ECE

Poster Number: **50** :: Innovative Technology/Entrepreneurship/Design

Efficacy of Activated Carbon Pitcher Filters in Elevated Benzene Removal

Authors:

Ethan Edwards, Engineering

Abstract:

The Tubbs Fire (2017) and Camp Fire (2018) in California instigated a new type of drinking water disaster. Benzene was detected at levels of 40,000 ppb and 2,217 ppb in the distribution network following the fires, which exceeded the USEPA and California benzene maximum concentration levels of 5 ppb and 1 ppb, respectively. The benzene 1-day USEPA health advisory of 200 ppb and 26 ppb 1-day CAOEHHA levels were also exceeded. After the fire, residents installed in-home water filters in an attempt to make the contaminated water safe, but the county health department warned residents not to rely on these filters. Nine months after the Camp Fire, state guidance claimed activated carbon would effectively remove benzene and other organic contaminants from the water. While in-home activated carbon water treatment devices can be certified in accordance with NSF Standard 53 at benzene levels of 15 ppb to achieve reduction requirements at either 120% or 200% of the filter's rated capacity, they are not certified against heavily contaminated water. For the present study, the performance of three popular in-home activated carbon filters is being evaluated when challenged with elevated levels of volatile organic compounds (i.e., benzene 15 - 1,000 ppb). A Headspace Solid Phase Microextraction-Gas Chromatography method is being utilized to quantify contaminant removal efficiency. Study results will provide a basis for future responses and better understanding of whether in-home drinking water filters should be relied upon to protect the population from heavily contaminated drinking water.

Research Mentors:

Andrew Whelton, Engineering, Lyles School of Civil Engineering

Poster Number: **51** :: Innovative Technology/Entrepreneurship/Design

Reinforcement Learning and Uncertainty Quantification

Authors:

Kadir Efecik, Electrical and Computer Engineering

Kok Xin Tan, Electrical and Computer Engineering

Brett Weyer, Feny Patel, Electrical and Computer Engineering. Electrical and Computer Engineering

Abstract:

Abstract retracted.

Research Mentors:

Guang Lin, Electrical and Computer Engineering

Poster Number: **52** :: Social Sciences/Humanities

The Interacting Effect of Youth and Parent Substance Use on Parent-Child Relationship Quality

Authors:

Alishia Elliott, Purdue University

Abstract:

The family context, particularly the parent-child relationship, predicts substance use (SU) in adolescence (Rusby et al., 2018), and continues to be an important influence on SU in emerging adulthood (Kogan, 2017). Further, parent SU severity is linked to poorer parent-child relationship quality (Velleman & Templeton, 2007). However, youth also affect their parenting context, and which substances offspring choose to use may differentially impact the quality of the parent-child relationship (i.e., youth may behave and engage parents differently when on stimulants vs. depressants vs. hallucinogens). We hypothesized that parent-child relationship quality in emerging adulthood would be poorer when offspring use stimulants or hallucinogens than depressants, and that parental SU would exacerbate these associations. Using data from 775 families (71% male; M=21.89 years old; Tarter & Vanyukov, 2001), we fit a series of moderated regression models separately for mothers and fathers SU/relationship quality; age and socio-economic status were covariates. 318 youth used depressants, 228 used stimulants, and 195 used hallucinogens. There were no main effects of offspring SU types on relationship quality with mothers or fathers. There were two interactions: Only at the highest levels of maternal SU severity, youth who used stimulants had lower mother-child relationship quality compared to those who did not use stimulants (b=-5.82, p=.02). Second, only when father SU severity was high, there was an association of hallucinogen use and poorer father-child relationship quality (b=-5.79, p=.04). The implications of youth SU and parent SU for parent-child relationship quality, as well as maternal and paternal differences will be discussed.

Research Mentors:

Dr. Kristine Marceau, Human Development and Family Studies

Emily Rolan, Human Development and Family Studies

Poster Number: **53** :: Social Sciences/Humanities

Visualization of Opioid Use Disorder and Harm Reduction Availability in the US

Authors:

Soyol Enkh-Amgalan, College of Health and Human Sciences

Abstract:

Thousands of people worldwide die from overdose or diseases caused by opioid abuse that could've been prevented. An emerging model of harm reduction takes a public health position and aims to reduce the harm from drug use rather than seeing it as a moral failure. One of the fundamental principles of harm reduction is based on evidence that interventions are effective, practical, feasible and safe. The existing programs such as Needle and Syringe Exchange (NSP) and Opioid Substitution Therapy (OST) are shown to be effective in reducing HIV prevalence, injecting risk behavior and overdose. Also, these programs don't cause additional harm. Despite the huge body of evidence, the US has been reluctant to harm reduction as it conflicted with the country's "zero-tolerance" policies. Advocacy research is crucial to promote the ability to implement harm reduction in practice. Data visualization could be a convenient tool for advocating the importance of harm reduction. Visual attractiveness, ease of use, speed of comprehensibility, interactivity and online shareability of data visualization promotes public engagement with the issue. This project aimed to develop a visual dashboard that shows opioid-related deaths, HIV prevalence, and harm reduction treatment availability in the US on a county-level. The resulting interactive visualizations intend to ignite discussion among the public and give community-level insights for policymakers and those affected by opioid use.

Research Mentors:

Vetria Byrd, Polytechnic Institute, Computer Graphics Technology

Poster Number: **54** :: Social Sciences/Humanities

Department specific graduate teaching assistance manual: Investigation of best practices

Authors:

Charles R. Enlow, College of science

Ahmad H. Alfoudari, College of Science

Abstract:

Abstract retracted.

Research Mentors:

Franziska K. Lang, College of Science, Chemistry Department

Poster Number: **55** :: Life Sciences

Effects of Salinity on Invasion Success in Freshwater Communities

Authors:

Brittany Farmer, Science

Abstract:

Salt runoff from roads affects our freshwater systems in many ways; both chloride and sodium, the major components of road de-icing salt, are toxic to aquatic life and high levels can impair the survival of aquatic wildlife and vegetation. Salt concentrations may also influence other aspects of the ecosystem, including the invasion of non-native species. In this experiment, two freshwater species were used to study the effects of salinity on invasion. A salt sensitive zooplankton native to North America (Daphnia dentifera) and a common zooplankton invader (Daphnia lumholtzi) were used to simulate an invasion scenario across three salt concentration treatments (0 g/L, 0.75 g/L, and 1.5g/L of NaCl). Because D. dentifera appear to be more sensitive to salt concentrations, it was predicted that D. lumholtzi would be more likely favored to invade the population of D. dentifera at higher salt concentrations. D. lumholtzi and D. dentifera were counted weekly to monitor population density over time. On the day of invasion, densities of D. dentifera were significantly lower in the 1.5 g/L salt concentration when compared to the 0.75 g/L and 0 g/L salt treatments. These differences in D. dentifera densities across salt concentrations diminished by the final sampling day. In addition, there were no significant differences in D. lumholtzi densities or total Daphnia densities between salt treatments by the last sampling day. It was expected that D. lumholtzi invasion would be facilitated by higher salt concentrations, however this experiment contradicted that prediction by ultimately showing no significant differences in D. lumholtzi population densities. Although D. dentifera populations appear relatively resilient to high salinity, the low overall numbers of D. lumholtzi could have limited our ability to observe any significant impacts their invasion had on the populations of D. dentifera. Ultimately, our data could suggest some mechanism of tolerance to high salinity in D. dentifera, perhaps through the uptake of salt or evolved tolerance and that the trajectory of D. lumholtzi populations in invaded communities may not be influenced by salinity.

Research Mentors:

Catherine Searle, Science, Biological Sciences

Poster Number: **56** :: Social Sciences/Humanities

Efficiency of Gun Legislation Internationally and the American Gun Culture

Authors:

Dana Fennell, College of Liberal Arts

Abstract:

What can the U.S. learn from other nations' gun legislation? The purpose of my research was to compare the success of gun legislation in decreasing gun related deaths. Observing studies from countries comparable to the United States in economic, political, and technological power, I found the key to lowering gun related deaths in America is a change in purchasing procedures and access to guns. The United States can quickly and effectively apply new legislation by learning from other nations' attempts to control guns in modern society. Internationally, incidents in Tasmania and Canada show the stark differences and adverse outcomes of the United States enforcement of the Second Amendment. Yemen stands far behind the advancements of the United States, but has the most similar firearm purchasing process. A more elaborate purchasing process, limitation of buyable weapons, and stricter permitting are the best option for decreasing gun violence and deaths in America.

Research Mentors:

Ellen Rochford, College of Liberal Arts, Sociology

Poster Number: 57 :: Innovative Technology/Entrepreneurship/Design

Scaling up Thermal Imaging for High-throughput Phenotyping

Authors:

Grace Filley, College of Engineering, College of Agriculture

Abstract:

Digital agriculture is an increasingly effective and efficient way for farmers, conservationists, and other land managers to use digital technologies for optimizing outputs from their land. This research project analyzes photographs from three different types of cameras to provide high-throughput phenotyping of important crop traits. The goal is to support farmer decision-making by improving crop monitoring and yield prediction. Differences between red, green, blue (RGB), multispectral, and thermal cameras were analyzed and compared using a crop image extraction (CIE) algorithm coded in the programming platform MATLAB. This is the first in a 3-step data processing pipeline: 1) Crop Image Extraction, 2) Vegetation Indices Derivation, and 3) Data Mining. To start the pipeline, thousands of photos were taken from cameras mounted on an unmanned aerial system flying over a soybean field in Romney, Indiana. The photos were then stitched together, forming orthomosaic images (images geometrically corrected to a uniform scale) of the entire field. Both the orthomosaic and original aerial images were uploaded into the algorithm and segmented to increase the contrast between plant and non-plant pixels. The midpoints of plot boundaries were determined, and lastly, those midpoints were used to extract the crop image. Integration of the thermal camera data is proving difficult, as the initial images show little to no definition. Additionally, the thermal camera has only one spectral band, while the multispectral camera utilizes 4 and the RGB camera utilizes 3. This difference required experimenting to find the best fit for upload into the CIE algorithm.

Research Mentors:

Keith A. Cherkauer, College of Engineering and College of Agriculture, Agricultural and Biological Engineering

Stuart D. Smith, College of Engineering and College of Agriculture, Agricultural and Biological Engineering

Beichen Lyu, College of Engineering and College of Agriculture, Agricultural and Biological Engineering

Poster Number: 58 :: Life Sciences

Isotopic Analysis of Sugar-Starch Extractions

Authors:

Jared Foeppel, College of Science

Abstract:

Nonstructural carbohydrates (NSC) play a key role in how plants grow and respire; however, there have been many struggles to accurately measure NSCs. Two important forms of NSCs are sugars and starches. Analyzing stable isotopic signature of carbon in sugar and starch can give insight into the effect of changing environmental conditions on plants. To accurately examine the stable isotope signature of the NSCs, the sugars and starches must be separated through a chemical extraction process. We tested a process to separate sugars and starches in plant leaves. We conducted two sets of method validation experiments. The first set consisted a mix of sugars only and a pure starch. The second run consisted of a mixture of sugar and starch. The first set of runs was used primarily to see if the chemical extraction process would affect the carbon isotope value of either the starch or the sugar. The second run was used to see if the chemical extraction process was successful at separating the sugar from the starch and if there was an effect on the isotopic values. The results from both runs showed that there was an insignificant effect on the starch isotopic value; however, the value of the sugar was off by around 0.5 per mil. The results from the second set showed that the sugars and starch were successfully separated; however, the starch concentration after extraction was unusually low. More testing remains to be done to validate the sugar and starch extraction process for isotopic analysis.

Research Mentors:

Dr. Jani Sparks, College of Science, Department of Earth, Atmospheric, and Planetary Sciences

Dr. Lisa Welp, College of Science, Department of Earth, Atmospheric, and Planetary Sciences

Poster Number: 59 :: Social Sciences/Humanities

Neural sensitivity to reward among individuals with non-clinical psychosis

Authors:

Davis Giffin, Science, Health and Human Sciences

Abstract:

Schizophrenia is a mental disorder that affects around 1% of the population, and is characterized by positive (e.g., hallucinations), negative (e.g., flat affect), and disorganized (e.g., disorganized speech) symptoms. About 5% of the general population experience psychotic-like experiences with symptoms not severe enough to meet the threshold for diagnosis of a psychotic disorder. Literature in individuals with psychotic disorders suggests deficits in monetary reward processing, but less work has been done on monetary reward processing of people with subclinical psychotic symptoms; this study looks to address this gap. Electroencephalogram (EEG) records the electrical activity in the brain, and can be measured at specific events in time (i.e. event-related potentials (ERPs)). Commonly studied ERPs in reward processing are contingent negative variation (CNV), a neural component in anticipation of an upcoming target stimulus and reward positivity (RewP), which is a component elicited following receipt of reward. Participants completed self-reports to measure presence and severity of their negative, positive, and disorganized traits. This study was done to examine the relationship between psychotic-like traits with RewP and CNV. It is hypothesized that negative symptoms will correlate most strongly with the ERPs, which would suggest negative symptoms potentially driving deficits in reward processing. Preliminary results indicate that all symptoms have a higher correlational value with RewP compared to CNV, which suggests anticipation of potential reward remains intact, while consumption of rewards may be broken.

Research Mentors:

Dr. Dan Foti, Psychological Sciences, Health and Human Sciences

Sam Buck, Tim Stump, Keisha Novak, Health and Human Sciences, Health and Human Sciences, Health and Human Sciences

Poster Number: **60** :: Innovative Technology/Entrepreneurship/Design

Professional Golf Analytics: Predicting & Improving Player Performance

Authors:

Theo Ginting, Krannert School of Management

Nathan Ebikwo, Krannert School of Management

Matthew Kusno, Dawson Mcmahon, Anirudh Suresh, Krannert School of Management, Krannert School of Management, Krannert School of Management

Abstract:

We develop a model that predicts a professional golf players performance hole-to-hole and compare our model to the popular strokes gained measure, which measures the decrease in average strokes to hole relative to an average golfer. The motivation for our study is that sports analytics is on the rise especially in revenue-generating sports such as professional golf, because sports betting is being legalized in many states and less taboo. We canvassed the academic literature and found little research has been performed to understand professional golf performance and evaluate the usefulness of popular metrics used by golf commentators such as strokes gained (Broadie, 2012). Our study provides novel insights in regards to the drivers of player's on-course performance and how a sports investor or player might use our model to identify player success.

Research Mentors:

Matthew Lanham, Krannert School of Management

Poster Number: **61** :: Mathematical/Computation Sciences

Improving Design Lab Safety using Computer Vision

Authors:

Ethan Glaser, Engineering

Moiz Rasheed, Engineering

Seungjoon Rhie, Taher Dohadwala,Amogh Shanbhag,Xiangyu Zhang,Wenxi Zhang, Engineering,Science,Engineering,Engineering,Science

Abstract:

Person re-identification (re-id) and vectorization, also known as directionality, are relevant to current multi-camera networks in lab-safety applications. Before important human-behavioral data can be ascertained from video streams, person directionality must be accurately determined and people must be re-identified in order to create seamless paths across video streams. Many existing re-id solutions appear to only be focused on scoring high mean Average Precision (mAP) values on re-id datasets, and current vectorization models are only trained on close-up, high-resolution images. These solutions have little to do with real life applications and have yet to be implemented into a single, cohesive program for a live multi-camera network. Our method expands upon both vectorization and re-identification by combining both features into a single application that gathers the data necessary to determine how a space is being used. The implementation of re-identification increases the potential of vectorization by analyzing multiple angles of the same person in an overlapping camera-network. The re-identification method adds resilience for misclassifications by incorporating various methods of checks and balances. The combination of re-identification and vectorization is evaluated on a dataset from footage of Bechtel Innovation and Design Center's (BIDC) heavy machinery workshop. The system is evaluated on the error of the determined vectorization angle and the accuracy of the re-identification across multiple cameras. Our re-identification method re-identifies people correctly in our test footage 87.64% of the time. The results from the vectorization algorithm are within 10 degrees of the predetermined ground-truths for each person evaluated. These results are high enough to instill confidence in our system to collect reasonably accurate data in a controlled lab setting.

Research Mentors:

Dr. Yung-Hsiang Lu, Computer Engineering

Dr. David Barbarash, Horticulture and Landscape Architecture

Poster Number: **62** :: Innovative Technology/Entrepreneurship/Design

Using Predictive Analytics to Find Forever Homes for Sheltered Pets

Authors:

Nicolas Glesing, Krannert

Mark Schneider, Krannert

Jacob Watkins, Julianne Hughes, Yaonan Deng, Krannert, Krannert, Krannert

Abstract:

We use predictive analytics methods to predict how likely a sheltered pet is to be adopted using a posts pet description and visual image of the pet. The motivation for this study is two-fold. First, there are millions of pets that need a home and being able to predict what drivers about the ad or image lead to them finding a forever home is paramount. Secondly, while our research focus is on pet adoption, our methodology could be extended to many other business areas. For example, retailers provide images of their products along with product descriptions. Using our predictive analytics design they could follow a similar approach to better word-smith their product descriptions and showcase their products which could lead to increased business performance.

Research Mentors:

Matthew A. Lanham, Krannert, Management

Poster Number: **63** :: Innovative Technology/Entrepreneurship/Design

Title: A MATLAB-based 5G wireless channel simulator based on NYUSIM

Authors:

Alexander Gokan, Electrical and Computer Engineering

Godfrey Walker, Electrical and Computer Engineering

Benjamin Holewienko, Electrical and Computer Engineering

Abstract:

5G communication system reduces waste of energy by transmitting information directly from a transmitter to the geographically pinpointed receivers. We can determine the optimal implementation of 5G networks in a particular environment, by creating a parameter driven testbed using the channel modeling software NYUSIM, one of the industry-leading channel simulation softwares that is publicly available. By providing a testbed to determine the optimal 5G network setup for a particular environment, 5G solutions can be tailored to any location of interest. Our team will write a MATLAB script that will interface with NYUSIM to run the channel simulator multiple times across a finite set of related signal and environmental variables. The MATLAB script will have easily tweakable parameters so that many 5G solutions can be modeled. First we will implement the functionality to run and interface with NYUSIM multiple times from a separate script. From there, we will devise a method of generating a range of NYUSIM input sets from specific and modifiable hyper parameters in our own script. Based on the output of the script we can determine the efficiency of the resulting 5G solution given the user's specified hyper parameters. Finally, simple optimization and machine learning algorithms can be used to determine the best frequency, antenna setup, etc. for implementing an optimal 5G network in a region. Any future student who would need to simulate their analytical discoveries will not have to go through the trouble of learning how to navigate NYUSIM.

Research Mentors:

Chih-Chun Wang, Electrical and Computer Engineering

James Krogmeier, David Love, Borja Peleato, Electrical and Computer Engineering, Electrical and Computer Engineering, Electrical and Computer Engineering

Poster Number: **64** :: Physical Sciences

Standing Pattern Affect on Surgeon Pain Development

Authors:

Magdalena Ann Haas, Industrial Engineering

Hussain Saifuddin, Industrial Engineering

Abstract:

There is a large amount of research supporting the conjecture that prolonged standing can have negative health impacts such as discomfort symptoms in the lower extremities. The primary purpose of this study is to test the significance of the relationships between standing patterns and pain development. Data was collected from twenty five different surgeons. They were first asked to fill out a subjective survey regarding their level of pain before surgery. Then, they stood on force platforms as they performed the surgeries. Afterwards, they were queried about their level of pain and the intensity of the procedure. The mat raw data was analyzed to detect the right and left feet of surgeons while operating. The main challenge was to track the feet as the surgeons were not restricted to have specific feet location. The data from the force platforms was used to determine the number of times that the participants shifted, drifted, or fidgeted. It was also used to give a center of pressure for the surgeon's foot throughout the surgery. It was necessary to extract frames where participants stepped off of the platform or external objects were resting on the platform. Approximately, 90% of the data from the force platforms was valid. The image processing algorithm to determine the position and pressure exerted from the foot had to be modified several times to achieve this success rate. Analysis found that there was a significant difference between the nonconforming movements (shifts, drifts, or fidgets) and the increase in lower extremity pain. It also found that there was not a significant difference between the location of the center of pressure and the increase in lower extremity pain.

Research Mentors:

Hamed Asadi, Industrial Engineering

Poster Number: **65** :: Physical Sciences

CORONA Georectification and Landcover Classification across the Arequipa Region, Peru

Authors:

Nicholas Hamp-Adams, Science

Abstract:

In the Arequipa Region of Peru, change in regional landcover through time has not been thoroughly documented. The goal of this project is to use remote sensing techniques to identify different land cover types throughout the region, classify them according to the U.S. National Land Cover Database classes, and model land cover change through time. This semester, the focus was on data from the 1960s and 1970s. The project began with the georectification of 1-5 m2 resolution CORONA data in ArcGIS version 10.7 so that high resolution imagery could be used to accurately identify different land covers throughout the landscape. This was supported by landcover data of the Arequipa Region published by the Peruvian Government. Landsat 1 and 2 data were used to calculate different spectral indices for the region to better highlight areas of high and low vegetation density and to differentiate between barren land and snow alongside the georectified CORONA imagery in order to delineate supervised landcover classification training areas. The classification model was trained and executed with raw Landsat bands, various spectral indices, terrain data, and road density data. The final is a regional landcover classification for 1975 which can be compared with a previous classification of Arequipa for 2005 using the R software version 3.6.0.

Research Mentors:

Zachary Brecheisen, Agriculture, Agronomy

Darrell Schulze, Agriculture, Agronomy

Poster Number: **66** :: Physical Sciences

Annual Modulation of Muons in XENON1T

Authors:

Jiaxuan Han, Science

Tim Houston, Science

Siwen Hu, Marco Iacobucci, Science, Engineering

Abstract:

XENON1T uses a Time Projection Chamber (TPC) filled with 3500kg of liquid xenon and is designed to detect weakly interacting massive particles (WIMPs), which are currently one of the main candidates for dark matter. This experiment looks for dark matter interactions with the xenon in the TPC. It works by measuring the light emitted by various particle interactions using hundreds of photomultiplier tubes (PMTs). However, muon particles will often interact in the detector, leading to a signal in the PMTs, and meaning that the data in that time does not signify a dark matter interaction. The TPC is inside a water tank that uses PMTs to collect Cherenkov light from muons and determine when muons are affecting the TPC. Our team is focusing on the annual modulation patterns in the rate of muon events in the water tank, which would help to filter out a background influence on the experiment. The data recorded by the PMTs show the time of muon events occurring. This study preliminarily measured 16,029,709 muon-like events over the year 2018, which is around 211 muons per hour on average, but the rate is likely to depend on month. In the future, we will compare annual modulation patterns in muon-induced events to annual modulation of atmospheric temperature and pressure. We have acquired this atmospheric data from NASA and will look at annual patterns near the Gran Sasso National Laboratory (LNGS), where the XENON1T experiment is being conducted.

Research Mentors:

Abigail Kopec, Science, Physics and Astronomy

Rafael Lang, Physics and Astronomy

Poster Number: **67** :: Mathematical/Computation Sciences

Dynamic Sparsity Optimizations for Embedded Compilers

Authors:

Nicholas Haythorn, Engineering

Brian Helfrecht, Engineering

Alan Gregorian, Atif Niyaz, Engineering, Engineering

Abstract:

Machine learning (ML) has pervaded into nearly every industry from security to economics to medicine. However, one field that has yet to see a large increase in machine learning technologies is that of small, low power electronics such as wearable electronics or Internet of Things (IoT) devices. Traditional machine learning applications perform billions of computations and therefore require a considerable amount of power to function. Typically, this power draw is a key limiting factor in the integration of machine learning algorithms into portable IoT devices. As such, methods are needed to reduce the number of calculations carried out by a processor. This can be achieved by leveraging sparsity, or the lack of meaningful data produced during the inferencing stage of a machine learning system.

To take advantage of sparsity most effectively, modifications to the LLVM compiler system are being made to identify blocks of ML code that can be skipped in the absence of meaningful data. If the compiler detects a region of code in which register values remain unchanged after several instructions, the region will be marked by the compiler and subsequently skipped by the hardware during execution of the program. Currently, research is being conducted to develop an algorithm to detect sparsity in Convolutional Neural Network code. Upon completion, this project will further the integration of machine learning algorithms on low-power processors and lay a foundation upon which more complex applications for these devices can be executed in the future.

Research Mentors:

Dr. Mark Johnson, Engineering, Electrical and Computer Engineering

Dr. Sam Midkiff, Engineering, Electrical and Computer Engineering

Poster Number: **68** :: Social Sciences/Humanities

Learning Predictive Analytics From The NFL Big Data Bowl

Authors:

Parker Hedrick, Purdue University

Vineel Devalapalli, Purdue University

Conor Sheridan, Zhuoyuan Li, Purdue University

Abstract:

We provide an undergraduate business student's perspective on learning and doing predictive analytics by participating in a challenging Kaggle sports analytics competition sponsored by The National Football League. We discuss the goals of this competition, our approach to predicting how many yards a player will gain after a handoff, and how this problem could be related to other common business problems.

Research Mentors:

Matthew A Lanham, Krannert Business Analytics and Information Management

Poster Number: **69** :: Mathematical/Computation Sciences

Automatic music transcription of monophonic audio recordings

Authors:

Brian Helfrecht, College of Engineering

Abstract:

Musicians often find it difficult to procure sheet music for every song they may want to play. To eliminate this problem, automatic transcription programs can be used to convert audio signals into their component notes. However, most transcription programs use machine learning architectures which can be expensive and time consuming to train and may not support alternate instrument tunings or guarantee that the resulting sheet music can be played by a human. The transcription software developed for this project aims to alleviate these issues by reducing the computational power required for transcription, adding support for alternate tunings, and ensuring playability.

The guitar was selected as the instrument of focus. A monophonic recording was input to the program and decomposed into frequency and amplitude data using a moving window FFT. The data was then smoothed using a windowed threshold filter to remove erroneous frequency values, and the amplitude profile of each frequency was analyzed to determine the times at which it was played. Tablature was created by aligning the resulting frequency data with a frequency map unique to the desired tuning to determine each note’s location on the guitar neck.

Transcription was completed up to 94% faster than existing software with an accuracy of 89% for individual notes and 44% for chords. All tablature produced was playable by a human and could be properly transposed into any specified alternate tuning. The program underperformed in its ability to detect chords and rapidly repeating notes.

Research Mentors:

Chih-Chun Wang, College of Engineering, School of Electrical and Computer Engineering

Poster Number: **70** :: Innovative Technology/Entrepreneurship/Design

Predicting Season Ticket Renewals for a Professional Sports Team

Authors:

Griffin Herdegen, Krannert

Kyle Betelak, Krannert

David Day, Alejandro Isaac, Krannert, Krannert

Abstract:

In collaboration with a professional sports team, we develop a predictive model to identify why season ticket holders renew year over year. The motivation for our research is that professional sports is a billion dollar business. The interesting thing is that in sports, attendance and season ticket renewals tend to be a function of team performance and not necessarily business operational performance (e.g. ticketing, marketing, etc.). Our study is novel in that we identify demographic segments of fans and actions that the club can perform that lead to a higher likelihood of ticket renewal. We discuss from these customers and actions the firm can take to drive the business in a positive direction.

Research Mentors:

Matthew A. Lanham, Krannert, Management

Poster Number: **71** :: Life Sciences

“Reconstitution of Flavivirus Envelope Proteins into SMA Nanodiscs”

Authors:

Hannah Himes, College of Science

Abstract:

Flaviviruses such as Zika, Dengue, etc. have the potential to infect 3.1 billion people each year, and continue to spread rapidly due to a lack of effective and approved antivirals and vaccines. One method of Flavivirus antiviral design currently focuses on identifying and exploiting key virus structural components as drug targets. Two out of the three structural proteins of flaviviruses are membrane-bound and, consequently, are difficult to work with outside of their native lipid environment. Thus the ability to study the drug/antibody interactions of these membrane proteins is difficult without using expensive and resource-consuming fully infectious particles. With that, we are currently investigating methods of detergent-free reconstitution of viral membrane proteins into styrene-maleic acid (SMA) copolymer lipid nanodiscs using Kunjin virus (KUNV-a known flavivirus) as a virus model system. KUNV is being used in this case because immature particles have already been purified and stabilized using well-established techniques in our laboratory. We will purify the SMA solubilized proteins for use in Western Blot, Octet Red, and Cryo-EM analyses. This project has the potential to produce novel tools for in vitro study of flavivirus membrane protein assembly processes and protein-protein interactions. Creating these nanodiscs with SMA could also provide something currently unavailable to viral studies-- the first membrane-bound structure of flavivirus envelope proteins outside of whole virus particle reconstructions.

Research Mentors:

Dr. Richard Kuhn, College of Science, Biological Sciences

Conrrad Nicholls, College of Science, Biological Sciences

Poster Number: **72** :: Innovative Technology/Entrepreneurship/Design

Development of Low-Cost, Simplified Humanoid Head

Authors:

Yuta Hoashi, Engineering

Abstract:

In recent advancement of technology, various types of robots have been developed, and humanoid robot is one of them. The purpose of the humanoid robot is to mimic the movement of the human body parts and complete tasks usually done by the human. Out of all the body parts, head is one crucial part to mimic, as the human face has more complicated structure and smaller parts compared to the rest of body parts. By enabling to mimic the heat, the robot is able to display facial expressions through different positions of the facial parts. There has been various researches and projects that have developed the humanoid head that can move facial features and express facial expressions, but most of them are very complicated and/or very expensive to reproduce by others. This project focuses on the simplified, affordable version of the humanoid head, using mostly pre-made products from easily accessible market. The easy set up and manual is developed and provided for the electric and software components for the motors used to control the facial features. Using the emotion recognitionsoftware developed in the lab, the project would allow different signals as inputs and display various designated facial expressions in order to indicate human emotions. By developing this project, more people would be able to replicate the product and use it for their respective purposes.

Research Mentors:

Wonse Jo, Polytechnic Institute, Computer Information Technology

Byung-Cheol Min, Polytechnic Institute, Computer Information Technology

Poster Number: **73** :: Life Sciences

Ranavirus Increases Vulnerability to Predation by Altering Tadpole Behavior

Authors:

Hailea Howard, Science

Abstract:

Within communities, pathogens and parasites have the potential to indirectly influence predator-prey interactions. For instance, prey that exhibit pathology or alter traits (e.g., behavioral shifts) following exposure could be more prone to predation, which is known as parasite-induced vulnerability to predation (PIVP). PIVP has been documented for pathogens with trophic transmission because predators are often critical in the pathogen's life cycle. However, for pathogens without trophic transmission, PIVP can lead to a healthy herds effect, reducing transmission in the system. In this study, we explored whether the pathogen ranavirus (Family Iridoviridae) enhances vulnerability of four species of larval amphibians, Spring Peepers (Pseudacris crucifer), Gray Treefrogs (Hyla versicolor), American Toads (Anaxyrus americanus), and Northern Leopard Frogs (Lithobates pipiens), to two common tadpole predators, larval Green Darners (Anax junius) and adult water bugs (Belostoma flumineum). For each anuran species, we conducted short-term microcosm experiments to assess predation rates on unexposed or exposed individuals to virus. To evaluate whether the change in predator success is mediated by a behavioral shift in ranavirus-exposed tadpoles, we performed a behavioral videography experiment using larval Wood Frogs (Lithobates sylvaticus). The larvae were exposed or unexposed to ranavirus and recorded daily to observe behavioral changes across fourteen days.

For three of the four species, we found that exposure to ranavirus decreased survival rates with Anax by 66 to 77%. However, we did not see the same trend with Belostoma, which indicates that predator identity is important to this interaction. More specifically, the higher efficiency of Anax in capturing and consuming prey, relative to Belostoma, may allow them to capitalize on trait changes induced by virus exposure and enhance the PIVP effect. This study indicates that trait-mediated indirect effects could play a role in creating healthy "herds" in amphibian communities. In our behavioral videography experiment, we found that exposed tadpoles had a 45% increase in percent activity and distance traveled compared to unexposed tadpoles. These behavioral changes induced by ranavirus could increase the detectability of tadpoles by movement-based predators such as Anax. Collectively, our work suggests that behaviorally-mediated PIVP could play an important role in driving the healthy herds effect in amphibian communities.

Research Mentors:

Jason Hoverman, Agriculture, Forestry and Natural Resources

Poster Number: **74** :: Innovative Technology/Entrepreneurship/Design

Virtual Teaching Assistant

Authors:

Shreya Ilango, College of Engineering

Chayaphon Pugkhem, College of Engineering

Abstract:

Advances in AI and accumulation of data have proven to be extremely beneficial to various industries as evident by many automated tasks. We saw the opportunity in education sector for adopting this technology to accommodate the communication between instructors and students in the growing size of classes and enhance classroom experience. This project is aimed to create an AI-powered Virtual Teaching Assistant chatbot (VTA) to aid professors and teaching assistants in answering common questions about assignments, exams and scheduling appointments.

Currently, our VTA is built upon an open-source chatbot engine called “ChatScript” which we use to create a knowledge base for the chatbot. With sufficient amount of knowledge, our current VTA can provide proper responses to student’s questions and schedule appointments. However, it is still not able to understand the nuances in natural language. For instance, our chatbot does not comprehend the question if there are some typos in it. Hence, it occasionally results in undefined behavior or gives irrelevant responses. To solve these issues, we propose to reinforce our bot with AI capabilities in NLP. Integrating NLP models with our chatbot’s ChatScript will help improve its ability to recognize nuances and context of the words which leads to more accurate responses. Thus the main tasks for this semester are:

- To explore and analyze existing pre-trained NLP models that can be applied to our chatbot.
- To determine the most appropriate NLP model for our chatbot.

We delved into different types of NLP models, and compared their performances on various benchmark score such as SQuAD (Stanford Question Answering Dataset). We found that Google’s BERT model resulted with the best performance, regarding its score on multiple tests. BERT’s tensorflow code is also publicly available and compatible with CPU, GPU, and cloud TPUs. We concluded that we will be using this model to empower our VTA’s capabilities. Our plan for next semester (Spring 2020) is to successfully fine tune this model to handle our chatbot question answering task. We also hope to improve other aspects of the chatbot including its server concurrency.

Research Mentors:

Mithuna Thottethodi, College of Engineering, Electrical and Computer Engineering

Poster Number: **75** :: Physical Sciences

Neutron Multiple Scatter Events in Xenon

Authors:

Gozde Iloglu, Science

Nicole Osborn, Science

Ben Gruber, Science

Abstract:

Our group is working on the multiple scattering of neutrons in the Xenon TPC. Neutron multiple scatters are a rare event that occurs from the spallation of neutrons when Xenon atoms in the detector interact with various particles, knocking off neutrons that further interact with Xenon atoms. We are working with the muon data, applying cuts to obtain the multiplicity data. Multiscatter neutrons have characteristics that can be filtered. This research has been explored in previous papers, however, the details about this event are largely undocumented. So far, we have examined the scintillation light yield and charge yield of our data. We expect neutron multiple scatters to occur as nuclear recoils. In order to narrow our search for neutron multi-scatter events, we wanted to only look into events with a nearest muon veto trigger cut. This helped us initially to narrow down the data. In addition, we used the corrected yields because of how PAX interprets the signals from the detector. We have made preliminary cuts to one month's worth of data. We just recently obtained the data needed to complete all the desired cuts which will lead our research into the next steps. We anticipate that this research could help confirm the current models of the detector.

Research Mentors:

Juehang Qin, Science, Physics and Astronomy

Rafael Lang, Science, Physics and Astronomy

Poster Number: **76** :: Innovative Technology/Entrepreneurship/Design

Drone Video Imaging

Authors:

Rufat Imanov, Purdue University

Justin Qualley, Purdue Univerisity

Avanish Subbiah,Katherine Sandys,Oduduabasi Victor, Purdue University(everyone)

Abstract:

Algorithms built to detect and identify objects from drones require datasets of annotated images and video taken from drones. We propose a new drone video dataset designed for person re-identification and segmentation. Existing datasets only tackle parts of this problem and are not designed for the training or testing of low-power computer vision such as could be used on a drone. VisDrone2018 is made up of drone-caught footage and images but is not designed for person re-identification or segmentation. ViPER and MS COCO are capable of training person re-identification and segmentation respectively, but neither have images taken from drones. Our dataset is created by using drones to capture carefully choreographed sequences to emulate real-world scenarios. The scenes feature different lighting conditions, types of people, clothing, speeds, and postures. The footage is captured from a low-altitude viewpoint. The video sequences are labeled with both bounding boxes and per-object segmentation with an emphasis on people. The dataset is evaluated by a comparison with existing datasets that are similar to our dataset. While it is smaller than datasets with significant financial backing such as MS COCO, it is still large enough to represent a variety of situations. The data is further evaluated by training it on existing image segmentation and re-identification algorithms. It is annotated using software and checked by hand to ensure the labels are as accurate as possible. This dataset will help solve new problems with a specific focus on finding and identifying humans in drone footage.

Research Mentors:

Yung-Hsiang Lu, Purdue,Professor of Electrical and Computer Engineering

Poster Number: **77** :: Innovative Technology/Entrepreneurship/Design

A Business Analytics Approach to Identify and Grow Customer Loyalty

Authors:

Jacob Irvin, Krannert School of Management

Cameron Kwieciak, Krannert School of Management

Jonathan Leung, , Alberto Navarro, Spencer Rose, Krannert, Krannert, Krannert

Abstract:

This study develops an approach to predict customer loyalty and target those customers with recommendations that increase their loyalty to certain merchants. The motivation for study is that a business' ability to understand their customers wants and develop productive relationships can lead to increased customer loyalty. Our study provides a business analytics design to this problem by focusing on how a credit card firm could offer their customers promotional recommendations and if done correctly would entice them to visit and purchase from specific merchants. From both the credit card and merchant perspective there needs to be shared benefit. We discuss how to accomplish this.

Research Mentors:

Matthew A. Lanham, Krannert, Management

Poster Number: **78** :: Mathematical/Computation Sciences

Neural Network based stable/unstable classification

Authors:

Meige Jia, Engineering

Peiyuan Li, Engineering

Abstract:

Neural Network based stable/unstable classification is a very wild topic that has been studied by a lot of people. Reinforcement Learning has always been a very popular topic to study because as science continuously grows, people tend to find more methods to train machines to do different types of work. There are two aspects could be considered for this research topic, linear or nonlinear situations. Our research topic only consists of linear situation. For the linear situation, what we are doing is that we randomly generate a lot of data in a wide integer range to fit into the linear module we selected and using the mathematical computing eigen value method to determine whether the data are stable or unstable. Next, we are going to record the results corresponded with the random generated data. Then we are going to apply these data and results to the logistic regression model for the future system training. Eventually, we are going to apply this trained system to predict the stability for our future generated data.

Research Mentors:

Guang Lin, Math

Poster Number: **79** :: Innovative Technology/Entrepreneurship/Design

A Market Basket Analysis Product Recommendation System for Online Retailers

Authors:

Zoe Jordan, Krannert

Arika Flickinger, Krannert

Michael Buchalo,Zhonghui Wu, Erica Liu, Krannert, Krannert, School of Industrial Engineering

Abstract:

We develop a market basket analysis model to predict which products customers will purchase together in their next order given their historical purchasing patterns. This research is important as traditional in-store shopping retailers such as Kroger, Meijer, among others are now developing intelligent product recommendation engines that e-tailers such as Amazon have had for some time. The idea is for retailers to use analytics to recommend what products a particular customer is likely to purchase so if they do not put a likely desirable product in their cart, the retailer can automatically recommend that product to them before they complete their purchase. Consumers regularly forget items they need or they may be unaware of products that are available, so an intelligent recommendation system provides value to both the customer and the vendor. Our study provides a quantitative and cross-validated design to this problem, where we show the business benefits of using the model versus not providing intelligent recommendations.

Research Mentors:

Matthew A. Lanham, Krannert

Poster Number: **80** :: Life Sciences

The Effects of Environmental Copper Exposure on Developing Zebrafish

Authors:

Christina Kaucic, HHS

Abstract:

Copper is an essential metal that is key in many metabolic functions and is a vital cofactor in many enzymes. Copper homeostasis is dually important for optimal health. Excess copper has been associated with minor symptoms such as fatigue, weakness, and memory loss as well as with neurological disorders such as Wilson's disease, Alzheimer's disease and some cancers in humans. Similarly, excess copper has been shown to damage visceral organs and produce abnormal behaviors in multiple fish species including the zebrafish who has a high degree of genome sequence homology when compared to humans. For this reason, the zebrafish is an advantageous model for the study of copper toxicity. In this study, we assessed survival, behavioral alterations, and morphological changes in developing zebrafish. We hypothesized that zebrafish exposed to higher levels of copper during embryogenesis would show signs of increased physiological and behavioral stress. To test this hypothesis, zebrafish embryos were obtained through natural spawning and exposed to a control or one of three experimental groups: 13ppb, 130ppb or 1300ppb (current regulatory concentration in US drinking water) copper. Fish were exposed through 120 hours post fertilization (hpf). Survival was assessed every 24 h and behavioral analysis was performed at 120 hpf using the DanioVision chamber and EthoVision software. Copper caused mortality at 1300ppb and decreased time spent moving as well as decreased counterclockwise rotation frequency at 130ppb ($p<0.05$). Developmental exposure to copper produces dysfunctional locomotor behavior and mortality at concentrations lower than regulatory concentration in US drinking water.

Research Mentors:

Dr Jennifer Freeman, HHS, Health Sciences

Poster Number: **81** :: Life Sciences

Effects of direct fed microbial on calf growth and health parameters

Authors:

Morgan Keirn, Agriculture

Becca Klopp, Agriculture

Abstract:

The most critical time of calf growth and health is prior to weaning, when calves have a lack of sufficient antibody production. Therefore, calves are most susceptible to diseases such as bovine respiratory disease and scours. Our objective was to evaluate if a direct fed microbial would improve growth and health measurements in dairy calves. Holstein bull calves (n=60) in were blocked by body weight and serum total protein and allocated to either the direct fed microbial treatment (DFM) or control treatment (CON). The DFM calves were fed 1 gram of DFM per day in milk replacer and 0.07% (on a DM basis) DFM in starter grain with CON calves receiving the same milk replacer and calf grain without a DFM. Body measurements were taken every two weeks from 0 to 56 d. We observed no treatment differences for body weight or body condition score (P>0.4). Calves on the CON tended to consume more starter grain than DFM calves (P=0.07). Calves on DFM treatment had higher feed efficiency, with less intake and similar gain (P=0.02). No differences for respiratory score or fecal score were observed (P=0.85 and P=0.89, respectively). Total medications used per calf were numerically lower for DFM calves (DFM=0.7 and CON=2.2; P=0.13). Direct fed microbials may aid in feed efficiency in early life of calves; however, did not result in changes in growth parameters. In conclusion, direct fed microbials may be useful to reduce the use of antibiotics in calves with no negative effects on growth or performance.

Research Mentors:

Jacquelyn Boerman, Agriculture, Animal Sciences

Poster Number: **82** :: Social Sciences/Humanities

Commitment Penalty: An Experimental Test of The Effects of Organizational Policies on Parental Leave

Authors:

Navni Kharde, College of Liberal Arts

Natalia Lillie Torrez, College of Liberal Arts

Abstract:

Parental leave policies are a pressing social concern, with mounting evidence that parental leave-taking leads to better outcomes for parents and children, and also that Americans would like to have access to better paid leave policies- but paradoxically, low rates of leave-taking among workers, especially among men. The ideal worker norm suggests that workers should always be available to work, should prioritize work, and be committed to their jobs. Not surprisingly, violations of the ideal worker norm carry consequences in the form of a commitment penalty: workers who take parental leave are seen as less committed to their jobs. This study examines whether the institutional conditions under which parental leave is taken affect perceptions of workplace commitment. We examine what aspects of organizational leave policies minimize the commitment penalty associated with parental leave-taking. Our experimental survey design includes a robust set of policy manipulations that reflect the diverse leave policies that currently exist in the U.S. Based on the above, we hypothesize that: (1) mothers will be viewed as less committed than fathers; (2) workers who take longer leaves will be viewed as less committed; (3) commitment penalties associated with longer leaves will be stronger for fathers than mothers; and, most critically, that (4) commitment penalties will be smaller when leave policies are more supportive. The results of this study will be content-coded participant open-responses which evaluate the decision making behind parental leave and the perceptions surrounding it.

Research Mentors:

Trenton Mize, College of Liberal Arts, Sociology

Poster Number: **83** :: Innovative Technology/Entrepreneurship/Design

Autonomous Aerial Vehicle (AAV) Abstract

Authors:
Young Sun Kim, Engineering
Ho Jung Ryoo, Engineering
Minjun Song, Jongwon Min, Engineering

Abstract:
Today, drones have an overall impact on many industries due to numerous applications that can be utilized for. Our goal in building this drone is to create an aerial vehicle based on open source software with Pixhawk controller that has an ability to do various autonomous tasks. For our drone, Pixhawk controller is used for the flight control and stability. It controls drone's attitude and enables to follow pre-mapped routes. A wireless telemetry system is used to get the current drone status such as rpm and output voltages with gyroscopic view and GPS location for mapping route and current location. Moreover, In order to do image processing and object recognition, a Raspberry Pi is attached to the drone and serves as a slave computer that communicates to the Pixhawk via MavProxy. It runs an algorithm that identifies an object through the camera and tracks it by keeping the object within a specified pixel range. To keep the drone positioned over the object, Raspberry Pi sends command to Pixhawk controller through a serial port. The Raspberry Pi will be running an openCV library in order to access the necessary software.
Facial recognition technology is the most natural biometric technology in security and utilization perspective, and it is becoming very prevalent in our society today in both the private and public sectors. Brining autonomous abilities to this quadcopter can open up limitless possibilities for the interaction of human and machine and further exploration into this realm of technology.

Research Mentors:
Samuel Midkiff, Engineering, Electrical and Computer

Poster Number: **84** :: Innovative Technology/Entrepreneurship/Design

A Study on the Impact of Movements and Audiovisual Feedback of Swarm Robots on Users

Authors:

Jaeeun Kim, Polytechnic

Abstract:

Abstract retracted.

Research Mentors:

Byung-Cheol Min, Polytechnic, Computer and Information Technology

Wonse Jo, Polytechnic, Computer and Information Technology

Poster Number: **85** :: Physical Sciences

Scoping Review of Objective Measurements of Non-Technical Skills in Surgery

Authors:

Ian Kletch, Engineering

Abstract:

Recent literature has shown that non-technical skills (NTS; e.g. situation awareness, decision making, communication & teamwork, and leadership) affect surgical outcomes. Current assessments of NTS rely on self or expert ratings, which can be time intensive or have inherent biases. Objective measurements of NTS using sensing technology may overcome the limitations of subjective assessments. However, there is a lack of a formal review of objective metrics for NTS in the operating room. The purpose of this study was to conduct a scoping review of the literature to identify objective measures of surgeons' NTS in the surgical environment. Articles were collected from five online databases (PubMed, PyschInfo, Compendex, Inpec, and Scopus). Three reviewers completed a title and abstract reviews. One reviewer reviewed all 15,943 articles, another reviewed a random 50% of the articles, and another reviewed 10% of the articles. An article was included if its abstract described objective metrics of NTS and tools to measure them as they relate to surgeons during surgery. Results of this study included an aggregation of the current studies into measurements and associated NTS skills.

Research Mentors:

Denny Yu, College of Engineering, Industrial Engineering

Jackie Cha, College of Engineering, Industrial Engineering

Poster Number: **86** :: Social Sciences/Humanities

The Historical Recreation of Omaha Beach in a Virtual Environment

Authors:

Matthew T Konkoly, Science

Abstract:

Omaha beach is one of the most notorious battlegrounds of the second World War. Not only is it notorious for its casualty rate, but also for the sheer amount of planning and preparation on both sides. The allies with their bombing raids, and false flag operations to sow confusion, and the axis with their formidable Atlantic wall defenses and veteran troops, this was a battle doomed to end violently. And that it did, with almost three thousand allied losses, this was one of the bloodiest battles of World War Two for the American forces. The documentation for this battle has been carefully recorded and expanded upon over the years in many publications. However, the lack of a truly convincing visual representation is apparent. Many films and video games have tried to replicate Omaha beach to varying degrees of success. Films are usually highly detailed and historically accurate, but are only visible to the public in predetermined shots and sequences. Videogames on the other hand have the opposite problem, they are detailed enough and easily explored by the player, but often fall flat in terms of the scale and true historical layout of Omaha. Not to mention the player will find himself dodging bullets while trying to get a good view of the terrain.

To solve these limitations, we have decided to take a hybrid approach to bring Omaha beach to the public as a general purpose, educational, and open source model. With full freedom to explore in a virtual environment, this model will be the ultimate educational tool. Using real-world terrain data that accurately reflects the topographical conditions of 1944, and fortifications as they looked on the fateful morning of June 6th, this project will be the principal recreation of Omaha beach.

Research Mentors:

Sorin Adam Matei, Liberal Arts, Undergraduate Research

Poster Number: **87** :: Life Sciences

Toxicity of lead and atrazine mixture using the larval zebrafish model system

Authors:

Anusha Kotapalli, College of Health and Human Sciences (HHS)

Abstract:

Lead (Pb) and atrazine are hazardous environmental toxicants that can exist as a mixture in potable water. Pb exposure happens through pipes of plumbing systems in households built before 1986. Atrazine is a runoff herbicide applied to cornfields. Numerous single-chemical studies on Pb and atrazine support adverse health outcomes, including neurotoxicity, but mixture studies are limited. We hypothesize that Pb and atrazine mixtures result in a greater than additive toxicity, causing increased adverse health outcomes than single chemical exposure using larval zebrafish. The Environmental Protection Agency set the maximum contaminant level for drinking water of Pb to 10 parts per billion (ppb) and atrazine to 3 ppb. The sublethal concentrations used were 3 ppb atrazine, 30 ppb atrazine, and 100 ppb Pb, which are environmentally relevant concentrations. Zebrafish embryos were exposed from 1-hour post fertilization (hpf) to 120 hpf with single chemical exposures and mixtures. Toxicity was evaluated with larval behavior at 120 hpf using a light/dark behavioral routine on the Noldus DanioVision to determine if exposure changes behavior. Data collected were analyzed with analysis of variance (ANOVA) and post-hoc test (Î±=0.05). Preliminary behavioral data showed a trend towards increased movement in the 30ppb atrazine/100ppb Pb mixture group compared to other mixtures and single chemical exposure groups. This suggests hyperactivity at higher concentrations; however, more replicates are needed. In the future, toxicity will be assessed by measuring morphological parameters, including head length, head width, body length, and brain length to confirm the presence of a greater than additive toxicity effect.

Research Mentors:

Dr. Jennifer Freeman, HHS, Health Sciences

Poster Number: **88** :: Innovative Technology/Entrepreneurship/Design

2D Microscopy Image Analysis and Segmentation

Authors:

Kalika Lacy, Electrical and Computer Engineering

Rui Wang, Electrical and Computer Engineering

Shutao Wang, Electrical and Computer Engineering

Abstract:

The purpose of this research is to create a software tool that identifies biological segments such as nuclei and microtubules in fluorescent cell images by using U-Net, a convolutional neutral network (CNN) designed for biomedical image segmentations. CNN is a deep learning model that uses pre-trained weights, the likelihoods of detecting the desired target, to automatically analyze an input image and perform object segmentation. The current strategy medical professionals use to identify and track the number of biological segments is being completed by hand. This can be expensive. Due to this reason, the project's main objective is to create a cell identification tool that would make the process more efficient by developing a traditional CNN with transposed convolution to improve its accuracy in image segmentation. The project started with using CellProfiler, a biological image analyzer software, in order to understand how biological identification generally worked. Before creating a cell identification classifier, intensive research on image processing and analysis and machine learning had to be completed. The biological segments tool would be trained with an accurate dataset of 200 labeled fluorescent cell images taken by a well-known university. The end goal for the project is to discover an algorithm that would be able to identify all desired segmentations of a specific object in an image in less than 500 milliseconds, with above 75% accuracy. The cell identification tool will be beneficial for biological research field and reduce the time required for cell identifying, tracking, and counting for medical professionals.

Research Mentors:

Dr. Edward Delp, Electrical and Computer Engineering

Dr. Carla Zoltowski, Electrical and Computer Engineering

Poster Number: **89** :: Innovative Technology/Entrepreneurship/Design

Earth History Visualization-Data Mining Abstract

Authors:

Eric Langbert, College of Engineering

Abstract:

Understanding data is important for researchers to better develop and identify trends. The Data Mining Team of the Earth History Visualization Vertically Integrated Project is adding additional display options that allow the user to view data from different angles. The specific data we are focusing on is the number of stable isotopes present on Earth in the past millions of years. Users of our program have previously only been able to display a column graph that shows the amount of certain stable isotopes (Oxygen-18, Carbon-13, Strontium) over time. We are now adding the option for users to display and analyze the rate of change of these isotopes over time in a column graph. For example, more Oxygen-18 on Earth has aligned with cooler global temperatures, and warmer temperatures have been accompanied with lower oxygen levels. Users can see this trend by displaying amount of Oxygen-18 vs time, but how can sharp changes in Oxygen-18 be further examined, and why is it important? Displaying rate of change will show sudden shifts in the amount of oxygen present. Although our program examines rate of change over millions of years, using rate of change can show us the effect of global warming. We can find similarities between past changes in oxygen with current changes in temperature, and draw connections that can be tied to global warming. The addition of rate of change is a step towards the right direction in helping researchers, scientists, and companies explore past trends to plan for the future.

Research Mentors:

Abdullah Khan Zehady, Computer Science Doctoral Program

James Ogg, Aaron Ault,

Poster Number: **90** :: Life Sciences

Partial NMDAR agonist D-Cycloserine does not facilitate safety discrimination or the acquisition and consolidation of fear extinction

Authors:

Caitlin Lee, Health and Human Sciences

Abraham Escobedo, Health and Human Sciences

Abstract:

Individuals with posttraumatic stress disorder (PTSD) have difficulty regulating their fear responses in the presence of non-threatening cues. Previous research has shown that D-Cycloserine (DCS), a partial NMDA receptor agonist, can facilitate the acquisition and consolidation of fear extinction in rodents and has been shown to facilitate exposure therapy in patients. However, it is unclear if DCS is facilitating discrimination between fear and safety or is affecting non-discriminative fear extinction. The purpose of this study was to examine the effects of DCS in male Long Evans rats during a fear, safety, and reward cue discrimination conditioning task, as well as its effect on fear extinction. It was hypothesized that DCS would facilitate discrimination between a fear cue paired with a mild foot shock and a combined fear+safety cue presented without a shock, and this facilitated discrimination would then facilitate subsequent fear extinction. We found that DCS did not facilitate safety discrimination when it was administered 30 minutes before training, as well as having no effect on subsequent fear extinction. We then investigated if DCS would facilitate the acquisition and consolidation of fear extinction in non-discriminative fear learning based on prior research. To assess the effects on acquisition versus consolidation, DCS was administered after fear conditioning, either before the first round of fear extinction training or immediately after. In neither case did we see improved extinction retention. Based on our results, DCS does not facilitate the acquisition or consolidation of non-discriminative fear extinction.

Research Mentors:

Dr. Susan Sangha, Department of Psychological Sciences, Purdue Institute of Integrative Neuroscience

Poster Number: **91** :: Mathematical/Computation Sciences

Reflectance and Transmittance Simulator Development for Multi-Layer Thin Film Structures.

Authors:

Changkyun Lee, Purdue University

Abstract:

To understand working principles, structures and properties of TPV system, Stanford Stratified Structure Solver (S4) was used. This resource guided independent learners to go through the process of simulating the reflections and transmittance off a thin film or multi film layers using S4. And, S4 data were compared to analytical expressions model done by MATLAB for single or multi-layer reflection and transmittance. This helped determine the accuracy of analytical model by data comparison. Then, the analytical model was compared to experimental data to determine the optical dispersion of samples. The data obtained could then be compared to relevant prior experiments as a sanity check, although an exact match is not expected. After all these works were done, a simple tool was built to assist in performing this procedure with future samples having similar geometries and testing conditions. This could be done in Python due to compatibility to apply to develop GUI. And, then a GUI (Graphical User Interface) could be added in Rappture workspace, which is a toolkit supporting Rapid application infrastructure, designing it quick and easy to develop powerful scientific applications.

Research Mentors:

Peter Bermel, Electrical Engineering

Ze Wang, Electrical Eneineering

Poster Number: **92** :: Physical Sciences

Examining Proton-Proton Collisions with Final Dilepton States

Authors:

Daniel Lense, College of Science

Bruce Senter III, College of Engineering

Nolan Kruger, College of Science

Yao Chen, College of Science

Abstract:

The work of this research team aims to draw conclusions that either support or object the physics of the Standard Model using data from CERN's Compact Muon Solenoid (CMS) detector within the Large Hadron Collider (LHC). Our analysis is primarily focused on the dilepton events of proton-proton collisions that arise from top-antitop quark pairs, wherein we can examine Δφ, the azimuthal angle between these leptons. From this variable, we define the asymmetry in Δφ, a quantity that is especially sensitive to new particle physics, for further inspection. Specifically, we are looking to employ various statistical techniques, such as principal component analysis and hypothesis testing, in order to support or counter the notions of Supersymmetry, a leading theory of new particle physics.

Research Mentors:

Amandeep Singh Bakshi, Department of Physics and Astronomy

Rafael Lang, Department of Physics and Astronomy

Poster Number: **93** :: Life Sciences

Genetic Control of Flowering Time in Interspecific Grapevine Families

Authors:

Hannah Levengood, College of Agriculture

Abstract:

Flowering, likely a complex trait in grapevines, is controlled by both genetic and environmental factors. Although the effects of the environment on grapevines have been widely studied, the genetic control of flowering has rarely been examined in vines used in breeding programs in North America. A better understanding of the genetic control of flowering time can be useful in developing grape cultivars that are adapted to the changing climate. We studied two grapevine populations, one that descends from an early flowering species (V. rupestris B38 x Horizon' (RH); 151 vines) and one that descends from a late flowering species (Horizon x V. cinerea B9 (HC); 127 vines). Our analyses in the RH population indicate that the onset and end of bloom are highly heritable, while the length of the blooming period has low heritability, indicating that the latter trait is influenced by environmental factors. From composite interval mapping, two significant Quantitative Trait Loci (QTL) for the end of bloom were identified on chromosomes 5 and 19 explaining 15.6 and 8.8% of the phenotypic variation, respectively. Compared to 2018, the bloom period in 2019 was unusually wet and cool. It is likely that additional replicates of flowering time data will be required to re-confirm results. Additional results from the HC population will be presented in the poster.

Research Mentors:

Bruce I. Reisch, Cornell University, School of Integrative Plant Science

Avinash Karn, Cornell University, School of Integrative Plant Science

Poster Number: **94** :: Life Sciences

Effect of a Human Microbial Consortium Grown with Complex Fibers on the Mouse Gut Microbiome

Authors:

Laura Libera, Colleges of Engineering and Agriculture

Abstract:

Awareness of the importance of microbiomes to human health and wellness has been increasing, including interest in how they recover from stresses. A consortium of bacteria was grown in vitro for one week with daily transfer from human fecal matter, and this consortium was orally gavaged into mice for a 6-week elimination study of the microbes transferred into the mice's microbiomes. The treatments for the mice consisted of prebiotic (sorghum arabinoxylan, SAX), probiotic, and symbiotic treatments with some groups also receiving an antibiotic treatment prior to the main treatment. Stool samples were regularly collected throughout the experiment and GC mass for linkage analysis and GC for SFCA were performed, both on the original consortium and the stool samples. The consortium showed distinct separation between the days. The microbiomes treated with antibiotics were less resilient than the other groups and the female microbiomes appeared to be more easily influenced.

Research Mentors:

Steven Lindemann, Agriculture, food science

Tianming Yao, Agriculture, food science (graduate student)

Poster Number: **95** :: Physical Sciences

Catalytic Diazocine Synthesis Using a Dinuclear Nickel Catalyst

Authors:

Jianheng Ling, Agriculture

Abstract:

Diazocines are attractive photoswitches, as compared to their azobenzene counterparts, in that they possess superior photophysical properties. Despite their valuable properties as photoswitches, there have been few efficient synthetic methods to date for their synthesis. Using a redox-active dinuclear nickel catalyst, that has previously been shown to catalyze azide coupling reactions, this study aims to develop an alternative method for the synthesis of various diazocine photoswitches in a redox-neutral pathway. The effects of bridge length, heteroatom incorporation into the bridge, as well as electronic effects on the photoswitching behaviors of diazocines are currently being explored in this work.

Research Mentors:

Christopher Uyeda, Science, Chemistry

John Andjaba, Science, Chemistry

Poster Number: **96** :: Social Sciences/Humanities

Personality Profiles of Women in Relationships Involving Men with Pathological Personality Features

Authors:

Katherine Lucas, Health and Human Sciences

Abstract:

Relationships involving people with antisocial (ASPD), borderline (BPD), and narcissistic (NPD) personality disorders are known to be distressing to partners. There is a relative dearth of research, however, into the personalities of the partners of people with ASPD, BPD, and NPD. Understanding the personality traits of these partners can have implications for treatment of maladaptive relationships. The current study examines the personalities of women in relationships with men with ASPD, BPD, or NPD. We sampled 601 women (ages 18-70) from an online support group. Participants completed measures of normal range personality traits, extreme ends of personality traits, and partners' personality disorder features. We found that our sample of women were significantly more agreeable than the average person. We also conducted a latent profile analysis. Using one measure of normal personality, we found 4 personality profiles that are consistently high on agreeableness and conscientiousness but vary on neuroticism and extraversion. Using a different measure of normative personality traits, we found 5 personality profiles that were consistently high on agreeableness but ranged from high to low on neuroticism and conscientiousness and from high to maladaptively low on extraversion. Using a different measure of normative personality traits, we found 4 personality profiles that were consistently high on agreeableness but ranged from high to low on neuroticism, extraverstion, and conscientiousness. Our results suggest that that there are several different personality profiles of women who find themselves in a relationship with men perceived as high in maladaptive personality features.

Research Mentors:

Susan South, Health and Human Sciences, Psychological Sciences

Doug Samuel, Health and Human Sciences, Psychological Sciences

Poster Number: **97** :: Life Sciences

Milk fatty acid changes through the transition period in dairy cows

Authors:

Emilee Ludwick, Agriculture

Abstract:

Milk fatty acid changes through the transition period in dairy cows.

E.J. Ludwick, T.S. Steckler, J.P. Boerman

Milk fat is synthesized in the mammary gland from either de novo milk fatty acids (FA;<16 carbons in length) or the uptake of preformed FA in circulation (>16 carbons in length) in dairy cattle. Mixed FA are 16 carbons in length can come from either de novo synthesis or taken up from circulation. Due to negative energy balance in early lactation where the energy demand exceeds energy intake, increases in preformed milk FA from adipose tissue are likely present. The objective of the study was to determine changes in the milk FA profile of dairy cows through early lactation until 60 days in milk (DIM). The study utilized thirty-two multiparous, Holstein cows that were enrolled in the study. Milk samples were taken on d 2, 9, 15, 22, 30, and 60 of lactation. The milk FA from each sample were analyzed by gas chromatography. De novo synthesized milk FA were highest at 60 DIM and lowest at 9 DIM (P<0.0001). Mixed FA were highest at 60 DIM and lowest at 15 DIM (P<0.04). Preformed FA were highest at 9 DIM and lowest at 60 DIM (P<0.0001). In the future, milk FA may be used as an indicator of energy status of the cow with changes in profile indicating a change in energy status of the cow. Additionally, as we continue to understand the bioactive properties of individual milk FA, the profile of FA that we feed both to calves and to humans has increasing focus.

Research Mentors:

Dr. Jacquelyn Boerman, Agriculture, Animal Sciences

Tabitha Steckler, Agriculture, Animal Sciences

Poster Number: **98** :: Innovative Technology/Entrepreneurship/Design

Developing/Implementing Training Tools/Videos to Help Users Learn Web-based Systems

Authors:

Sara Lynch, Krannert School of Management

Ruoxi Zhang, College of Engineering

Abstract:

CATME support has two functions, answering questions and creating secondary materials that our customers can access such as: videos, FAQ's, and other training tools. Developing these tools requires extensive research and work to ensure that the final product will help the customers with any additional questions they might have. It is important to have a well rounded knowledge of CATME to ensure that our videos and training materials cover enough to allow customers the ability to use our product better. The implementation phase has more implications due to the fact that we wish to implement these tools so that as many people as possible can view it. We find that numerous customers are unaware of the fact that we have a second website that includes our FAQs and youtube videos. However once customers, mainly instructors, have been made aware that these resources exist there is an increase in the amount of views and a decrease in customer support questions.

Research Mentors:

Dan Ferguson, College of Engineering, Engineering Education

Ohland, Matthew W, College of Engineering, Engineering Education

Poster Number: **99** :: Mathematical/Computation Sciences

Dislocation velocity in Fe-Cr-Al using MD

Authors:

Raven Maccione, Engineering

Abstract:

Fe-Cr-Al alloys are extensively used in the nuclear reactors due to their enhanced mechanical and physical properties. This has motivated researchers to study dislocation mediated deformation mechanisms in these alloys. In this work we have looked into the motion of edge dislocations under applied shear stress, in a BCC Fe13%Cr9%Al alloy using Molecular Dynamics (MD). We have created an edge dislocation dipole with two anti-parallel dislocations having

burger's vector a[111] and a[Ì„1 Ì„1 Ì„1] and gliding on parallel (1 Ì„10) planes. The distance 22

between the planes of the two dislocations are sufficiently large to minimize any elastic interaction between them. Critical Shear stress of 300 Mpa applied along the [111] direction made the edge dislocations mobile. The dislocations exhibit characteristic stick and slip motion over certain length along their line. This shows that the alloying elements impede dislocation motion and lead to more strengthening. We have calculated velocity of the dislocations at different applied shear stress (300 Mpa, 400 Mpa and 500MPa) and temperatures (300K and 400K). We have further calculated mobility of the dislocations at the specified temperatures. At 300K, we have obtained a mobility of 4.866 e-5 and we expect this value to increase with an increase in temperature. The mobility values thus obtained can be used in Dislocation Dynamics (DD) simulations to study dislocation interactions and their effect on strengthening.

Research Mentors:

Anter El-Azab, Engineering, Materials Engineering

Sanjoy Kumar Mazumdar, Engineering, Materials Engineering

Poster Number: **100** :: Social Sciences/Humanities

Developing a Growth Mindset in Purdue Underclassmen With Respect to Professional Development

Authors:

Kushaal Manchella, Engineering

Motinuolu Orederu, Engineering

Obinna Udoyeh, Engineering

Abstract:

During the course the 2019 fall semester, our team presented to first year engineering students on job search and professional development where we found that the majority of these students tend to assume that they are unable to secure an internship in their field of choice. Thus our research is focused on understanding the problem of lack of involvement of freshmen in professional development. Our goal is “To positively impact the professional development of first year students at Purdue by identifying the barriers faced by these students.

In order to achieve this goal, we have designed a survey which is geared towards understanding different first year student’s experiences thus far in college as well as analyzing how these experiences have shaped their current opinions on career development.Furthermore, we aim to conduct interviews on different categories of survey candidates that will be determined upon further data analysis of responses to our survey. In this way, we create an avenue to interview survey participants to better understand their survey responses.

In conclusion, we believe that understanding the issue is the first step in enabling first year engineering students to reach their career goals. We aim to use our data to find the major root causes of lack of involvement of freshmen in career development and at the very least create a platform that will be used to solve this issue.

Research Mentors:

Carla Zoltowski, ECE, Engineering Education

Poster Number: **101** :: Physical Sciences

Muon Spallation in the XENON1T Experiment

Authors:

Christopher Manilla, Engineering

Donovan Trzybinski, Sciences

Abstract:

In the process of attempting to detect dark matter, the XENON1T detector often records events resulting from muons passing through the detector. The data from these events are thrown out, limiting the amount of useful data the XENON1T experiment can collect. By more closely analyzing these events, the research group may be able to recognize spallation events from muons. By identifying these events, we attempt to take the next step to identify which elements the muons are spallating with most often. This would be done by comparing estimated energies of events with those of the decays of elements that compose both the TPC and the water tank of the XENON1T. These are the elements that the muons would likely be interacting with. This information could be of value in further improvements in data collection and the overall accuracy of said data for the XENON1T experiment.

Research Mentors:

Juehang Qin, Sciences, Physics and Astronomy

Rafael Lang,

Poster Number: **102** :: Innovative Technology/Entrepreneurship/Design

Data Analysis and Visualization on Delayed and Cancelled Flights

Authors:

Natalie McGuckin, Polytechnic

Abstract:

In 2018, according to the U.S. Travel Association, 1.1 trillion dollars was spent by travelers in the United States of America. Winter break travelers account for a large amount of the economy. Delays commonly occur because of weather, security, and maintenance. This project specifically focuses on cancellations and delays since these commonly occur for travelers. There have been visualizations in the past made for departure vs delay data, average delay time data, and flights made by carrier, but visualizations for winter break cancellation and delay data have not been made. The research question that this project addresses is: What are the cancellations and delays for winter break travelers? D3.js and Tableau will be used to create visualizations conveying the findings for cancellations and delays for winter break travelers. Expected outcomes for this research project include making predictions for the next year in order to reduce unsatisfactory travel.

Research Mentors:

Dr. Vetria Byrd, Polytechnic

Poster Number: **103** :: Physical Sciences

GUI and Report Creation for the ADEPT-m MATLAB Toolbox

Authors:

Kathleen McLarty, College of Engineering

Yoonkyu Na, College of Engineering

Litao Xu, Ruby Wellen, Can Zhang, Jagan Krishnasamy, College of Engineering, College of Engineering, College of Engineering, College of Engineering

Abstract:

As part of the effort to use more renewable energy sources, it is important to understand how to make photovoltaic cells more efficient. A MATLAB toolbox, a Device Emulation Program and Toolbox (ADEPT-m), aids researchers in modeling and simulating customized solar cells depending on a variety of characteristics inputted by the user. Although ADEPT-m is a very powerful and robust tool, it can be confusing to navigate and understand. It is difficult to use due to the extensive amount of input variables, and the results can be difficult to comprehend because the relevant data is not compiled in one place. Therefore, we want to develop a way to make the program more user-friendly. Our goal is to design a Graphical User Interface (GUI) and a report such that any user, regardless of their experience with MATLAB, can easily use ADEPT-m to design and analyze photovoltaic devices. We are working on making the existing build button within the GUI compatible with the analysis. We are also adding a function that will create a report summarizing the information from the ADEPT-m. It will include at least, but not limited to: input data, steady-state plots, and basic properties of the solar cell. As a result, the GUI and report will increase the ease of simulation by reducing the need to enter every MATLAB command, thereby allowing a wider range of users to use this tool.

Research Mentors:

Jeffery Gray, College of Engineering, School of Electrical and Computer Engineering

Poster Number: **104** :: Social Sciences/Humanities

Provider/Patient Shared Decision-Making and Opioid Prescribing

Authors:

Leroy Medrano, Health and Human Sciences

Abstract:

Abstract retracted.

Research Mentors:

Cleveland Shields, Health and Human Sciences, Human Development and Family Studies

Poster Number: **105** :: Life Sciences

Characterizing the interactions of an abiotic-stress related protein in Arabidopsis thaliana.

Authors:

Marina Mehling, Honors College, College of Engineering, College of Agriculture

Abstract:

Abiotic stresses such as drought, heat, ultraviolet (UV) radiation, and cold pose as significant threats to crop health and the sustainability of global agriculture. Various proteins are upregulated during plant response to abiotic stresses, but the exact mechanisms of several of these proteins are still unknown. One such unknown protein is senescence-related protein (SENR). This study investigates the potential interacting partners of SENR to hypothesize its role in the stress-response behaviors of model plant Arabidopsis thaliana (A.th). A yeast two-hybrid assay was performed with SENR bait plasmids against a complete cDNA library of A.th. The purification, extraction, and sequencing of positive colonies resulted in 36 identified protein-interactors. Of these results, eleven were specifically cited in literature for their involvement in abiotic stress response. Interactions of interest include protein phosphatase C1 (AP2C1) which negatively regulates mitogen-activated protein kinases in stress responses, heat shock family proteins, and MYB-family transcription factors which negatively regulate UV stress response. Observations made during a seed analysis of SENR mutant A.th plants supports the yeast two-hybrid interaction which suggests SENR regulates A.th stress response to UV-B light by trapping MYB-family transcription proteins in the cytoplasm. Characterizing SENR's function in vitro contributes to the global knowledge of A.th biology and the potential for its metabolism to be engineered to produce plant lines that are less susceptible to abiotic stresses.

Research Mentors:

Dr. John Dyer, USDA-ALARC Plant Physiology Department Head

Poster Number: **106** :: Social Sciences/Humanities

Exploring maternal responsivity within parent-mediated interventions for children with elevated autism risk

Authors:

Megan Morris, Health and Human Sciences

Allyson Broadstreet, Health and Human Sciences

Abstract:

For families raising children with, or at elevated risks of an autism spectrum disorder (ASD), caregivers frequently report elevated levels of stress, depression, and/or endorse elements of subclinical autism-like features. Elevated social difficulties are not commonly reported in mothers. However, recognizing current field standards for training mothers as therapists within parent-mediated interventions (PMI), understanding the associations between observed and reported maternal social behaviors may be important to identify mothers who may require additional support/scaffolding when implementing an intervention.

The present study expands our understanding of maternal responsiveness within an ongoing PMI by examining (1) whether mothers report social responsiveness difficulties at enrollment, (2) whether responsiveness during play increases following an eight-session intervention, and (3) associations between play-based and self-reported responsiveness. As part of an ongoing PMI, six mothers (Table 1) completed the Social Responsiveness Scale (SRS) at enrollment. Home visit recordings of play interactions pre- and post-intervention were rated for maternal responsiveness using an established scale. Overall, mothers reported an average SRS T-Score of 53.67 (Range: 41-71), which falls within the normative range (Figure 1). To assess responsivity pre- to post-intervention, a repeated measures ANOVA revealed a significant increase in responsiveness, $F(1,5)=62.24$, $p=.001$ (Table 2). To examine associations between self-report and play-based responsivity, we conducted a series of linear regressions. No significant associations were observed. In sum, the present study provides a preliminary examination of maternal responsivity within PMI contexts. Future studies should build upon this study by examining other caregiver variables (e.g., stress; depression) that may impact PMI effectiveness.

Research Mentors:

AJ Schwichtenberg, Health and Human Sciences, Human Development and Family Studies

Carolyn McCormick, Ashleigh Kellerman, Health and Human Sciences, Human Development and Family Studies

Poster Number: **107** :: Life Sciences

Edge Effects on Urban and Rural Forests

Authors:

Breanna Motsenbocker, College of Engineering

Benjamin McCallister, College of Agriculture

Abstract:

Trees that are located on the edge of a forest are exposed to a different suite of environmental factors than trees on the inside of a forest. Edge trees are impacted by environmental factors such as higher exposure to light, wind, and temperature gradients. Other factors include effects from neighboring land depending on type and use. The purpose of this project is to quantify differences in the edge effect on trees in rural settings compared to urban settings. In late summer 2019 we established two urban and three rural research plots in Tippecanoe County. Our hypothesis is edge effects in both urban and rural settings promote higher tree biomass (measured as basal area; BA) and more structurally complex canopies. At each site, we created a 40m x 40m plot which was then gridded into 10m x 10m subplots. We used a Portable Canopy Lidar (PCL) to characterize the canopy structure of the trees. We also recorded inventory data on all trees larger than 5cm in diameter, including species, diameter at breast height (DBH = 1.3 meters from the ground) to calculate basal area (BA), and canopy status. Canopy structure and BA were analyzed as a function of distance from the edge. Previous studies showed a decrease in BA from the edge inward. Preliminary analysis of our data indicates an increase in BA from the edge inward compared to relatively steady measurements in urban and rural sites respectively. PCL data is currently being analyzed to understand edge effects on canopy structure.

Research Mentors:

Brady Hardiman, College of Engineering and College of Agriculture, Environmental and Ecological Engineering and Forestry and Natural Resources

Poster Number: **108** :: Physical Sciences

Annual Modulation

Authors:

Daniel Nguyen, College of Science

Viraj Mantri, Engineering

Ethan Cho, Science

Abstract:

In the search for dark matter particles, the XENON1T Experiment in Laboratori Nazionali del Gran Sasso (LNGS) uses direct detection through a phase time projection chamber (TPC) surrounded by a 10 m water tank that serves as a muon veto. Since the muon veto does not function all of the time, our group has decided to find a trend of when most muons will interact with the water tank over the course of a year; Previous research, including the GERDA experiment, shows a direct correlation between the temperature and the number of events in a day. Muons decay from pions near the stratosphere, but pions experience a probability to interact with air particles but not decay into muons when air density rises. We will use this data over the course of a year to predict the air density's affect on muon annual modulation.

Therefore, our group expects to find a sinusoidal wave of muons and air density per year. With an amplitude of about 5% difference from the yearly average with its maximum in June and minimum in December. The transition from minimized interactions with maximized interactions should have a shallow rate of incline whereas the transition back to minimal interactions should vice versa. This is due to how temperature normalizes over time from hot to cold versus cold to hot.

Research Mentors:

Juehang Qin, Science

Poster Number: **109** :: Mathematical/Computation Sciences

Optimizing a Real-Time Feature Indexing Storage System on Live Video Streams

Authors:

Vina Nguyen, Engineering

Ethan Lee, Science

Abstract:

The problem we are facing is that our real-time feature indexing storage

system has a weak point. The weak point is the driver system which stores the images into the system. This has become the bottleneck of the project and caused the whole system to run slower than we hoped. There are existing systems that are block-based storage systems and use CNN-based object detection. However, the efficiency of these systems storing specific objects were not optimal. Video streams along with their captured features cannot be search able immediately after the video is recorded. Our method is designed to lower the inefficiency issue of storing and indexing live video streams by trying to avoid passing similar frames through a CNN-based object detector and store video frames implemented on a Linux server. By making the stored frames search-able, this lowers the latency of storing frames because we aren't storing multiple frames of the same image. This will enable instantaneous feature-based indexing on live video streams after video streams are captured and processed through object detectors. To evaluate our method, we performed an experiment using public video data sets consisting of cars and people moving as well as stationary scenes. We evaluated the number of frames that could be processed and stored per second, the storage space usage, and the latency. Through experimental results, the system could reach a possible 108 frames per second. Our proposed system, on average, improves the number of processed frames of the base system by 6.8 times. In addition to the frame speed, the throughput of the system is improved by 5.8 times on average.

Research Mentors:

Yung-Hsiang Lu, Engineering, Electrical and Computer Engineering

Poster Number: **110** :: Innovative Technology/Entrepreneurship/Design

Tetherless Remote Control for Bio-Inspired Aerial Robotics

Authors:

BINH NGUYEN, Engineering

Sebastian Quesada, Engineering

Abstract:

Abstract retracted.

Research Mentors:

Prof. Xinyan Deng, Engineering, Mechanical Engineering

Zhan Tu, Fan Fei, Engineering, Mechanical Engineering

Poster Number: **111** :: Mathematical/Computation Sciences

Highly Flexible and Transparent Conductor for Solar Cell

Authors:

Thao Nguyen, Engineering

Abstract:

Flexible and wearable electronic technology has recently gained a significant amount of attention because of its potential applications for life improvement. Application of many existing and nouveau devices, such as electronic skin, human-machine interfaces, and health monitoring sensors, can increase comfort for better user experience. Because the most commonly used transparent conductor in photo-voltaic devices, indium tin oxide (ITO), is rigid and brittle, it cannot be used in flexible devices. Given that, as the wearable electronic and optoelectrical technology grows, the demand for a highly flexible electrode to accommodate human body movement like folding limbs or stretching muscles for such devices emerges. In this paper, a flexible electrode comprising of fused silver nanowires (AgNWs) and a conductive polymer blend having proficient conductivity and high optical transparency has been developed. The solution-processed electrode can be made at low temperature and cost, making it efficient for mass production. After multiple bending and twisting cycles, the flexible electrode film still has a sheet resistance of 24 ohm/sq. and average optical transmittance of 85%. The developed transparent electrode shows proficient flexibility and competent optoelectrical performance compared to commercial ITO, making it a promising candidate for flexible, transparent electrodes in solar cells.

Research Mentors:

Letian Dou, School of Chemical Engineering

Blake Finkenauer, School of Chemical Engineering

Poster Number: **112** :: Innovative Technology/Entrepreneurship/Design

SADD Structures Team Abstract

Authors:

Saketh Nibhanupudi, Engineering

Xianyu Pan, Engineering

Abstract:

Everyday, millions of pieces fly through low earth orbit, and they are often the size of a speck of dust. These pieces pose a significant threat to spacecraft because they can still cause damage due to the speed at which they are flying, but they are not detectable since they are so small. The objective of this program is to develop a shielding structure capable of protecting spacecraft from micro debris traveling at speeds of up to 8 km/s. Different types of shielding design have been used on the ISS and many other spacecrafts for a period of time. However, all current designs are either exceedingly thick or insufficient with regards to shielding performance if implemented outside the satellite. The structure we built consists of Al-Ti spikes, CFRC, Kevlar, Nextel, and aluminum plates protecting the modified circuit/satellite behind it. The relationship between distance of each layers and performance has been studied. Impact under various conditions (projectile mass/ speed) will be simulated and tested both digitally and physically. Damage prediction under each condition is done from simulation and verified through experiments. To investigate the limit of each design, a two-stage gas gun will be used to test the shield. This gun is capable of shooting projectiles at a velocity of 8 km/s, so the shield design can be better optimized after completing testing. The cost benefits of this technology will be significant since the longer lifespan of satellites will save billions of dollars for new and existing space programs.

Research Mentors:

Vikas Tomar, Engineering, Aerospace

Leonardo Facchini, Engineering,Aerospace

Poster Number: **113** :: Life Sciences

Carcass and Meat Quality Traits of Market Weight Gilts Exposed to Gestational Heat Stress

Authors:

Mariah Nondorf, Agriculture

Jacob Tuell, Agriculture

Jacob Maskal, Agriculture

Abstract:

The objective of this study was to evaluate the effects of in utero heat stress on carcass and meat quality traits of market weight gilts. A total of 24 pregnant gilts were blocked by body weight, then 12 of them were exposed to a thermoneutral environment (IUTN) while the other 12 were heat stressed (IUHS) during their pregnancy. Gilts born from IUTN and IUHS (n=10/treatment) were raised to market weight and harvested under standard conditions. At 24 hours postmortem, carcasses were ribbed at the tenth rib and evaluated. The right side loin muscles were sectioned and chosen to undergo either no aging or 7 days of aging at 2°C. Pork chops were cut and used to measure meat quality and oxidative stability over 5 days of retail display. Carcasses from IUHS had significantly lower head and heart weights, compared to IUTN. IUHS had a decreased loin muscle area ($P < 0.05$). The samples that were aged had reduced drip, freezing/thawing, and cooking losses ($P < 0.05$), likely due to the purge lost during the aging process. Warner-Bratzler shear force values were decreased with aging ($P < 0.0001$), as well as in IUTN compared to IUHS ($P < 0.05$). However, temperature and pH decline, color, fatty acid profile, lipid oxidation, and protein denaturation were unaffected by in utero environment ($P > 0.05$). These results suggest that IUHS may negatively impact carcass and meat quality traits through having decreased loin muscle area and increased shear force values.

Research Mentors:

Dr. Brad Kim, Agriculture, Animal Sciences

Jay Johnson, USDA-ARS

Poster Number: **114** :: Innovative Technology/Entrepreneurship/Design

Declining Birthrates and the Rising Age of First Time Mothers in the United States of America

Authors:

Katherine O'Brien, Purdue University

Abstract:

For the past ten years, the Birth Rate in the United States has been on a steady decline. In 2018, the birth rate reached the lowest total births in 32 years, sinking the fertility rate across all racial and age groups to an all-time low. With the economy and the job market experiencing upward growth, demographers expected the birthrates to rise as well to meet these demands. Previous researchers have mentioned the recession in 2008 may have played a major role in the decline, but in 2012, the birth rate slowly rose only to nosedive again the following year. The simultaneous loss of able-workers, consumption, and an increasing retired population will place significant burdens on the economy and society as a whole in the United States. This research will focus on the declining birth rates of the United States of America from 2008 to 2018. Observing the trends across all racial groups including Non-Hispanic White, Non-Hispanic Black, and Hispanic, especially looking into financial responsibilities and class distribution. This study will observe trends pertaining to an increase in the age of first-time mothers, monitoring what economic, cultural, and social progressions or digressions may have affected these rates. The data statistics used within this study refer to the national Natality Statistics of the United States made publicly available by the Centers for Disease Control and Prevention and the Pew Data Research Center to answer what social and economic trends may have caused the Birth Rate to drop in the past ten years.

Research Mentors:

Dr. Vetria Byrd, Polytechnic Institute

Poster Number: **115** :: Life Sciences

Design and Synthesis of Pyrazole-Based SHP2 Inhibitors

Authors:

Lauren Orr, Science, Pharmacy

Abstract:

Abstract retracted.

Research Mentors:

Brenson Jassim, Pharmacy, MCMP

Poster Number: **116** :: Innovative Technology/Entrepreneurship/Design

Implementing Design for Test Techniques for System on Chip Extension Technologies

Authors:

Fredric Owens, Engineering

Cole Nelson, Engineering

Xianmeng Zhang, Karthik Maiya, Engineering, Engineering

Abstract:

The Joint Test Action Group (JTAG) protocol is an industry standard serial protocol designed for silicon verification and testing. The current System-on-Chip (SoC) developed by the SoC Extension Technologies (SoCET) team over the past several years currently does not support this standard. One common application of a JTAG module is reading and writing a chain of shift registers, known as a scan chain, connected to the SoC's core, which is otherwise difficult to access. Interacting with the scan chain can be used to verify the chip's functionality. The implementation of the JTAG module was developed and tested using SystemVerilog. The testing process utilized sub-module-level SystemVerilog testbenches as well as a top-level testbench for sub-module integration. The testbenches were used to confirm the functionality of the design in both simulation and gate-level synthesis. The JTAG module will allow SoCET partners to more effectively test chips after fabrication through interaction with the aforementioned scan chain. In the future, the JTAG module will permit faster device programming and high-level debugging features via interaction with debugging software like OpenOCD.

Research Mentors:

Dr. Mark Johnson, Engineering, Electrical and Computer Engineering

Dr. Matthew Swabey, Engineering, Electrical and Computer Engineering

Poster Number: **117** :: Innovative Technology/Entrepreneurship/Design

Older Drivers' Self-perception on Manual Driving: A Systematic Review

Authors:

Jun Woo Park, Health and Human Science

Abstract:

The fastest growing population is projected to be older adults who are 65 years and older (predicted to be 33 million by 2020). This population also has the greatest involvement with car accidents according to the research, presumably due to age-related declines in functional, cognitive, and visual functions. With the rapid development of autonomous vehicles, these age-related declines may be mitigated, as these vehicles require less drivers' engagement. However, current autonomous vehicles still have limitations and are subject to fail due to many situations (e.g., construction zone), which will require human driver manually takeover of the vehicle. However, it is still uncertain that how older adults' self-perceptions on their driving ability may impact the driving performances after they take over control of the vehicle. Before investigating this research gap, it is critical to first understand how older drivers' self-perception affect their driving performance in manual driving. In the current study, a systematic literature review was conducted with the initial search of more than 2,000 articles, and based on their content and the research question of current study, it was narrowed down to 32 articles for review. Findings from the review suggested that, older drivers rated themselves more positively in terms of driving performance compared to cohorts and discrepancies between their self-perception and driving performance existed when their actual driving ability was measured through driving test (e.g. on-road testing). Results may infer various implications on regulation development for enhancing road safety and potentials for implementing autonomous driving for older drivers' advantages.

Research Mentors:

Gaojian Huang, Industrial Engineering

Poster Number: **118** :: Life Sciences

Nutrient Value Quantification and Evaluation of the Food Pantry Environment

Authors:

Catharine Pickford, Health and Human Sciences

Abstract:

Food pantries are part of the food environment that serve as a resource to “very low food secure,” groups and are therefore a target for improving food security and dietary intake in these groups. The Food and Nutrient Database for Dietary Studies (FNDDS) and National Nutrient Database for Standard Reference (NDSR) (SR 28) are two USDA nutrition composition databases created to quantify the nutrients in foods reported in dietary assessment that may be useful for quantification of nutrients in a food pantry environment. However, their accuracy is unknown in this novel application. This cross-sectional secondary analysis draws from a larger multi-state intervention (Clinical Trial Registry: NCT0356609) and seeks to assess and compare the accuracy of the databases by “grading” the match of the recorded food inventory description with the assigned nutrient database food description. Linear regression will be completed to determine the relationship of database (FNDDS or SR28) with nutrient totals for all foods and by food group while accounting for the accuracy measure. NDSR is expected to be a more accurate match to determining the nutrient values that comprise the food pantry environment because more “raw” or “unprepared” foods are included than FNDDS. By identifying a superior nutrition database for characterizing the nutrients in a food environment, the estimation of nutrient values within the food environment will be improved and provide a baseline from which to create interventions targeted to improve the nutrient environment of food pantries.

Research Mentors:

Dr. Heather Eicher-Miller, College of Health and Human Sciences, Nutrition Science

Poster Number: **119** :: Innovative Technology/Entrepreneurship/Design

Characterization of Iron and Manganese Nanoparticles in the Spark Discharge System to Simulate Welding Fumes

Authors:

Kaushal Arvind Prasad, Health and Human Sciences

Mishael Theis, Health and Human Sciences

Abstract:

Particles in welding fumes contain a large percentage of nanoparticles (<100 nm). These nanoparticles often contain hazardous metals, such as manganese (Mn), chromium (Cr), cadmium (Cd), etc. During the welding process, inhaled metallic nanoparticles can reach the alveolar region and be translocated to different parts of the body. In this study, a spark discharge system (SDS) was used to simulate the emission of metallic nanoparticles during the welding process. The spark discharge was formed in the SDS and it vaporized the materials from the test electrodes. The metal vapor was cooled by the air and formed metallic nanoparticles. Two pairs of test electrodes were made from Fe/Mn alloy and contained 10% and 50% of Mn, respectively. The applied voltage and loading current were maintained to 5 kV and 0.5 mA, respectively. The size distributions of the particles produced from each pair of electrodes were measured using a scanning mobility particle sizer for two hours. The particles were also collected on a mixed cellulose ester filter, which was later analyzed by X-ray fluorescence. The Fe90%/Mn10% electrodes produced more particles (7.73Ã—10^6 particles/cm^3) than the Fe50%/Mn50% electrodes (6.56Ã—10^6 particles/cm^3). The geometric mean diameter of particles from the Fe50%/Mn50% electrodes (54.3 nm) was larger than one from the Fe90%/Mn10% electrodes (43.5 nm). This system will be linked with an in-vitro cell exposure system for further toxicology tests to evaluate the effect of Mn in nanoparticles.

Research Mentors:

Dr. Jae Hong Park, Health and Human Sciences, Health Sciences

Poster Number: **120** :: Social Sciences/Humanities

Co-Op Research VIP

Authors:

Jason Qian, Polytechnic Institute

Megan Kodati, College of Science

Abstract:

Opportunities for professional development are incredibly important to any student's future. College sponsored programs, such as Purdue's Co-Op program help students get valuable work experience and make lasting connections with employers. This research examines the actual vs. perceived benefits of Purdue's Co-Op program in order to better allow the program to best reach out to the people that need it the most, and improve its current programs. In order to best analyze the perceived and actual benefits of the program, we administered a survey targeted at all College of Engineering majors including those in and out of Co-Op, to gain a surface-level understanding of the factors that students felt were significant in them deciding to participate in the program. A key part of understanding the data that this survey will provide, is making sure that the results obtained are representative of the College of Engineering population. To this end, historical data from the Office of Professional Practice and the College of Engineering will be used as an external data source to ensure the validity of our data. Deeper understanding of people that have had strong experiences with the Co-Op program and how their backgrounds contributed to the factors they deemed most important to Co-Op's impact on their life will be gained through 1-on-1 interviews. The information gathered in this research will be used to formulate suggestions on how to improve current Co-Op programs and their outreach to students in need.

Research Mentors:

Professor Carla Zoltowski, College of Engineering, Engineering Education

Poster Number: **121** :: Mathematical/Computation Sciences

Virtual Reality Environment Optimization based on Real Environment Constraints

Authors:

Varun Ramakrishnan, Polytechnic Institue

Krishna Suresh, College of Science

Abstract:

An important issue with Virtual Reality(VR) is fitting the virtual environment to a real-world environment (For example, a user's room might be too small for a given environment). In situations like this, a user might not be able to use the virtual environment since the room they're in has various obstacles and constraints that inhibit the user's virtual movement. This is what my research hopes to solve.

The research project has two primary goals - One, come up with an algorithm, and a program that can effectively simulate and optimize the placement of objects in virtual environments, and Two, optimize virtual environments to fulfill various user-specified, real world constraints. Both of these will be put together into a playable game so that the user can interact with the final product.

Since VR is a relatively new area of study, we will face problems that are completely new - we will attempt to solve these problems to make a valuable contribution to the field in addition to our primary research goal. Our research will have applications in almost every field that includes virtual environments - video games, computer-aided physical therapy, general computer graphics etc.

Research Mentors:

Christos Mousas, Polytechnic Institute, Computer Graphics Technology

Poster Number: **122** :: Innovative Technology/Entrepreneurship/Design

Pothole Detection

Authors:

Nazura Ramli, College of Electrical and Computer Engineering

Aidan Abbott, College of Electrical and Computer Engineering

Krystian Misiewicz, College of Science

Abstract:

Every year, local authorities of the cities around the United States have been facing problems with potholes on the roads. It has been a great concern for road maintenance especially during certain seasons which causes water to be trapped within the soil structure more often. The weight of vehicles passing by the affected area causes the roadway material to disrupt easily especially when the temperature fluctuates above and below the freezing point. This is because water expands when it freezes which leads to larger cracks and hollows. Currently, most major cities provide a website where reports about potholes can be submitted but it is considered inefficient. Our team is working on an autonomous device to detect the potholes which can be mounted on any vehicle. This depth sensor will collect data and update the location of the pothole detected along with its level of severity. Our system will utilize deep learning in analyzing the data provided by the depth sensor. The system will help determine the severity of potholes better since the depth feature of the sensor is not affected by shadows compared to normal RGB object detection. The report regarding the potholes will be sent to the local authorities to better assist the road maintenance team in detecting potholes efficiently and fixing them in a timely manner. Ultimately, this will result in a decrease in the severity of potholes and the amount of time they are left unfixed on the road.

Research Mentors:

Mohammad Reza Jahanshahi, College of Engineering, Department of Civil Engineering

Poster Number: **123** :: Social Sciences/Humanities

Maternal stress and parent-mediated interventions for children at elevated risks for autism

Authors:

Chetana Rao, Health and Human Sciences

Abstract:

For young children developing at-risk for an autism spectrum disorder (ASD), parent-mediated intervention (PMI) models are the current field standard. In training parents as interventionists, it is important to consider parenting factors that may impact treatment efficacy (e.g., parenting stress). However, signs of parenting stress are not typically reported within at-risk PMI studies. Reporting levels of parenting stress within at-risk PMI contexts may be important for identifying parents that may require additional support to optimize intervention treatment effects.

The present study expands our understanding of maternal stress within an ongoing elevated-risk PMI by (1) identifying whether mothers endorse parenting stress at enrollment, and (2) whether symptoms decrease following an eight-session intervention. Sixteen mothers (Table 1), raising children at-elevated risks for ASD, participated in a family routines-based PMI and completed a series of assessments pre- and post-intervention, including the Parenting Stress Index (PSI). The PSI-Short Form is a reliable, 36-item self-report measure with cutoffs for clinically relevant concerns (Figure 1). Overall, mothers reported an average Total Stress Score of 63.3 (Range 28-95), which falls within the no concerns range. To examine parenting stress pre-to-post intervention, a repeated measures ANCOVA was conducted, with terms for infant sex and family income. No significant differences were evident, $F(1,13)=1.27$, $p=0.28$. Unexpectedly, a subtle descriptive increase in total parenting stress pre- to post- intervention was observed (Table 2). Future research may build upon these findings by documenting and targeting sources of stress to optimize child outcomes.

Research Mentors:

A.J. Schwichtenberg, Ph.D., Health and Human Sciences, Human Development and Family Studies

Ashleigh Kellerman, M.S., Health and Human Sciences, Human Development and Family Studies

Poster Number: **124** :: Mathematical/Computation Sciences

Detection of Wheat Spikes using Masked RCNN in a High Throughput system

Authors:

Miguel Rodriguez, Purdue University

Hsiang-En Hsu, College of Electrical and Computer Engineering

Zhengsen Fu, College of Electrical and Computer Engineering

Abstract:

In recent years, machine vision became a powerful tool since it allows researchers to identify objects with different traits from images or even videos. For example, it can detect and segment objects of interest in a determined image. This research analyzes the possibility of using Masked Region Convolution Neural Networks (RCNN) in the field of agricultural research and digital phenotyping. Crops like wheat have a large number of spikes that would be time-consuming to count manually. However, it is a crucial parameter to evaluate the growth condition of this plant. Therefore, counting them with a precise and automated method in High Throughput (HTP) systems are needed. We are now using wheat spikes as the object of interest, and Masked RCNN is one of the machine learning algorithms that best fit our interests to, as a goal, identify and count the wheat spikes from an image correctly. This ongoing research will evaluate the models we trained through Masked RCNN by the parameter called mean average precision. To train the neural network, the training images were acquired from Purdue University's Controlled Environment Phenotyping Facility (CEPF). These images are collected with two types of cameras: RGB and a hyperspectral Visible and Near-Infrared (VNIR). Initially, the wheat spikes in the images are manually labeled for training. After some pre-processing, the images are trained to identify, mask, and label the wheat spikes. It is expected that the Masked RCNN will be relatively accurate, considering the previous success of this method identifying other objects.

Research Mentors:

Yang Yang, College of Agriculture,institute for Plant Sciences

Augusto Souza, : Mohsen Mohammadi, College of Agriculture Institute for Plant Sciences,College of Agriculture, Agronomy

Poster Number: **125** :: Social Sciences/Humanities

Recommended Reads: Diversity in Indiana's Classroom Literature

Authors:

TJ Rosa, Education

Abstract:

Elementary teachers face many challenges in their career in order to improve the quality of education for their students. One way in which they strive to do so is by creating more diverse and representative classroom libraries.

This white paper offers recommendations for the Indiana Department of Education's "Sample Texts by Genre and Grade Span" book list; specifically, it provides suggestions for additional titles and resources to accompany the historical fiction category of the fourth and fifth grade portion of the list. It outlines the makeup of this portion of the list, details some of the problematic content of books included on the list, and then presents possible solutions for creating a more diverse list. Recommended solutions are based on 4th and 5th grade academic standards (see Appendix C) and an analysis of the current list in conjunction with current children's literature offerings and support from experts in the field.

Research Mentors:

Christina Wessel-Powell, Education, Curriculum & Instruction

Poster Number: **126** :: Physical Sciences

Understanding Global Carbon Cycle through Leaf Decomposition

Authors:

Nur Adilah Rosli, Science

Abstract:

Due to its significant impact on global temperature, the carbon cycle has increasingly become an important discussion topic in chemistry classes. However, it is a quite complex system for students to comprehend. We have developed an experiment that would allow students to understand through a hands-on experience of how organic decomposition affects the carbon cycle. In this experiment, students measure the amount of carbon dioxide released from leaf decomposition. The carbon dioxide released was determined from the amount of carbon dioxide uptake by a sodium hydroxide solution with subsequent titration. To calibrate our method, students also measure carbon dioxide uptake directly from dry ice sublimation. In our work, we conclude that carbon dioxide released from leaf decomposition can be measured successfully using this method. On average, we obtain 0.05 g of carbon dioxide released per 1 g of decomposing leaves in a week.

Research Mentors:

Dr. Jon Rienstra-Kiracofe, College of Science, Department of Chemistry

Poster Number: **127** :: Innovative Technology/Entrepreneurship/Design

Image and Printing Group - Minimum Optimal Resolution subteam

Authors:

Cameron Ruggles, Science

Zicong Wang, Engineering

Runjia Shen, Engineering

Abstract:

Abstract retracted.

Research Mentors:

Litao Hu, Engineering, Electrical and Computer Engineering

Jan P. Allebach, Engineering,Electrical and Computer Engineering

Poster Number: **128** :: Innovative Technology/Entrepreneurship/Design

Identifying Drivers of Student Success Using Predictive Analytics

Authors:

Aaron Rush, Krannert

Norman Chan, Krannert

Cat Stouffer, Daniela Mendia-Rodriguez, Krannert, Krannert

Abstract:

In collaboration with a leading educational technology company, we develop a predictive model of student outcomes from a popular common course taught by different instructors having different types of assessments. The motivation for this study is to identify drivers of student success that the instructor or student has control over (e.g. actions) so that future positive actions or interaction recommendations might lead to better outcomes. This study is novel in that many of the features came not only from assessment and exam scores, but also a student interaction with their common online course management system. Our model provides decision-support to the instructor and student in how to maximize a student's grade.

Research Mentors:

Matthew Lanham, Krannert, Management

Poster Number: **129** :: Mathematical/Computation Sciences

Hockey Analytics: The Science of Player Performance

Authors:

Nikolai Saporoschetz, Krannert School of Management

Logan Barr, Krannert School of Management

Cam Wilson, Danielle Lange, Andrew Scheidt, Krannert,Krannert,Krannert

Abstract:

The goal of this project is to build a linear model to predict points per minute on ice or player efficiency for all forwards in the NHL. While many sports have undergone an analytics revolution, hockey has lagged behind due to the fluid nature of the sport. The hockey analytics community has still managed to churn out new measures of player performance over the past couple years such as the Corsi and Fenwick statistics which are used throughout the league. Many teams have begun relying upon these new statistics as measures of player ability without visibility into their reliability of predicting actual player performance. We believe our study provides novel insights into what the most important predictors for points per minute are for forwards in the NHL. And with these insights coaches can begin to use data driven decision making to set lineups or they can improve their current data collection practices to find better measures of player performance.

Research Mentors:

Mathew Lanham, Krannert, Quantitative Methods

Poster Number: **130** :: Innovative Technology/Entrepreneurship/Design

Hummingbird Robot Power Driver Integration

Authors:

Bryce Sasser, Engineering, Purdue University

Carel van der Merwe, Purdue University

Aaryan Raj Rathi, Charlie Geraci, Lander Greulich, Purdue University (all)

Abstract:

The nimble flight of a hummingbird presents one of nature's greatest evolutions for dynamic flight. A hummingbird's wings are quiet, incredibly fast, and maneuverable. Hummingbird-based robotic flight presents one of the newest and greatest challenges facing the future of drones. Apart of Purdue's VIP program, our team is helping design, build, and test a hummingbird-inspired robot. Specifically, we are redesigning the power driver circuit for the motors. The circuit must be optimized for minimal weight, maximum power output, and optimal system inclusion. The system integration work has required designing unprecedented schematics for the power driver. This requires designing both a PCB microcontroller and an H bridge rectifier to optimize the output for driving the DC motors that create lift. This will require optimizing a larger breadboard circuit before scaling down to a size that could fit on someone's finger. After optimization, the power driver circuit must be reintegrated into the hummingbird robot and tested yet again. The project will require both mechanical and electrical backgrounds, challenging our team with a range of senior to freshman students to work together effectively. It will require background knowledge in electrical designing, assembly programming, and mathematical modeling to build this ultimate aerial device. If successful, the hummingbird robot could revolutionize the drone industry with it's incredibly quiet, maneuverable, and fast flight trajectory. Our team is elated to work on such an equally exciting and challenging task for system integration.

Research Mentors:

Xinyang Deng, Purdue University, Associate Professor of Mechanical Engineering

Zhan Tu, Purdue University, Mechanical Engineering

Poster Number: **131** :: Life Sciences

Characterizing histone post-translational modifications in anaerobic gut fungi

Authors:

Makayla Schacht, Science

Abstract:

Fungi are leveraged for many applications given their ability to thrive in diverse environments. For example, anaerobic fungi (phylum Neocallimastigomycota) are native to the digestive tracts of ruminant and hindgut fermenting animals, and are essential for proper digestion in their host organisms. Despite their diversity, many fungi remain understudied partly due to lack of genomic information currently documented. The goal of my work is to characterize the types of histone post-translational modifications and elucidate the roles of these modifications in anaerobic fungi. This knowledge will illuminate gene expression strategies in these cryptic organisms. First, potential histone modifications were predicted by analyzing published anaerobic fungal genomes that are taxonomically similar and comparing their histone sequences. Many of the fungi that were compared contained conserved histone regions and are expected to exhibit similar modifications. We are corroborating these predicted modifications by western blotting and mass spectrometry analyses. I have improved upon a novel method to isolate nuclei from anaerobic fungi by using Neocallimastix sp. Gf-ma to prototype my methods. Future work includes identifying the putative histone methyltransferases and histone deacetylases in these organisms, which are critical for manipulating gene expression. This work may identify novel epigenetic and genetic engineering strategies for gut fungi. This could be useful in optimizing their abilities such as increasing expression of secondary metabolites, which could be used as precursors for medicines or biofuels.

Research Mentors:

Dr. Kevin Solomon, Engineering, ABE

Casey Hooker, Engineering, ABE

Poster Number: **132** :: Physical Sciences

Effective Mass Determination of InAs/InP Quantum Well with a Variable AlInAs Top Barrier

Authors:

Matthew Schulz, Science

Abstract:

The effect of an alloy top barrier of varying thicknesses on the electron transport properties of an InAs/InP heterostructure was examined. The Shubnikov-de Haas (SdH) Effect is a well-documented result within the Quantum Hall Effect due to the depopulation and repopulation of energy sub-bands, causing oscillations in the electron transport properties of the Hall bar as a function of magnetic field. These SdH oscillations thus appear in the longitudinal resistance of the Hall bar, which can then be examined at several different temperatures to find the effective mass of the electrons in the sample. By taking several different SdH oscillations in the longitudinal resistance at different temperatures for four different top barriers (3nm, 5nm, 7nm, and 9nm), a relationship between top barrier thickness and effective mass can be constructed. As the top barrier was increased, the effective mass of the electrons was found to decrease. This is due to bending of the energy levels in the InAs quantum well due to the placement of the chemical potential energy of the top barrier. This allows for tunability in the effective mass of the sample, which can be used to put materials into a topological regime (a regime of much interest in some applications of quantum computing).

Research Mentors:

Prof. Michael Manfra, Science, Physics and Astronomy

Poster Number: **133**:: Life Sciences

High-throughput screening for novel therapeutics of epilepsy via inhibition of veratridine-induced Nav1.2 activation in dye-loaded HEK293 cells.

Authors:

J. Marshall Shafer, Pharmacy

Maria Olivero, Pharmacy

Abstract:

Voltage-gated sodium channels in neuronal and cardiac cells play an important role in action potential initiation and propagation. Mutations in the gene encoding sodium channel 1.2 (Nav1.2) have been implicated in autism, epilepsy, and other neurodevelopmental and neuropsychiatric disorders. Non-selective inhibitors of sodium channels such as phenytoin and carbamazepine have been used to prevent and treat seizures; however, their side effect profiles are undesirable due to off-target effects. The aim of this study was to high-throughput screen for novel therapeutics that specifically inhibit Nav1.2 as a treatment for epilepsy.

Voltage-gated sodium channels in neuronal and cardiac cells play an important role in action potential initiation and propagation. Mutations in the gene encoding sodium channel 1.2 (Nav1.2) have been implicated in autism, epilepsy, and other neurodevelopmental and neuropsychiatric disorders. Non-selective inhibitors of sodium channels such as phenytoin and carbamazepine have been used to prevent and treat seizures; however, their side effect profiles are undesirable due to off-target effects. The aim of this study was to high-throughput screen for novel therapeutics that specifically inhibit Nav1.2 as a treatment for epilepsy.

Human embryonic kidney cells (HEK293) transfected with Nav1.2 were loaded with a fluorescent dye responsive to changes in membrane voltage potential. Fluorescence was measured using the Hamamatsu FDSS plate imager in Purdue Institute of Drug Discovery. Nav1.2 was activated using veratridine. Various concentrations of known inhibitors (phenytoin and carbamazepine) were then used to inactivate the channel and elucidate dose-response curves for baseline control. IC50 values were obtained and consistent with the literature. Well-to-well consistency of the plates was assessed and a Z' value of 0.69 determined the assay was suitable for high-throughput screening. Initial screening has been performed and inhibitor "hits" have been identified. Future studies will utilize this assay to screen additional chemical libraries. Inhibitors can be rescreened for selectivity for Nav1.2 among other sodium channel isoforms to determine structural characteristics responsible for activity and selectivity. Selective Nav1.2 modulators have potential for treating epilepsy with fewer cardiac and neurological side effects.

Research Mentors:

Dr. Yang Yang, Pharmacy, MCMP

Poster Number: **134** :: Mathematical/Computation Sciences

Efficiency of MobileNet & MorphNet Algorithms

Authors:

Enes Shaltami, Engineering

Abstract:

Abstract retracted.

Research Mentors:

Rih-Teng Wu, Engineering, Civil Engineering

Poster Number: **135** :: Innovative Technology/Entrepreneurship/Design

Estimation of Tree Diameter at Breast Height Using Close Range Stereo Photogrammetry

Authors:

Yezhi Shen, ECE

Nick Ellopoulos, ECE

Abstract:

Abstract retracted.

Research Mentors:

Yung-Hsiang lu, ECE

Keith E. Woeste, Agriculture, Forestry and Natural Resources

Poster Number: **136** :: Life Sciences

A role of microgliosis in the neuropathology of prolonged seizures

Authors:

Kevin Shim, Science

Abstract:

The purpose of this study was to understand the relationship between microgliosis and epileptogenesis. There is a suspected link as microgliosis increases drastically during epileptogenesis. PLX3397 was used to inhibit the Colony stimulating factor 1 receptor (CSF1R) which are present in microglial cells. By inhibiting CSF1R, which downstream regulates proliferation and survival, PLX3397 can reduce microgliosis. This was done to see the effect of microglial cells on epilepsy. Four test groups were used, Control+Veh, Control+PLX, SE+Veh, and SE+PLX. After inducing epilepsy in some male rats using the pilocarpine model of SE, select rat groups were given PLX3397 in their chow for 3 weeks. Tissue samples were taken at 3 weeks. Behavior (novel object recognition, and Barnes maze) were taken from day 13 to day 20. IBA1 and CX3CR1 were used to mark microgliosis. GFAP and C3 were used to mark gliosis. We found that PLX3397 treatment reduced microglial cells in the hippocampus, PLX3397 treatment reduced SE-induced changes in GFAP levels, but not in C3 levels, and PLX3397 treatment did not affect learning or memory in control or SE rats. Although PLX3397 can reduce microgliosis using by inhibiting the CSF1R, there is another unknown pathway that still affects epileptogensis. The results support the idea that microgliosis is a result of SE pathology, not a step in it.

Research Mentors:

Season K. Wyatt-Johnson M.S., Health and Human Sciences

Alexandra L. Sommer M.S., Stephanie Lam B.S., Amy L. Brewster Ph.D, Department of Psychological Sciences

Poster Number: **137** :: Social Sciences/Humanities

Promoting Reading Motivation in an After-School Program

Authors:

Megan Smit, Health and Human Sciences

Abstract:

The purpose of this study was to discover whether the introduction of two novel reading materials would improve reading motivation at an after-school community center in a disadvantaged neighborhood. The study presented elementary school children separately with two novel reading materials: Choose your own Adventure books and graphic novels. The study tracked the amount of time needed for the child to begin reading after arriving and the child's attitude towards the task and then compared these results with data prior to introducing the new materials. For the first few weeks after the introduction of each new material, the children began reading more quickly and exhibited an increased motivation to read. After the initial novelty of the material wore off, most children took a similar amount of time to begin reading as before the new material was introduced. In general, the children were more motivated to read the graphic novels than the Choose your own Adventure books. From these results, the study tentatively concludes that children are more motivated to read novel materials and books that are more visually appealing. Based on this study, educators and parents might implement a variety of visually distinct and appealing reading materials when working with children and seek to introduce new books when possible.

Research Mentors:

Jason Ware, Honors College

Poster Number: **138** :: Innovative Technology/Entrepreneurship/Design

Earth Remote Sensing of Soil Moisture using I-Band Signals of Opportunity on a UAV

Authors:

Eric Smith, College of Engineering

Leo Li, College of Engineering

Grace Ulmer, College of Engineering

Ji Woon Nam, College of Engineering

Nadeem Siddique, College of Engineering

Renaissa Ghosh, College of Engineering

Joeseph Bushagour, College of Engineering

Kai Wilson, College of Engineering

Abstract:

Soil moisture measurements, with penetration into the root zone (20cm-100cm), are of interest to farmers and hydrologists trying to predict floods or droughts. Soil moisture can be estimated through remote sensing, however previous remote sensing instruments use L-band or higher frequencies, which only penetrate the top 5 cm of soil. These frequencies are used to avoid band allocation restrictions and radio frequency interference. Utilizing Signals of Opportunity for remote sensing allow lower frequencies to be used, which increases the penetration depth of the measurement. This instrument utilizes Signals of Opportunity (SoOp) in the I-Band to estimate soil moisture from an Unmanned Aerial Vehicle (UAV). Direct signals from ORBCOMM communication satellites are received by the antenna on top of the drone, while the same signal is reflected off the ground and received by the antenna on the bottom of the drone. A Software Defined Radio is used to record both signals and store them for processing.

Keywords: Remote Sensing, Unmanned Aerial Vehicle (UAV); Software Defined Radio (SDR); Soil Moisture; Signals of Opportunity (SoOp)

Research Mentors:

James Garrison, Engineering, AAE

Jared Covert, AAE

Poster Number: **139** :: Life Sciences

DAC

Authors:

Hyunoh Song, Purdue University

Abstract:

Abstract retracted.

Research Mentors:

Jacob Covey, Purdue University, Electrical Engineering

Poster Number: **140** :: Mathematical/Computation Sciences

Software implementation of Alamouti codes for wireless multiple-input/multi-output (MIMO) communication systems.

Authors:

Locchanan Sreeharikesan, Engineering

Liren Wang, Engineering

Abstract:

Title: Software implementation of Alamouti codes for wireless multiple-input/multi-output (MIMO) communication systems.

Space-Time Block Codes (STBCs) are encoded the bit strings over multiple different antennas (thus space) and over multiple time slots (thus time). Specifically, in STBCs multiple copies of the data are sent in order to combat channel fading, one of the most detrimental effects in a practical wireless environment. Alamouti Code is one of the most widely used STBCs and the only one to achieve the full-rate bit rate of 1. 5G and Beyond due to the increasing focus on multiple input, multiple output (MIMO) multi-antenna communications.

A python simulation will be used to verify the efficiency of Alamouti codes in a wireless communication system. Plots comparing the signal to noise ratio (SNR) to the symbol error rate (SER) and IQ constellation of the sent and received signals will be generated by realistic computer-based simulations. When implementing the simulation, first a BPSK system will be created as a baseband system with no noise with 2 transmit antennas and 1 receive antenna. Next complex-valued noise will be added to the system. After noise is added, the symbols will be modulated to a carrier frequency and then demodulated. Finally, the same process will be applied to a BPSK system where the Alamouti codes are applied. The new software implementation will allow future students to better understand the channel estimation problem and the ubiquitous importance of STBC in modern wireless communications.

Research Mentors:

Chih Chun Wang, Engineering, ECE

Poster Number: **141** :: Innovative Technology/Entrepreneurship/Design

Generation of Physically Accurate Virtual Image Dataset for Detection of Unsafe Behaviour in an Indoor Environment

Authors:

Siddharth Srinivasan, Electrical and Computer Engineering

Uday Thapar, Electrical and Computer Engineering

Youngsik Yoon, Andrew Liu, Alex Xu, Nobelle Tay, Peter Huang, Vaastav Arora, Science, Science, Electrical and Computer Engineering, Electrical and Computer Engineering, Science, Science

Abstract:

Recent applications for computer vision have been driven by the desire to prevent accidents. However, current data-sets are in-sufficient for training the models and it is not possible to recreate these accidents to generate a large data-set of real images. Moreover, the collection and annotation of images from the real world is time-consuming, labor-intensive, and error-prone. Therefore, researchers are using virtual images to overcome these challenges. In the past, people have used open-world games such as GTA V and 3D modeling engine such as Sim4CV to generate those image data-sets. Most of those tools are focused on generating outdoor images and lack the focus on physically correct aspect - our problem involves mostly indoor images and requires them to be not only visually realistic but also physically correct where the light leaving and collected by the “camera” obeys the law of conservation of energy. In this paper, we present an approach to create a virtual data-set for detection of unsafe behaviour in an indoor environment. We will use Blender 2.8, a free and open-source 3D computer graphics software tool-set, to generate the images. This method allows the creation of physically accurate images that could be annotated automatically by the models. For the evaluation of our model, we will first train an optical flow model with our newly created virtual data-set. Further, we will validate our model using a real image data-set. The results will be evaluated in terms of a model trained off our virtual data-set and some real images compared to a model trained on the real data-set alone. The model trained with the virtual and real data-set is expected to be more accurate and outperform the model trained with only the real data-set model.

Research Mentors:

Prof. Yung Hsiang Lu, Electrical and Computer Engineering

Ryan Dailey, Electrical and Computer Engineering

Poster Number: **142** :: Life Sciences

Utilization of a sensitive Î²-lactamase reporter assay to screen for drugs which inhibit Ebola entry

Authors:

Hongyu Su, College of Pharmacy

Caroline B Plescia, College of Pharmacy

Abstract:

The previous Ebola virus disease outbreak has been a significant life-threatening medical challenge. The current treatment has not been developed sufficiently for Ebola virus infection.

The previous 2014 Ebola virus (EBOV) outbreak demonstrated the challenge of combating this life-threating pathogen. Still, there are no FDA-approved therapies to treat the virus leaving both the U.S. and global populations vulnerable in the event of another outbreak. Although the previous studies showed that antibody-based therapy has been shown to be effective in a small population, the cost of antibody treatment is enormous and established drug-based therapy is significantly limited. Therefore, there is an unmet medical need to which our research caters: repurposing FDA-approved compounds for use as anti-viral therapies against EBOV discovery of novel compounds which inhibit EBOV entry and screen for potential additive or synergistic antiviral effects in novel combinations. To approach these objectives, we plan to utilize two main anti-EBOV screening assays and a cytotoxicity orthogonal screen; confirmed drug and combinatorial hits will be followed up with target validation. I have focused on optimizing one of the two anti-EBOV screening assays: the Î²-lactamase-reporter based EBOV entry assay.

Research Mentors:

Robert V Stahelin, College of Pharmacy

Poster Number: **143** :: Mathematical/Computation Sciences

Analysis of open-source dataset for plant classification using convolutional neural networks

Authors:

Hardi Sura, Agricultural and Biological Engineering

Abstract:

Deep learning offers opportunities for identifying plants with varying level of accuracies using supervised classification methods. The supervised classification methods require large quantities of properly annotated training images to render effective results, which is a major challenge due to high procurement cost and time needed for acquiring training data. In this study, three publicly available datasets of plant images were combined to form a collective dataset of 28,042 images spanning over 23 classes of plants. This dataset was used to train, validate, and test a PyTorch based supervised deep learning model by employing transfer learning and convolutional neural networks (CNNs). The transferability of the model and learned features were further analyzed by testing the trained model over 54 selected web images of plants corresponding to the training set classes. The model resulted in over 96% accuracy when tested on a subset of images from the created dataset, whereas it resulted in less than 20% accuracy when tested on the images procured from the web. The results suggest that factors such as similar plant families, growth stages, part of the plant covered in the image and image quality can influence the performance of deep learning models and need to be accounted for, through comprehensive training data.

Keywords: Plant classification, deep convolutional neural networks, precision agriculture, PlantCLEF, transfer learning

Research Mentors:

Dr. Dharmendra Saraswat, College of Engineering, Department of Agricultural & Biological Engineering

Benjamin Hancock, College of Engineering, Department of Agricultural & Biological Engineering

Poster Number: **144** :: Innovative Technology/Entrepreneurship/Design

Image Processing For Bacterial Colony Count

Authors:

Yuichiro Suzuki, Engineering

Ryan Madden, Engineering

Anirudh Gupta, Shutao Wang, Shreyas Iyengar, Engineering, Engineering, Engineering

Abstract:

Bacterial colony count is a fundamental step to access the cell numbers in samples which are widely used from biology to clinical settings. Conventional methods range from manual count to using dedicated colony counter. While dedicated counter is convenient, it comes with a steep cost so in many laboratories, manual count is still performed This work aims to develop a batch of image processing algorithms to count and analyze phenotypic and statistical information in an automated fashion. Current counting methods are either expensive, not efficient or time consuming with high chances of error while counting. This study was conducted to replace these laborious and error-prone manual counting with an efficient and accurate automated counting method. The algorithm was first developed by analyzing simple binary images with default Matlab toolbox. Then further development was made in order to analyze more complex real world images that have different level of local backgrounds and noises. This algorithm heavily utilizes both imaging and image processing methods involving modified circle hough transform. The preprocessing of raw image is done by various smoothing filters and image binarize tools to obtain a processable black and white image. Applied with modified circle hough transform identifies the centers and total count of the colonies on the raw image. The algorithm is tested by comparing with mean manual count for different types of colony samples. The results proved to be accurate and showed significant flexibility of input images.

Research Mentors:

Eui Won Bae, Mechanical Engineering

Poster Number: **145** :: Mathematical/Computation Sciences

Deep Reinforcement Learning with Transfer Learning

Authors:

Julia Taylor, Purdue College of Engineering

Tessca Almeida, Purdue College of Engineering

Tim Zhou, Abbey Vincent, Purdue College of Engineering, Purdue College of Engineering

Abstract:

Deep Reinforcement Learning is a subset of Machine Learning that focuses on teaching computers how to learn without human intervention. The process of learning begins with the system looking for patterns in the given data sets, which will then be used to make decisions in the future. Because systems are becoming more reliant on data, Machine Learning models need to learn to adapt to existing data in an efficient manner. Transfer Learning, a subset of Deep Reinforcement Learning, reuses the learning process from one system and applies the pattern to another related system, which will decrease training time and improve scalability.

When implementing Transfer Learning, it is necessary to have a trained source task. Deep Deterministic Policy Gradient (DDPG) was utilized with a balancing pendulum environment. DDPG is an actor-critic method that is optimal for training a continuous action space. The pendulum environment requires continuous action as gravity acts as a constant force on the pendulum, but the net force necessary is non-constant as there is centripetal acceleration also acting on the pendulum as it spins. Once this model trains the source task, the pre-learned neural network is applied to a similar environment to reduce the amount of data and time required to train this new task, thus Transfer Learning is applied.

By altering the physical parameters of the pendulum and applying the transfer learning algorithm, it is anticipated that the number of episodes needed train the new environment will be less than the DDPG source task training.

Research Mentors:

Guang Lin, Purdue College of Engineering

Lusine Kamikyan, Purdue College of Engineering

Poster Number: **146** :: Physical Sciences

Evaluating the Utility of WGANs in High Volume Particle Physics Data

Authors:

Trevor Teague, Engineering, Science

Haoxuan Yu, Engineering

Dominic Seidita,Austin Beasley, Science,Science

Abstract:

Wasserstein generative adversarial networks (WGANs) offer fast methods for the generation of data sets. The potential for their application to background noise reduction in the context of large volume particle physics data is being studied. Namely, di-Higgs boson production events are investigated due to their aptitude for the discovery of new physics. Preliminary results with the use of a vanilla GAN trained on Monte Carlo generated data have shown that the distributions of di-Higgs sourced b-jet parameters can be well emulated using this approach.

Research Mentors:

Andrew Wildridge, Science, Physics and Astronomy

Rafael Lang, Science, Physics and Astronomy

Poster Number: **147** :: Life Sciences

GRIN Lens Imaging of in vivo Neurons to Quantify Modulation of Stimuli Responses

Authors:

Alexander Tesmer, Science / Honors

Abstract:

Abstract retracted.

Research Mentors:

Denis Burdakov, Health Sciences and Technology

Paulius Viskaitis, Health Sciences and Technology

Poster Number: **148** :: Social Sciences/Humanities

Automated language sampling for children with social communication difficulties

Authors:

Kelsie Thacker, HHS

Emily Garza, HHS

Abstract:

To personalize treatment plans for children with, or at-elevated risks of an autism spectrum disorder (ASD), research is exploring the use of automated devices to capture social communication skills beyond the clinic settings. For example, the Language ENvironment Analysis (LENA)1 device is easily worn throughout the day and provides clinicians with summarized day-long recordings of vocalizations and conversational turns. Previous research demonstrates the usability of LENA to detect vocalization differences in children diagnosed with ASD2 and within elevated ASD-risk samples.3 The present study expands our understanding of naturalistic language use, as indexed by LENA, within infant siblings of children with ASD - who are exhibiting developmental concerns (DC) by 3 years of age, compared to their typically developing peers (TYP).

As part of a prospective study, 23 infant siblings (Table 1) wore a LENA device for one day (8-10 hours per child), between 18-30 months of age. These children were placed in DC (n=12) or TYP (n=11) groups using data from their laboratory-based outcome visit. Automated LENA analyses produced Automated Vocalization Assessment standard scores, conversational turns, and daily vocalizations. To assess group differences in language use, a series of ANCOVAS were conducted with terms for infant sex and household income. Overall, we found a significant difference in daily vocalizations, such that the DC group vocalized significantly less than the TYP group (Table 2). In sum, these findings highlight the importance for clinicians to encourage parents to model language-learning opportunities beyond clinical settings to promote children's social communication development.

Research Mentors:

Dr. A.J. Schwichtenberg, HHS, Department of HDFS

Ashleigh Kellerman, HHS, Department of HDFS

Poster Number: **149** :: Physical Sciences

Preparation and Use of Economical, Insensitive Energetic Precursors: Potassium Nitroformate and 3,6,7-Triamino-[1,2,4]triazolo[4,3-b][1,2,4]triazole

Authors:

Michael Thoenen, College of Engineering, Materials Science

Abstract:

The synthesis of 3,6,7-Triamino-[1,2,4]triazolo[4,3-b][1,2,4]triazole (TATOT), a precursor to a series of energetic compounds, is detailed. A new, less hazardous route to Potassium Nitroformate, a reagent in the formation of multitudes of N-heterocycles, that does not require the formation of incredibly toxic tetranitromethane is also described. Both molecules can be readily prepared using economical, commonly available chemicals. The use of TATOT as a cation for energetic salts prepared through ion exchange is outlined.

Research Mentors:

Davin Piercey, College of Engineering, Materials Science and Mechanical

Matthew Gettings, College of Engineering, Materials Science

Poster Number: **150** :: Social Sciences/Humanities

A Review of Financial Aid Policies Across Institutions

Authors:

Nicholas Tomlin, Engineering Education

Abstract:

Financial aid is an important factor in reducing student debt at graduation with respect to initial tuition amounts. With an ever-increasing national student debt sum, how students might obtain and keep financial aid is an important consideration. Institutions vary in their policies concerning how to maintain eligibility for academic aid, their consideration of financial need in the admission process, and if they meet the full demonstrated need of their students. Institutions that recognize student financial need during admissions may be more lenient in their policies, or have a higher baseline for students applying for financial aid as a result. Those institutions that meet full demonstrated need of their students may have higher standards for financial aid, though there may be a distinction in those universities that offer loans and those that don't when meeting full demonstrated need. Financial aid available to students also changes from state to state, with some states having merit-based scholarships, like Florida's Bright Futures Scholarship Program. Those institutions with increased state support in scholarships may either offer reduced scholarships at the institutional level, or have higher requirements than institutions without a large amount of state aid. As an aid to future investigations, this project aims to provide a review of current financial need policies and produce an evaluating structure for categorization.

Research Mentors:

Hassan Al Yagoub, Engineering Education

Poster Number: **151** :: Social Sciences/Humanities

A Review of Standards for English as a Second Language for Post-Secondary Applicants

Authors:

Nicholas Tomlin, Engineering

Abstract:

English standards for engineering applicants with English as a second language ensure that those students in the application process have the necessary skills for the post-secondary school system in the United States. Standardized tests fulfill the role of gatekeeper for these students, as evidenced by the TOEFL, IELTS, and English sections of the SAT and ACT. While the requirements vary from institution to institution, the goal of this project is to track the English proficiency requirements by institution over the past 30 years and provide a review of the differences across institutions and a method for their classification. Policies will be taken from undergraduate course catalogs and compiled thereafter. These policies will then be analyzed qualitatively and grouped along their corresponding impact to the student. These impacts include: IELTS and TOEFL policies and scores, alternative courses for low IELTS/TOEFL scores, remedial programs, SAT/ACT scores and or subject tests, and policies for students that graduated from high school in the United States or another country with English as the national language. The analysis and categorization methods in this project aim to improve future projects with new tools when investigating students affected by policies for those with English as a second language.

Research Mentors:

Hassan Al Yagoub, Engineering Education

Poster Number: **152** :: Social Sciences/Humanities

Commitment Penalty: An Experimental Test of The Effects of Organizational Policies on Parental Leave

Authors:

Natalia Torrez, Liberal Arts

Navni Kharde, Liberal Arts

Abstract:

Parental leave policies are a pressing social concern, with mounting evidence that parental leave-taking leads to better outcomes for parents and children, and also that Americans would like to have access to better paid leave policies- but paradoxically, low rates of leave-taking among workers, especially among men. The ideal worker norm suggests that workers should always be available to work, should prioritize work, and be committed to their jobs. Not surprisingly, violations of the ideal worker norm carry consequences in the form of a commitment penalty: workers who take parental leave are seen as less committed to their jobs. This study examines whether the institutional conditions under which parental leave is taken affect perceptions of workplace commitment. We examine what aspects of organizational leave policies minimize the commitment penalty associated with parental leave-taking. Our experimental survey design includes a robust set of policy manipulations that reflect the diverse leave policies that currently exist in the U.S. Based on the above, we hypothesize that: (1) mothers will be viewed as less committed than fathers; (2) workers who take longer leaves will be viewed as less committed; (3) commitment penalties associated with longer leaves will be stronger for fathers than mothers; and, most critically, that (4) commitment penalties will be smaller when leave policies are more supportive. The results of this study will be content-coded participant open-responses which evaluate the decision making behind parental leave and the perceptions surrounding it.

Research Mentors:

Trenton Mize, Liberal Arts, Sociology

Poster Number: **153** :: Mathematical/Computation Sciences

Food and Energy Farms Simulation Tool

Authors:

Hans Torsina, Engineering

Abstract:

With the continually increasing food and energy demands which require sustainability, novel solutions in which agrivoltaic is a part of are pushed to solve local land shortages and increase land productivity. Compared to traditional solar energy installations which casts deep shadows on the ground and prevent crops from growing, agrivoltaic can develop strategies on design optics that allows simultaneous co-production of food and energy. Currently, however, there is not an easily accessible tool program that will assist in this push on agrivoltaics through simulation models. This is important for researchers looking to model certain agrivoltaic scenarios or even anyone exploring the prospect without a highly technical research context. The Agrivoltaic Simulation tool will calculate based on the solar panel parameters, geometries, patterns, and tracking system to provide outputs of contour shadowmaps, solar and electrical power output plots, along with input-output tables. The open-access simulation tool based on optical simulations built by our group, utilizes prior open-sourced code from PVLib, which is hosted and run on nanoHUB. This provides a more accessible and approachable user interface that promotes dual-function land use and assists planning for an agrivoltaic system.

Research Mentors:

Peter Bermel, Engineering, Electrical and Computer Engineering

Allison Perna, Engineering, Electrical and Computer Engineering

Poster Number: **154** :: Life Sciences

Characterizing Donor-Specific T cells in Islet Transplant Recipients Using scRNA-seq

Authors:

Reed Trende, Engineering, Agriculture

Abstract:

Organ transplants remain an effective treatment of various end-stage diseases. Induction of tolerance has remained the elusive goal of transplant community to overcome mortality and morbidity associated with the chronic immunosuppression for long term function of the transplanted organs. We have developed a tolerogenic protocol using apoptotic donor leukocytes (ADLs) that circumvents the need for immunosuppressants and have established the efficacy of ADLs for islet transplants in macaques with diabetes. However, the mechanism by which ADLs induce tolerance has not been fully elucidated. Single-cell RNA-sequencing (scRNA-seq) has proven to be a powerful tool for precisely tracking changes to specific cell types and to cell developmental trajectories. Flow sorting using fluorochrome-labelled MHC class II tetramers was used to isolate donor-specific T cells from macaques that did and did not receive ADLs prior to an islet transplant, and scRNA-seq on the 10X Genomics platform was used to characterize these cells. Transcription profiling, TCR finger printing and functional clustering of the scRNA-seq data was used to describe how treatment with ADLs altered specific T cell subtypes, as well as how they develop and interconvert between subtypes. Additionally, combining scRNA-seq data with the macaques' clinical outcomes will enable identification of biomarkers that can alert physicians to the fate of the transplanted islets (tolerance or rejection). The results of this project enable a better understanding of the fundamental molecular mechanisms of tolerance induced by ADLs, and further validation studies of the identified biomarkers could greatly aid the physicians' ability to non-invasively monitor transplant recipients.

Research Mentors:

Sabarinathan Ramachandran, Medical School, Department of Surgery

Bernhard Hering, Amar Singh, Anders Matson, Medical School, Department of Surgery

Poster Number: **155** :: Social Sciences/Humanities

Developing a Growth Mindset in Purdue Underclassmen With Respect to Professional Development

Authors:

Obinna Udoyeh, Engineering

Motinuolu Orederu, Engineering

Kushaal Manchella, Engineering

Abstract:

During the course the 2019 fall semester, our team presented to first year engineering students on job search and professional development where we found that the majority of these students tend to assume that they are unable to secure an internship in their field of choice. Thus, our research is focused on understanding the problem of lack of involvement of freshmen in professional development. Our goal is “To positively impact the professional development of first year students at Purdue by identifying the barriers faced by these students.

In order to achieve this goal, we have designed a survey which is geared towards understanding different first year student’s experiences thus far in college as well as analyzing how these experiences have shaped their current opinions on career development. Furthermore, we aim to conduct interviews on different categories of survey candidates that will be determined upon further data analysis of responses to our survey. In this way, we create an avenue to interview survey participants to better understand their survey responses.

In conclusion, we believe that understanding the issue is the first step in enabling first year engineering students to reach their career goals. We aim to use our data to find the major root causes of lack of involvement of freshmen in career development and at the very least create a platform that will be used to solve this issue.

Research Mentors:

Carla Zoltowski, Engineering, ECE

Poster Number: **156** :: Mathematical/Computation Sciences

A Python and MATLAB Simulation Testbed for Error Correction Codes (ECC) and Orthogonal Frequency Division Multiplexing (OFDM)

Authors:

Alfred Krister Ulvog, Engineering

Jacqueline Renee Malayter, Engineering

Fangrui Qin, Engineering

Abstract:

5G is the exciting successor to the 4G LTE infrastructure, which will not only enhance today's mobile broadband services, but also expand mobile networks to support a vast diversity of devices and services with improved performance, efficiency, and cost. Two of the crucial technologies that enable the next-generation designs are Error Correction Codes (ECC) and Orthogonal Frequency Division Multiplexing (OFDM). Specifically, data encoding and modulation techniques allow communication systems to be more resilient to harsh channel conditions and improve successful transmission even with much higher data transmission rate. In this project, Python and MATLAB were used to implement ECC and OFDM. For each test case, pseudo-random bit sequences were generated and passed through an appropriate simulated communication channel. Certain parameters were manipulated in each test set, and the results of the tests were summarized in figures characterizing system performance. The simulation software of different modulation and encoding techniques will later be integrated into a complete communication system simulation, where eventually new techniques can be tested. In addition to building a model for a digital communication system, this will benefit future students by providing a fundamental idea of how ECC and OFDM work, and their roles in digital communication systems.

Research Mentors:

Chih-Chun Wang, Engineering, Electrical and Computer Engineering

Poster Number: **157** :: Innovative Technology/Entrepreneurship/Design

Hummingbird Robot Power Driver Integration

Authors:

Carel van der Merwe, Purdue University

Charlie Geraci, Purdue University

Aaryan Raj Rathi, Bryce Sasser, Lander Greulich, Purdue University (all)

Abstract:

The nimble flight of a hummingbird presents one of nature's greatest evolutions for dynamic flight. A hummingbird's wings are quiet, incredibly fast, and maneuverable. Hummingbird-based robotic flight presents one of the newest and greatest challenges facing the future of drones. Apart of Purdue's VIP program, our team is helping design, build, and test a hummingbird-inspired robot. Specifically, we are redesigning the power driver circuit for the motors. The circuit must be optimized for minimal weight, maximum power output, and optimal system inclusion. The system integration work has required designing unprecedented schematics for the power driver. This requires designing both a PCB microcontroller and an H bridge rectifier to optimize the output for driving the DC motors that create lift. This will require optimizing a larger breadboard circuit before scaling down to a size that could fit on someone's finger. After optimization, the power driver circuit must be reintegrated into the hummingbird robot and tested yet again. The project will require both mechanical and electrical backgrounds, challenging our team with a range of senior to freshman students to work together effectively. It will require background knowledge in electrical designing, assembly programming, and mathematical modeling to build this ultimate aerial device. If successful, the hummingbird robot could revolutionize the drone industry with it's incredibly quiet, maneuverable, and fast flight trajectory. Our team is elated to work on such an equally exciting and challenging task for system integration.

Research Mentors:

Xinyang Deng, Purdue University, Associate Professor of Mechanical Engineering

Zhan Tu, Purdue University, Mechanical Engineering

Poster Number: **158** :: Innovative Technology/Entrepreneurship/Design

EHV Geology Website

Authors:

Prithvi Velpuri, Engineering

Yuzheng Qian, Engineering

Abstract:

The goal of our sub-team is to display the user-uploaded geological earth history data (currently only data from China) on a website for people around the world. Data is uploaded in a suggested lexicon entry format as a word document and loaded into a database. We are able to query this database to obtain the information that the user is requesting. The website is currently up and running on our test server and search functionality is working. Users can navigate to the 'Search Formation' page and look up formation names that may be present in the database. If the user input does not match any formation names, an error message will redirect the user to try again. Upon a successful search, a list of potential formation matches will appear for the user to click on and learn more about. If there is only one matching result, the website will jump to the information display page of that specific formation directly. This search feature is also available to administrative users who have the permissions to edit content so that the website and information can be updated, and this change will be reflected back to the database.

Research Mentors:

Aaron Ault, Electrical and Computer Engineering

Poster Number: **159** :: Mathematical/Computation Sciences

Image Reconstruction

Authors:

Mimansa Verma, Engineering; Dung Nguyen, Engineering

Robert Sego, Engineering; Hannah Pike, Engineering

Abstract:

Our project ventures to reconstruct damaged and deteriorated images to a point where they are considered whole. Specifically we are taking images with lost data sections and creating a machine learning model to synthesize a new image from the damaged one. This specific method is called Inpainting, and while there are several non-machine learning approaches, machine learning methods have proved to be far more effective. The machine learning model we will be using is a General Adversarial Network. This network will be used to accomplish image-to-image translation and to create the final image. The final image will not be predicting any objects in the deteriorated parts of the input, and instead will simply fill in the blank locations with generated pixel data. A General Adversarial Network has two main parts to it: the Encoder and Decoder. There are several types of GAN implementations, but we have decided to use Generative Convolutional methods in the Encoder and to use the Decoder for validation. The Encoder will consist of a convolutional neural network (CNN), which will be deconstructing and reconstructing the original image for synthesis. A fake image will be created and will be evaluated against the ground truth and other validation sets in our dataset. We are using a large dataset consisting of several thousand natural images with a variety of coloring and orientation characteristics. The dataset contains the ground truth images, the damaged images, and the mask of the damaged images to serve as maps for the missing data locations. In order for our model to be able to reconstruct many different types of images, the dataset images have been damaged in several ways so that our model will be more versatile and robust. We have spent this first semester of the project extensively learning about Image processing techniques, CNNs, and GANs to be able to create our desired model. We referenced several published peer-reviewed papers for examination and decision-making on what approach and models would help us best achieve the image reconstruction method we hope to create. We are currently in the processing of coding, training, and testing our model with the inpainting focused dataset we have acquired. We cannot predict the accuracy that we will be able to achieve, but we hope to have a holistic working model that is applicable to images outside of the dataset as well. In our modern age of technology where it is crucial to protect or recover data that is corrupted, where there is an increasing pattern of analog materials being digitized, and rapid exploration of new phenomenon through image gathered data; our project hopes to provide a solution to these and many other modern technological problems.

Research Mentors:

Edward Delp, ECE

Carla Zoltowski, ECE

Poster Number: **160** :: Physical Sciences

Physiological Sensing for a Better Surgeon

Authors:

Ryan Villarreal, Engineering, Health and Human Sciences

Abstract:

Robot-assisted surgery (RAS) is quickly increasing as a non-invasive surgery technique. This technology uses precise robotic arms that are controlled by a surgeon using a console away from the patient. These arms allow for enhanced capabilities, giving patients more precise surgery with a shorter recovery. With the introduction of this technology in the operating room, it is still unknown how it affects the surgeons performing the operations. Currently, there are limited studies investigating how RAS affects surgeons' cognitive workload. This pilot study aims to measure cognitive workload during RAS using brain activity signals to analyze how it affects surgeons performing RAS.

Brain activity was measured using an electroencephalogram (EEG) to infer cognitive workload to measure brain activity while performing two different tasks on a surgical robot. The primary task consisted of users performing an adaption of the Fundamentals of Laparoscopic Surgery's Peg Transfer Task. An interval counting secondary task was completed in an alternative minute for a six-minute task duration.

The gNautilus EEG was used to measure brain activity. EEGLab was used to process the brain activity signals. Preprocessing pipeline was utilized to determine the alpha, theta, and beta mean power which was analyzed to determine workload. Findings from this work can be used to further research how cognitive workload is affected during RAS. Future work should investigate how real-time feedback can be incorporated into lowering workload, allowing for safer, more effective performance and better training practices.

Research Mentors:

Jackie Cha, College of Engineering, Industrial Engineering

Juan A Barragan Noguera, College of Engineering, Industrial Engineering

Dr. Denny Yu, College of Engineering, Industrial Engineering

Poster Number: **161** :: Innovative Technology/Entrepreneurship/Design

An Anomaly Detection Model to Identify Changes in Student Classroom Performance

Authors:

Xinyu Wang, Krannert

Pengcheng Fu, Krannert

Andy Yao, Krannert

Abstract:

In collaboration with a leading educational technology company, we develop an anomaly detection model to identify students whose class performance does not match their previous behavior. The motivation for this study is to identify unusual student behavior and alert the instructor whom may intervene. Often instructors are busy teaching, grading, mentoring, performing research, or doing other administrative duties and they might not realize a significant change in a students performance until it is too late. Our model is novel in that anomaly detection is often applied to fraud, banking, and manufacturing, but rarely for use in higher education decision-support.

Research Mentors:

Matthew A. Lanham, Krannert, Management

Poster Number: **162** :: Mathematical/Computation Sciences

Earth history visualization research group timescale project

Authors:

Yuanhao, Engineering

Abstract:

The purpose of the earth history visualization research team's timescale project is to develop and in depth understanding of web development and develop solutions for consumers over the world to use.The research team is currently split into a few groups that are working on separate projects,firstly we have a team working on a database for storing and allowing users to contribute to a database with data on rock formations. The users of web interface can easily search the information which they want to modify. In the future, we will work on how to make the web design look better and qualify users with more functionality like allowing them to upload images. We have another team working on data mining which uses reliable rock data to find similar trends and develops tools to help identify these trends.The website team has successfully managed to create a basic version of the website and are currently working on bug fixing and adding additional features that customers(in this case, other geologists) would utilize and other improvements that would make the user experience better.The data mining team is current working on a new tool to help identify more relationships between the data from rocks. Our work on this website for geologists (along with all the other toolsthat our research team produce) we try and the goal of the website part of the project is to give others some ideas on how to design and manage their own database in an administrative level. This is important because with the use of the website, people who need information may access it easily, and children could also use it for learning. It also brings an easier way for the manager of the database to update and publish the information on time.

Research Mentors:

James G. Ogg, EAPS

Poster Number: **163** :: Social Sciences/Humanities

User Experiences of Persons with Disabilities on CATME Web Interface

Authors:

Jiaxin Wang, Engineering

Zhibo Hou, Engineering

Jia Lin Cheoh, Siqing Wei, Behzad Beigpourian, Science, Engineering, Engineering

Abstract:

The sheer amount of lawsuit that targets inaccessible website makes it increasingly important for us to ensure that the CATME product is accessible to persons with disabilities. The primary step that we have taken to ensure that the CATME website is accessible is that we ensure that the CATME product is fully compliant with Web Content Accessibility Guidelines (WCAG). Previous studies, however, have proven that satisfying WCAG standards are not equivalent to the fact that persons with disabilities will be able to navigate the website smoothly. And hence, our research has focused on employing persons with disabilities recruited via Amazon Mechanical Turk (mTurk) to conduct user experience studies. We present the technical setup and the preliminary findings on our poster.

Research Mentors:

Prof. Daniel Ferguson, Engineering Education

Prof. Matthew Ohland, Engineering Education

Poster Number: **164** :: Innovative Technology/Entrepreneurship/Design

Phase-Locked Loop Design for SoC Applications

Authors:

Evelyn Ware, Engineering

Matthew Olinde, Engineering

Abstract:

Phase Locked Loops (PLLs) are used for a variety of reasons, and are a major part of many radio, telecommunications, and computer applications. The PLL allows the synthesis of new frequencies much higher than the steady reference frequency of its input. Rather than a 32k input, it can output frequencies in the range of MHz, or even GHz. The challenges with designing a PLL are minimizing spur and phase noise, while also being able to operate in the desired frequency range. This is what we hope to accomplish this semester when designing the different parts of the PLL. Using Cadence Virtuouso, the PLL was split into 5 building blocks: phase-frequency detector, charge pump, loop filter, voltage controlled oscillator, and frequency divider, which were individually optimized and simulated. Through simulation, the topologies we found worked best with our desired results were a mixed signal phase-frequency detector, active loop filter with a custom op-amp design, current-starved ring oscillator, and an integer frequency-divider. The building blocks were then combined to create a PLL that is able to multiply an input reference frequency of 32kHz by 256 to produce an output frequency of 8.2MHz which is the maximum frequency of the SoCET team microprocessor. Our design features low phase noise and spur, which makes it an attractive option as well. The PLL design can be incorporated in future SoCET chip designs to be used as a steady low-noise clock generator at different frequencies.

Research Mentors:

Mark Johnson, Engineering, Electrical and Computer Engineering

Matt Swabey, Jacob Covey, Engineering, Electrical and Computer Engineering, Engineering, Electrical and Computer Engineering

Poster Number: **165** :: Life Sciences

New England Aquarium Necropsy Sampling Techniques for Use in Marine Mammals

Authors:

Gabrielle Weinert, Agriculture

Abstract:

For twelve weeks, I worked as the marine mammal and sea turtle necropsy intern at the New England Aquarium’s Quincy facility in Massachusetts. During this time, I assisted with eleven necropsies on wild grey and harbor seals, a porpoise, and a Kemp’s ridley sea turtle. With the guidance of my supervisor, Katie Pugliares-Bonner, I undertook the project of creating four instructional videos of different necropsy sampling techniques to be used on marine mammals. The four topics were histological sampling, biotoxin sampling, contaminant sampling, and aseptic sampling techniques. These videos were made with photographs and videos I collected during necropsies at the New England Aquarium's facility, and they were organized by myself using video editing software. Each video was also accompanied by meticulously written scripts detailing the processes. There are currently no standards in place for the necropsy of marine mammals, though many various institutions perform them. Thus, the goal of this project was to create professional quality videos demonstrating ideal marine mammal necropsy techniques which can then be shared with other organizations to begin to establish standard procedures. Additionally, these videos have since been used at the New England Aquarium to train all new volunteers and workers in necropsy positions.

Research Mentors:

Katie Pugliares, NA - Supervisor from New England Aquarium

Poster Number: **166** :: Mathematical/Computation Sciences

Testing of Physics Informed Neural Networks

Authors:

Daniel Weld, Engineering

Praneeth Medepalli, Engineering

Zachery Berg, Niharika Bhardwaj, Science, Engineering

Abstract:

Abstract retracted.

Research Mentors:

Guang Lin, Science, Mathematics

Poster Number: **167** :: Innovative Technology/Entrepreneurship/Design

Investigating Place-Making at Northend Community Center or MatchBOX

Authors:

Abagail Westbrook, Polytechnic Institute

Abstract:

Currently, there is a rise in the use of co-spaces for personal and professional use. The goal of this study is to investigate place-making practices at the Northend Community Center and MatchBOX Coworking Studio in Lafayette, Indiana and ideate a digital mediation to aid place-making practices. This project utilizes user experience design practices, including a three-month ethnography of the before mentioned co-spaces as well as semi-structured interviews with people who use and facilitate the co-spaces. These methods help to uncover the current process of place-making in the spaces observed. Through the completion of primary research, it is suggested that there are significant differences in the way people participate and take ownership of the co-spaces observed. How each space is marketed and managed either hinders or aids place-making practices amongst the users of the spaces. The research lends itself to the creation of a digital mediation that can aid place-making practices. Co-spaces might consider devoting additional resources to support place-making practices through the implementation of digital mediators or similar solutions.

Research Mentors:

Dr. Austin Toombs, Polytechnic Institute, Computer Graphics Technology

Poster Number: **168** :: Physical Sciences

Annual Modulation of Muons in XENON1T

Authors:

Alan Wright, Science

Emily Kincaid, Science

Steve Zhou, Ian Bowyer, Science, Science

Abstract:

The purpose of this project is to measure an annual modulation in the muon flux with data from the XENON1T muon veto system. Muon events are counted over an entire year, and are weighted by the amount of time the detector was on. The relationship between muon flux and time will then be compared to atmospheric conditions. Currently, only the framework for constructing the flux modulation is developed, but it provides a strong basis for achieving the goals of this project.

Research Mentors:

Amanda Depoian, Science, Physics

Rafael Lang, Science, Physics

Poster Number: **169** :: Innovative Technology/Entrepreneurship/Design

Enhancing Sustenance through Food Quality Monitoring via Smart Tupperware

Authors:

Qinglan Wu, Engineering

Abstract:

Kitchen is a center of a sustenance in the house where dynamic activities happen including not only cooking and preparing a meal, but also social and entertainment. We build Smart Tupperware, an Internet of Things (IoT) based container to enhance these kitchen automations by collecting data from the sensors such as weight, volume and color, generating an automatic shopping list and suggesting a menu. An IoT network of multiple Smart Tupperware builds an inventory management system in the kitchen, however misses a value of monitoring a food quality. We propose an improvement to the current inventory management system to identify the food spoilage, estimate the remaining freshness and further learns a pattern of shelf life. We believe that the food quality monitoring will propose a new value to the IoT system and enables more services that provide customer conveniences at the front-end of the system. The enhanced system will bring conveniences of alerting the users upon a spoilage and estimating a shelf life based on different environments to improve a better kitchen experience to the customers. The system will benefit the customers locally in their kitchens, but we envision the services extended to the grocery stores and restaurants that operate with dynamic inventories on daily basis.

Research Mentors:

Sangjun Eom, Polytechnic

Poster Number: **170** :: Innovative Technology/Entrepreneurship/Design

Autonomous System Against Space Meteorites and Space Debris

Authors:

Ruochong Wu, Engineering

Edward Pedroza, Engineering

Tremael Arrington, Engineering

Abstract:

Small space debris orbiting Earth pose a significant threat to humanity's space ambitions. These debris, some as small as specks of dust, travel at speeds upwards of 7 km/s and can cause massive damage to spacecraft. The objective of this project is to design a smart electronic system that can protect and preserve spacecraft that are at risk of debris strikes. The system will include measures to detect and avoid debris using cameras equipped with debris and spacecraft tracking software, capable of detecting and tracking the position of nearby small debris and spacecraft. This ground-based system allows computers on the ground communicate when an impact is imminent and instructs the spacecraft to deploy its avoidance maneuver. If avoidance fails, the system will use damage detection circuitry woven into satellite shielding to determine damage sustained. Damage information will be processed by ARM Cortex-M0 microcontrollers and used to trigger self healing/redundant components controlled by circuits using programmable logic devices such as FPGA's or PLDS to perform self-reconfiguration autonomously. Satellite designs implementing such a system will see higher satellite lifetimes, and reduced need for backup satellites, offsetting the costs for such a system. Furthermore, the reduction of damaged satellites in space will lead to a cleaner and safer space for the future.

Research Mentors:

Vikas Tomar, Engineering, School of Aeronautics and Astronautics

Poster Number: **171** :: Innovative Technology/Entrepreneurship/Design

Bio-inspired Aerial Robots

Authors:

Yunlei Yan, College of engineering

Yuan-Cheng Chen, College of engineering

Nail Tarcon Gul,Yongling Li,Harim Song,Neha Priyadarshini, College of science,College of science,College of engineering,College of engineering

Abstract:

In this research, we are introducing new complex maneuvers to our bio-inspired humming bird robot. Our group's focus is on the software part that could train the robot model in our simulator in a more efficient way. We had already rewrap the code to a more readable and origanized way as the previous python library is not under maintainence anymore. Based on we had done so far, we are going to implement a new training algorithm as the current one may not be the most optimized policy. We had look through common training policies for unstable continuous action spaces for robotic use and decided to use PPO(Proximal Policy Optimization) as it is a on-policy algorithm in contrast to the off-policy DDPG(Deep Deterministic Policy Gradient) we are using right now and has the easiest implementation and relatively better performance than other policies we looked through. We are expecting to have a better convergence during the training process so that we can spend more time intergrating the model to our physical robot or have more training iterations. We will be comparing our train result between the one using DDPG from aspects including used iterations, model performance, time per iterations and the functionality on physical robots.

Research Mentors:

Xinyan Deng, College of engineering, Mechanical engineering

Fan Fei, College of engineering, Mechanical engineering

Poster Number: **172** :: Innovative Technology/Entrepreneurship/Design

SMART Abstract

Authors:

Yingning, Engineering

Abstract:

Social media provides eyewitness accounts and ground information that can help emergency responders increase situational awareness in responding to public safety events, such as natural disasters (e.g., hurricanes), trespassing, burglaries, and terrorist attacks. The Social Media Analytics and Reporting Tool (SMART) is a tool developed at Purdue's VACCINE lab to leverage historical and real-time tweets for event monitoring and responding. In addition to Twitter data used by SMART, contextual information can help filter and corroborate social media information, such as concurrent news reports and surrounding traffic data. Integrating information from different sources can be a challenge, both for visualization designs and knowledge extraction by the end users. This project addresses this problem by examining the integration of news and traffic data into a social media data analytics platform, i.e. SMART. Two types of data sources are examined for data analysis and visualization designs. For the news data, sources were studied to understand their accessibility and compatibility with the existing system. We identified a data source which gives permission to embed the news. Moreover, we import data visualization charts, including trends over time for specific topics, relevant information related to keywords, and geo-distributions of topics. Similarly, the traffic data source is used to provide additional situational awareness and context, such as regions with traffic congestion. We were able to converge to a user interface design that integrates news data sources for Yahoo! news and Google data visualization. Traffic data provides additional contextual information for analyzing public events and evolving situations. We will also provide quantitative assessments on the correlations between traffic and social media data surrounding a specific example event.

Research Mentors:

Luke Synder, Computer Science

Poster Number: **173** :: Mathematical/Computation Sciences

Integer-Only Machine Learning Benchmark for Low-Resource Devices

Authors:

James Zampa, Purdue University

Tucker Swan, Purdue University

Abstract:

As machine learning enters more diverse industries, there is a need to reduce the computational power required to run machine learning models. Sparsity aware Core Extensions (SparCE) take advantage of zeros in machine learning models, a common aspect of convolutional neural networks (CNNs). Sen (2017) found SparCE optimizations have an average of 19-31% reduction in application-level execution time and a 17-29% reduction in overall power consumption. This work will analyze the performance of SparCE optimizations for machine learning algorithms running on low-resource microprocessors. This study uses methods of quantization aware training outlined by Jacob (2017) to create a CNN suitable for integer-only inferencing. We trained the CNN on a dataset of 14x14 pixel images of handwritten digits 0-9 (MNIST) and used Tensor-Flow-Lite algorithms for integer-only inferencing. We plan to validate the theoretical efficiency improvements by running our SparCE optimized RISC-V core on a FPGA and measuring execution time, power consumption, and model accuracy. Our benchmark can be extended for any hardware optimization targeting CNNs. Future studies can use this platform for testing machine learning hardware accelerators on microprocessors limited to a small number of programming libraries.

Research Mentors:

Mark Johnson, Purdue University, Electrical and Computer Engineering

Poster Number: **174** :: Innovative Technology/Entrepreneurship/Design

Building and Running a Customer Support Function

Authors:

Ruoxi Zhang, College of Engineering

Sara Lynch, Krannert School of Management

Abstract:

The CATME system has been continually upgrading our customer support function to ensure that our customers are receiving better service when dealing with issues or general questions. The main focus of our project was creating a better way to assign and organize our customer support emails. To do this we worked with the customer service software called Zendesk. This has allowed us to meet the goals that we initially set and answer customer questions at a faster rate. This has thus allowed us to provide better customer service for our customers including: answering their questions, providing support and research, and if we need to do more research letting them know we have seen their questions. CATME employees also learn customer concerns and demand in a well-rounded and transparent way, which benefits future continuous improvement on CATME updates and designs. A few implications of this process was that our customer service was getting many questions about licensing and other subjects that we are not equipped to handle, to solve this we created a second Zendesk account to ensure that the licensing questions were answered by those with sufficient knowledge.

Research Mentors:

Dan Ferguson, College of Engineering, Engineering Education

Ohland, Matthew, College of Engineering, Engineering Education

Poster Number: **175** :: Mathematical/Computation Sciences

Pagewide Printer Characterization and Simulation

Authors:

Lanqing Zhao, College of Science

Shikai Zhou, College of Engineering

Matthew Wen, College of Engineering

Abstract:

The inkjet printer is one of the common printer models in our daily life, but the quality of printed products is often restricted by the effect of dot gain and random dot displacement. As a result, the performance of halftoning algorithm will be compromised in the printing process . In this project, we investigate a specific inkjet printer model to integrate it with halftoning algorithm called Direct Binary Search (DBS) to study its quality of printing. To study the printer model, we first obtain the dot profile and compute the dot displacement based on the dots captured on the test page. After that, we analyze the data to establish the statistical model of the dot shape and dot displacement. Our final objective is to simulate the printer model with DBS algorithm to test the performance of the printer.

Research Mentors:

Yafei Mao, College of Engineering, School of Electrical and Computer Engineering

Jan Allebach, College of Engineering , School of Electrical and Computer Engineering

Poster Number: **176** :: Innovative Technology/Entrepreneurship/Design

Region of Interest Extraction for Image Quality Assessment

Authors:

Yitong Zhao, Electrical and Computer Engineering

Adrian Calderon, School of Engineering

Abstract:

In industry, the electrophotographic (EP) process is avidly used, however this method can lead to various print defects. Since print quality is a key factor to success in industry print quality, print defects must be detected and analyzed to achieve optimal print quality. The purpose of the project is to develop a method with which to identify and extract regions of interest (ROI) on a digital image, which may contain said print defects. The proposed method uses a digital image object map to extract objects based in three categories: raster (pictures or photos), vector (background and gradient) and symbol (symbols and texts). These objects are categorized due to distinguishing color vector, or gradient, and background from the vector object. The ROI extraction procedure is accomplished in a series of steps. The first step of the process is to apply an edge detection. The two primary edge detection filters applied are the Sobel edge detection and Connected Components. The second step is to extract color vector and background region of interest, two methods should be completed: extraction of maximum area of rectangle and extraction of the deepest rectangle. In addition, in order to obtain the most useful region of interest region, the greedy algorithm should be applied. The final step is to use a Matlab GUI Tool to label the ground truth and verify the accuracy of ROI extraction.

Research Mentors:

Runzhe Zhang, School of Electrical and Computer Engineering

Jan P. Allebach, Yin Wang, School of Electrical and Computer Engineering, School of Electrical and Computer Engineering

Poster Number: **177** :: Mathematical/Computation Sciences

Census Data Visualization

Authors:

Allen Zheng, Purdue Polytechnic Institute

Abstract:

The state of Indiana and the city of Lafayette are diverse and complex areas to study. With a rise of diversity in the area, there can be concerns that arise with them. There are a variety of potential issues such as lack of education and opportunity for disadvantaged areas that can be solved or at least aided with data about the population. Data collected from census can be used to help solve some of these problems, but only effective if used correctly. Previous data visualizations on census data including maps and temporal data will also be explored and utilized to inform the outcome of this research.

In this study, census data will be analyzed and explored to find different trends. These insights will be combined to form a Census Data Dashboard. Ultimately, the goal is to inform stakeholders of all levels (community, local, state) of how they can more efficiently improve their talent pipeline and workforce.

This study will be conducted by visualizing data using Tableau. These visualizations in the form of a dashboard will help identify issues related to poverty and unequal opportunity in Lafayette and Indiana and offer some solutions. These solutions will also help drive future research and help others understand what needs to be done to help cities and states using census data.

Research Mentors:

Dr. Vetria Byrd, Purdue Polytechnic Institute, Computer Graphics Technology

Poster Number: **178** :: Mathematical/Computation Sciences

Investigating gender bias in first-year engineering classroom

Authors:

Chuhan Zhou, Science

Abstract:

Nowadays, teamwork becomes more and more common everywhere, and peer evaluations are often used to monitor its quality. Peer evaluations have their own strengths, but also might be biased to many factors, such as gender. While reviewing literature, different papers have different opinions on gender bias. Hence, the purpose of this study is to thoroughly examine the specific gender bias in peer evaluations by collecting data on our own. We collected the peer evaluation results from a college first-year engineering course, and we classified the results by the ratees' genders and the raters' genders. We then used one-way ANOVA to analyze the results. As a result, a significant gender bias is found between male students and students in genders except male and female. Gender bias between male and female students is found in some peer evaluations, but not very substantial. Hence, we believe that instructors should be careful when assigning students of other genders and should pay attention on their performance; however, male students and female students are doing overall fine when rating each other.

Research Mentors:

Behzad Beigpourian, Engineering Education

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