2018 PURDUE FALL UNDERGRADUATE RESEARCH EXPOSITION

NOVEMBER 12, 2018

West Lafayette, Indiana

PURDUE UNDERGRADUATE RESEARCH CONFERENCE

SCHEDULE OF EVENTS

NOVEMBER 12, 2018

8:30 — 9:30 AM	**Oral Presentations I, STEW 214**
9:30 — 10:30 AM	**Oral Presentations II, STEW 214**
10:30 — 11:45 AM	**Oral Presentations III, STEW 214**
12:00 — 1:00 PM	**Poster Presenter Set-Up**
1:00 — 4:00 PM	**Poster Symposium, PMU Ballrooms**

Oral presentation session schedule and the poster symposium layout 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 Honors College faculty. **To submit feedback to poster presenters, please use the QR code or link (bit.ly/2018fallexpo).**

Purdue Fall Undergraduate Research Expo
Oral Presentation Schedule

	PRESENTATION START TIME	STEW 214-A	STEW 214-C
SESSION 1 (8:30 to 9:30 am)	**8:30**	*Workstation Improvement in Parts Organization and Security* **Jeremy Chen, Kevin Yeh, Jim Campbell, Juan Byun, & Raquiem Moore** Polytechnic Institute	*Lip Reading and Subtitle Gernation* **Moe Ye Htet, Evan Bouillet, Jiwoon Nam, Patricia Palacín, & Gabriel Ferrate** College of Engineering
	8:50	*Suffering and Social Introspection within James Baldwin's Another Country* ‡ **Hollis Druhet** College of Liberal Arts	*DMSO-Free Natural Killer Cell Cryopreservation using Trehalose-Loaded Nanoparticles for Immunotherapy of Cancer* **Michaela Todd, Joshua Jovevski, Rui Xu, & Stella Jung** College of Pharmacy
	9:10	*Facial Expressions in Sign Language Grammar: What Does the 'Flat Chin' Mean?* ‡ **Lauren "Nik" Nikolai** College of Liberal Arts	*Emotion Detection* **Andrew Jasecka, Shutao Wang, Hussni Mohd Zakir, & Tianlong Yuan** College of Engineering
SESSION 2 (9:30 to 10:30 am)	**9:30**	*Characterizing the Iron-Carboxylate Interactions Underlying the Ferric Gum Photography Process* **Brandon Hacha** College of Science	*Development of a Sketch Planning Tool to Estimate the Wider Economic Benefits of Bridge Preservation in Indiana* ‡♦ **Sumedh Khair** College of Engineering
	9:50	*FGFR1 Interacts with Her2 and Promotes EMT-Independent Trastuzumab-Emtansine Resistance* **Zian Liu** College of Agriculture Honors College	*A Development of Unmanned Surface Vehicles for Algae Removal* ‡ **Yuta Hoashi** College of Engineering
	10:10	*Mother Knows Best?: Parental Investment Throughout* Schistosoma mansoni *Infection* **Olivia Lockyear** College of Science	*The Dehumanization of Immigrants and Refugees: A Comparison of Presidential Candidate Rhetoric* ♦ **Amanda Warnock** College of Liberal Arts
SESSION 3 (10:30 to 11:30 am)	**10:30**	*Describing Design Ethics through the Lens of Company Culture* ‡ **Rhea Manocha** Polytechnic Institute	*Recycling or Trash Bin?* **Kexing He** College of Liberal Arts
	10:50	*Optimal Design of a Residential Photovoltaic System* ♦ **Elijah St Angelo** Polytechnic Institute	*Christian Teachers' Religious Beliefs Impact on Classroom Practice* **Elisabeth Rohman** College of Education
	11:10	*The Influence of Art Expertise on Emotion and Preference Ratings for an Artwork* ‡ **Kanak Dhawan** Polytechnic Institute	*Developing Programmable ELP-based Transcriptional Regulators for Dynamic Pathway Control in Microbial Systems* **Juya Jeon** College of Engineering
	11:30	*Addressing Confidentiality Issues in Supply Chains when using Blockchain Technology* **Sihao Yin** **Shivam Bajpayi** College of Science	

Legend: ‡ - Interdisciplinary Project ♦ - Uses Archival Sources in Project

Time: 8:30:00 AM **Room:** 214A :: **Life Sciences**

Polytechnic Institute

Workstation Improvement in Parts Organization and Security

Authors:

Jeremy Chen

Kevin Yeh

Jim Campbell

Juan Byun

Raquiem Moore

Abstract:

The purpose of this project was to incorporate organizational and technological improvements to Aircraft Turbine Engine Propulsion Laboratory. This laboratory serves as the training ground bolstering students' knowledge in turbine engines and industry practices in a repair facility within Purdue's Aeronautical Engineering Technology program. The project centralized on improving the three workstation areas in which students will carry out engine disassembly, inspections, and reassembly. Due to the dated nature of the laboratory and the sensitive nature of engine components to handling damage during maintenance procedures, the focus of the improvements was spread twofold: ensuring parts organization and security and modernizing technological equipment. After consulting contacts within the aviation industry, the chosen solution was the installation of engine-specific foam inserts for the disassembly parts cart and the replacement of dated computer hardware in the lab. Student responses were gathered from those undergoing the gas turbine engine propulsion classes both before and after equipment installation in the effectiveness of the organizational aid the foam inserts provided. Timing data was also gathered to determine the effectiveness of noticing missing components for parts security. After testing there was a clear improvement in both the organizational and security side of the workstations. However, further improvements can be made to bring the laboratory to reflect that of a world-class maintenance facility.

Research Mentors:

Dr. Sergey Dubikovsky, Aeronautical Engineering Technology, Polytechnic Institute

Dr. John M. Davis, Aeronautical Engineering Technology, Polytechnic Institute

Time: 8:30:00 AM **Room:** 214C :: **Innovative Technology/Entrepreneurship/Design**

College of Engineering

Lip Reading and Subtitle Generation

Authors:

Moe Ye Htet

Evan Bouillet

Jiwoon Nam

Patricia Palacín

Gabriel Ferrate

Abstract:

The purpose of this project is to generate live subtitles by detecting and analyzing the movement of the lips from a video source. Currently, subtitles are automatically generated from audio. This project will explore the possibility of generating subtitles by analyzing the lip movement of the people talking in the videos. The team will use a Convolutional Neural Network (CNN) to interpret the speaking and generate proper subtitles. To meet this goal, the team will train the machine with “The Oxford-BBC Lip Reading in the Wild (LRW)” dataset, consisting of up to 1000 utterances of 500 different words spoken by hundreds of different speakers. One of the most common issues one can encounter when training a neural network is a problem called overfitting. Overfitting occurs when there is not sufficient amount of dataset to train the neural network. The dataset the team is using is large enough to overcome overfitting and, most importantly, already labeled. The team will begin the project with a simple configuration that detects simple words (eg. “yes” and “no”) with a target accuracy of 75%, a metric which has been achieved in similar studies. Later, the design will be expanded to a level that can detect continuous speech. The model can be developed further to achieve higher accuracy, or it can be expanded to cover different languages. This project could have several applications, such as helping people with hearing disabilities or improving the subtitles generation algorithm when paired with word recognition from an audio source.

Research Mentors:

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

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

Time: 8:50:00 AM **Room:** 214A :: **Social Sciences/Humanities**

College of Liberal Arts

Suffering and Social Introspection within James Baldwin's Another Country

Author:

Hollis Druhet

Abstract:

The purpose of this paper is to re-examine the critical outlook on the scope and function of identity within the literature of James Baldwin. Looking at Another Country specifically, the research provides a close look at the abrasive psychological conditions that characters are shown to endure and how these conditions evolve their perspectives on social expectations. Intersection of race, gender, and sexuality is shown to be essential for a fuller understanding of societal oppression and interpersonal relationships. Because these psychological conditions are explicitly tied to the characters' race, gender, and sexuality, critical theory is used in the reading of key passages. Critical discussion has largely focused on Baldwin's depiction of male sexuality, which doesn't account for the significant presence of women in the novel's cast of characters. A central question concerns how Baldwin's position as a bisexual, African-American man allows the author to bridge the gap between different discriminated groups, specifically women and bisexual men. Though historical elements of 1960's America will be mentioned in analysis, the scope of the paper is focused on literary passages from the book and previous scholarly criticism. This research expands on consideration for early depictions of intersectionality in literature and more specifically, Baldwin's construction of female characters.

Research Mentor:

Dr. Christopher Freeburg, English, University of Illinois at Urbana-Champaign

Time: 8:50:00 AM **Room:** 214C :: **Life Sciences**

College of Pharmacy

DMSO-Free Natural Killer Cell Cryopreservation Using Trehalose-Loaded Nanoparticles for Immunotherapy of Cancer

Authors:

Michaela Todd

Joshua Jovevski

Rui Xu

Stella Jung

Abstract:

Immunotherapy with genetically-engineered natural killer (NK) cells enables the effective targeting and killing of difficult-to-treat tumors. Our lab is investigating the use of such genetically engineered cells to attack and kill solid tumors where traditional approaches have failed. Part of the treatment regimen involves freezing engineered NK cells prior to adoptive transfer into patients. This is typically done with dimethylsulfoxide (DMSO) which is, however, toxic and has been associated with post-infusion complications. The purpose of our research is to develop a new cryopreservation approach to freeze NK cells without using damaging cryoprotectants like DMSO. We use trehalose—a safe, natural sugar with cryoprotective properties. In order for cells to take up trehalose, we have developed a nanoparticle system to shuttle it across the membrane, based on crosslinked chitosan-tripolyphosphate, since trehalose cannot cross the cell membrane alone. To functionally characterize the nanocarrier system we are using confocal microscopy to determine nanoparticle uptake into NK cells. We will also perform a cytotoxicity assay to determine anti-tumor function of cryopreserved NK cells and establish cell viability post-thaw. A degranulation assay will also be performed to determine cytotoxic activity of the NK cells against cancer targets. The hope is that these cells will proliferate and perform their functions before and after freezing with the use of the trehalose-loaded nanoparticles. After preliminary studies with the nanoparticles, we will study the anti-tumor immunity of these cryopreserved, engineered NK cells in adoptive transfer experiments in vivo toward clinical studies in humans.

Research Mentors:

Professor Sandro Matosevic, IPPH, College of Pharmacy

Jiao Wang, IPPH, College of Pharmacy

Andrea Chambers, IPPH, College of Pharmacy

Kyle Lupo, IPPH, College of Pharmacy

Time: 9:10:00 AM **Room:** 214A :: **Social Sciences/Humanities**

College of Liberal Arts

Facial Expressions in Sign Language Grammar: What Does the 'Flat Chin' Mean?

Author:

Lauren Nikolai

Abstract:

In sign languages, Non-Manual Markers (NMM) supplement information given by the hands, but are produced elsewhere on the body. For example, raised eyebrows mark interrogatives in American Sign Language (ASL) (Sandler & Lillo-Martin 2006). Though NMM are common, many of their purposes are still unknown. This study looks at the linguistic function of the NMM Action Unit 17 (AU-17), or “flat chin,” in ASL. Previous research suggests AU-17 correlates cross-culturally with expressing disgust (Ekman, Sorenson, & Friesen, 1969) and, within ASL, negation (Benitez-Quiroz, Wilbur, & Martínez, 2016). We propose that AU-17 has wider linguistic functions within ASL, and, based on our analysis of an ASL video corpus, present five such functions: speaker evaluation, partitive, uncertainty, discussing facial expressions & NMM, and lexical coarticulation. For speaker evaluation, AU-17 occurs where the speaker is making a judgment about what they are stating (27% of the appearances of AU-17 in our data). For partitive, AU-17 occurs over a phrase where the speaker discusses parts of an entity (20%). For uncertainty, AU-17 occurs where the speaker is uncertain about what they are saying or is offering a possibility for the future (13%). For discussing facial expressions & NMM, AU-17 occurs where the signer describes or emphasizes facial expressions NMM (13%). For lexical coarticulation, AU-17 is consistently coarticulated with individual signs such as MISS (3-15%). These functions account for approximately 76% of the appearances of AU-17 in our corpus, indicating that AU-17 does indeed have greater linguistic function than previously noted. Ultimately, our analysis of AU-17's functions will feed the development of automatic sign language translation algorithms, improve education of both native and non-native ASL signers, and fill in a gap in our overall linguistic knowledge.

Research Mentor:

Dr. Ronnie B. Wilbur, Dept. of Speech, Language, Hearing Sciences, College of Health and Human Sciences & Linguistics, School of Interdisciplinary Studies, College of Liberal Arts

Time: 9:10:00 AM **Room:** 214C :: **Mathematical/Computational Sciences**

College of Engineering

Emotion Detection

Authors:

Andrew Jaseckas

Shutao Wang

Hussni Mohd Zakir

Tianlong Yuan

Abstract:

The purpose of this project is to reliably detect and classify emotions portrayed in facial expressions. Using people's facial expressions can provide important information about how they are feeling, which is usually subconscious, to reveal their true feelings about a certain subject. One of our applications would be using this emotion detection model to manage undesired emotions within large audiences/excessive images, giving feedback to the users to allow them to adjust their tactics for managing the audiences/images accordingly. We will utilize a Convolutional Neural Network (CNN) as our emotion classifier. We will train the CNN model using an image dataset of 305GB containing 750,000 images that are labeled with the emotions each picture is expressing. We have done much research on Image Processing and plan on doing extensive research on the topics of Machine Learning to design the project. We also have an immense dataset that should allow us to train our CNN very well, leading to very accurate results. We are hoping for around an 75-80% accuracy rate on emotion detection- a number decided on by the group since we have very powerful dataset that should be enough for a very high accuracy percent, but we do not plan on building a flawless CNN, which would lower the effectiveness or our dataset. We are planning on progressing through this project for two semesters. Although we are only in the early stages of our project, we plan on measuring our results primarily on the satisfaction of the user since our emotion detection can be used in many ways, but we also care about the increase in productivity/production the user has gained from our product. Detecting emotions from images and videos has many implementations for everyday tasks, so creating such a project will have many benefits for all people.

Research Mentors:

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

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

Time: 9:30:00 AM **Room:** 214A :: **Physical Sciences**

College of Science

Characterizing the Iron-Carboxylate Interactions Underlying the Ferric Gum Photography Process

Author:

Brandon Hacha

Abstract:

Ferric gum photography is an alternative photographic technique first created in the late 20th century. This technique uses the gelation of a polysaccharide, gum arabic, in contact with iron (III) ions. Photochemical reduction of iron (III) to iron (II) occurs when paper coated with iron(III) chloride is exposed to UV light and because the gum only gels on contact with the trivalent species, a gel image can be formed. This gelation phenomenon has never been reported in chemical literature and the mechanism underlying it is therefore unclear. Our research uses vibrational spectroscopy to understand the interaction between gum arabic and iron (III) ions to determine how the gel forms. First, we focus on the infrared spectra of gum arabic on regular iron (III) chloride-soaked paper. Changes are seen in the spectral regions corresponding to the symmetric and asymmetric stretching modes of carboxylates, indicating complexation between the iron ions and the carboxylic acid residues in the gum. Because the only acidic moiety in gum arabic is glucuronic acid, we further explore the changes in infrared spectra of pure glucuronic acid, sodium glucuronate, and iron (III) glucuronate. In addition, we use the asymmetric and symmetric stretching mode frequencies of these pure salts to classify the denticity of the carboxylate-iron complex. This work shows that the bidentate chelation of iron (III) ions by multiple carboxylate groups forms a water-filled network of cross-linked polysaccharide chains. Outside of photography, this hydrogel has potential for applications in wastewater treatment, nanoparticle synthesis, and ion-affinity chromatography.

Research Mentor:

Dr. Michael R. Columbia, Department of Chemistry, College of Arts and Sciences, Purdue University Fort Wayne

Time: 9:30:00 AM **Room:** 214C :: **Innovative Technology/Entrepreneurship/Design**

College of Engineering

Development of a Sketch Planning Tool to Estimate the Wider Economic Benefits of Bridge Preservation in Indiana

Author:

Sumedh Khair

Abstract:

Higher rates of economic growth and development increase pressure on transportation infrastructure. Transportation engineers, along with designing new facilities, are responsible for the sustainability and preservation of aging infrastructure. Infrastructure preservation projects therefore can prevent, delay or reduce deterioration of infrastructure to restore intended function and allow for handling higher transportation volumes.

Sketch planning tools can be used as a first step for screening the roadway network and identify assets in need of preservation. A bridge preservation sketch planning tool has been developed by the Sustainable Transport Systems Research Group at Purdue University. The tool determines the percentage of motor carriers (trucks) that should detour due to posted weight limits, which are put in place to prevent further damage to existing bridges. Percentage of detour is determined using truck gross vehicle weight data collected from the Indiana Department of Transportation's (INDOT) weigh-in-motion database. Data collected from the database is used to construct weight distribution histograms for each truck class and subsequently determine the percentage of trucks that should detour.

As detour routes are longer than original routes with bridges, detouring trucks impose additional vehicle operating costs and travel time costs on businesses, which translate into economic impacts on the statewide level. INDOT planners can use the developed tool to obtain general order-of-magnitude estimates of these impacts. Estimating these impacts is an essential task when conducting cost-benefit analysis to assess the economic feasibility of bridge preservation projects in Indiana.

Research Mentors:

Dr. Nadia Gkritza, Associate Professor of Civil Engineering

Yue Ke

Time: 9:50:00 AM **Room:** 214A :: **Life Sciences**

College of Agriculture

FGFR1 Interacts with Her2 and Promotes EMT-Independent Trastuzumab-Emtansine Resistance

Author:

Zian Liu

Abstract:

Breast cancer is the most predominant and one of the deadliest types of cancer. The Her2-positive subtype is found in 20-25% of patients. Although Her2 is associated with more aggressive forms of breast cancer, Her2 targeting treatments such as trastuzumab are readily available to treat such types of cancer. Trastuzumab emtansine (T-DM1) is an antibody-drug conjugate that targets Her2 and has shown clinical effects on improving overall survival of patients with advanced Her2 positive breast cancer. However, some patients experience relapse and acquired resistance to T-DM1 upon treatment.

We have previously demonstrated that induction of epithelial-to-mesenchymal transition (EMT) with TGF-β facilitated a breast cancer cell subpopulation that acquired resistance to Her2-targeting drugs, and the drug-resistant population is more sensitive to FIIN-4, an FGFR targeting drug. In this research project, we explored resistance towards T-DM1, the molecular basis of this resistance, and potential treatment options with FIIN-4.

We have generated an in vitro T-DM1 resistant cell line (TDM1R), which has been demonstrated to have reduced Her2 expression, elevated mesenchymal molecular biomarkers, including elevated FGFR1 expression. TDM1R cells are more sensitive to FIIN-4 than the parental cell populations. Overexpression of FGFR1 alone minimally affects Her2 and EMT markers expression but renders the cell less sensitive to T-DM1. Mechanistically, FGFR1 prevents trastuzumab from binding to Her2. We are currently evaluating whether FGFR1 physically interacts with Her2. Our current evidence suggests that enhanced expression of FGFR1 through EMT plays a critical role in acquired resistance to T-DM1. Furthermore, targeting FGFR1 with next generation covalent kinase inhibitors may provide opportunities to overcome in vivo T-DM1 resistance.

Research Mentors:

Michael K Wendt, Department of Medicinal Chemistry and Molecular Pharmacology, College of Pharmacy

Saeed Salehin Akhand, Department of Medicinal Chemistry and Molecular Pharmacology, College of Pharmacy

Time: 9:50:00 AM **Room:** 214C :: **Innovative Technology/Entrepreneurship/Design**

College of Engineering

A Development of Unmanned Surface Vehicles for Algae Removal

Author:

Yuta Hoashi

Abstract:

We present an autonomous multi-robot system for algae removal in various environments using an environmental-friendly and immediate method. Harmful algal blooms in ponds and lakes produce toxic effects on people and the environment. They can degrade water quality, severely impacting the economies of fisheries, tourism industries, and residential properties. We decided to take mechanical measures, which seemed to be the most environmental-friendly and immediate method of control for the algae bloom. The proposed system is based on a multi-robot system composed of a heterogeneous team of Unmanned Aerial Vehicle (UAV) and Unmanned Surface Vehicles (USVs). The main task of the UAV is to provide a global view of the environment to identify algae patches. We developed a machine learning-based computer vision system to detect algae in various environments and conduct a path planning for the USVs, which are allocated near algae patches and remove the algae. We aimed for the small size and the low cost of the USV by assembling most of the components from PVC pipes. After extensive simulations on the model regarding the structural safety and the water/air flow, the USV was assembled and tested in indoor water, where we had success in its flotation, the algae suction, and the device control. As for the future work, the filtering system will be designed in order to separate algae from water efficiently and perform its task in outdoor water resources, such as lakes and ponds.

Research Mentors:

Dr. Byung-Cheol Min, Department of Computer and Information Technology, Polytechnic Institute

Wonse Jo, Department of Computer and Information Technology, Polytechnic Institute

Time: 10:10:00 AM **Room:** 214A :: **Life Sciences**

College of Science

Mother Knows Best?: Parental Investment Throughout *Schistosoma mansoni* Infection

Author:

Olivia Lockyear

Abstract:

Parental investment theory describes the ability of organisms to respond to an environmental challenge by increasing the fitness of future offspring. Utilizing life history changes, organisms can maximize fitness by increasing their total reproductive output or by investing more into the success of fewer offspring. In cases where parasitic infections result in castration of their host, increased reproductive effort known as fecundity compensation has been demonstrated in a variety of organisms. This response appears predictive of expected future reproductive losses. Recent evidence of both immune priming and transgenerational effects challenge the historically held assessment that invertebrate immunity is non-specific and without memory. In immune priming, primary infection lowers the prevalence and intensity of a subsequent infection by the same pathogen. Transgenerational immune priming (TGIP) carries pathogen resistance into further generations without genotypic changes. The focus of this study was to determine whether invertebrate parental investment into offspring resistance varies over the course of an infection. Utilizing the snail host Biomphalaria glabrata and its trematode parasite Schistosoma mansoni, offspring were reared from specific time intervals in the parent's infection and subsequently exposed to the same pathogen once they reached the same age. Differences in infection prevalence and intensity were expected based on when the offspring were born during their parent's infection. This study predicted a tradeoff between reproduction and offspring resistance. Offspring born during the period of fecundity compensation were predicted to exhibit lower resistance due to a dilution of individual investment by parents into a larger offspring pool. The results suggest that S. mansoni resistance in B. glabrata may be influenced by more than just genetics.

Research Mentors:

Dr. Dennis Minchella, Biology, College of Science

Stephanie Gutierrez, Biology, College of Science

Time: 10:10:00 AM **Room:** 214C :: **Social Sciences/Humanities**

College of Liberal Arts

The Dehumanization of Immigrants and Refugees: A Comparison of Presidential Candidate Rhetoric

Author:

Amanda Warnock

Abstract:

This study contributes to contemporary dehumanization theory by tracking and comparing dehumanizing rhetoric about immigrants and refugees used by all presidential candidates during the 2008, 2012, and 2016 elections. Using data hand-collected from all presidential speeches conducted during these periods, including accounting for ad libs by Donald Trump, it is found that Trump was distinctive in his dehumanization of immigrants and refugees, far surpassing all other candidates. His language surrounding these groups focused heavily on 1) using non-human language to describe their actions and migrations; 2) assigning criminality and viciousness to immigrants; 3) repeating stories of the deaths of American citizens by immigrants; 4) saying that immigrants and refugees have values incongruent with Americans; and 5) emphasizing the idea that immigrants and refugees are a threat to the American way of life. Dehumanization is often used as justification for aggressive policies and behaviors, which has been demonstrated through the Trump administration's family separation policies. This presentation adds to the conversation about dehumanization by providing evidence that Trump's language presents a major increase in dehumanizing rhetoric compared to other candidates, which is important to note as new policies unfold. Additionally, it provides a foundation of collected data for future studies.

Research Mentor:

Dr. James McCann, Departments of Political Science & Latin American Studies, College of Liberal Arts

Time: 10:30:00 AM **Room:** 214A :: **Innovative Technology/Entrepreneurship/Design**

Polytechnic Institute

Describing Design Ethics through the Lens of Company Culture

Author:

Rhea Manocha

Abstract:

HCI researchers are increasingly engaged in describing the complexities of user experience (UX) design practice. At the same time, advancements in technology require UX practitioners to engage with new forms of ethical decision-making that relate to technologies that they design, the potential for sociotechnical impact, and the balance between user and stakeholder goals. There has been some focus on ethics and values in UX practice, but little research addresses the intersection of organizational culture and ethics in design practice. In our previous work (Gray & Chivukula, in review), we established that factors such as organizational culture, individual practices, and unique requirements of a project mediate each others' influence to impact ethical decision-making. In this paper, we further explore the influence of various aspects of organizational culture on a designer's ethical awareness and decision-making. Using a practice-led approach, we conducted 11 interviews with design practitioners of varied backgrounds, responsibilities, company types, and locations. We conducted a bottom-up thematic analysis in order to identify and define these different factors. The results focus on exploring themes such as hierarchy, power dynamics, the experience of individuals in a practice context, and the motivation of money in a business setting. We propose future work on ethical awareness and mediation, particularly exploring views toward social responsibility.

Research Mentors:

Dr. Colin Gray, Computer Graphics Technology, Purdue Polytechnic Institute

Sai Shruthi Chivukula, Computer Graphics Technology, Purdue Polytechnic Institute

Time: 10:30:00 AM **Room:** 214C :: **Social Sciences/Humanities**

College of Liberal Arts

Recycling or Trash Bin?

Author:

Kexing He

Abstract:

What affects people's behavior when they dispose items? This project aims to understand how people make recycling decisions in front of bins. Our project focused on two main aspects: How easy/difficult it is to identify a bin as a trash vs recycling bin and on consumers' knowledge about recycling. In this phase of the project, we took pictures of bins inside of buildings and categorized the bins based on their forms, colors, and labels and the expected difficulty in classifying bins as recycling or trash bins. Our hypotheses are as following: (1) People make fewer errors when they identify clear-labeled (easy) bins compared to unclear (difficult) ones. (2) It takes longer for participants to identify difficult bins than easy bins. To test the hypotheses, we developed a Qualtrics survey. The survey questions are divided by two parts: (1) Part 1 asks participants to identify an individual bin as a trash or recycling bin; (2) Part 2 asks participants to select the right bin to dispose a number of different items. The program will record which bins participants select and also take the time it takes participants to form these decisions.

Research Mentor:

Dr. Torsten Reimer, Departments of Communication and Psychology, Brian Lamb School of Communication

Time: 10:50:00 AM **Room:** 214A :: **Innovative Technology/Entrepreneurship/Design**

Polytechnic Institute

Optimal Design of a Residential Photovoltaic System

Author:

Elijah St Angelo

Abstract:

This presentation seeks to demonstrate the optimal design of a residential photovoltaic system with an electrical grid connection, which provides a sustainable, economical, and reliable electricity source to a house. The conditions for the house were based on average residential electricity use in the Midwest United States. For the purpose of this presentation, a house in Carmel, Indiana in the United States is used to test the system design. The house's geographic coordinates are approximately 40.0°, -86.1°.

The optimal photovoltaic array size was calculated and simulated. HOMER Pro software was utilized to conduct the simulation. Residential electricity use data was collected from the U.S. Energy Information Administration. Meteorological data and system components' costs were sourced from HOMER Pro software.

The photovoltaic system was optimized through the analysis of its individual components, such as solar panels, inverters, and battery storage. Components were selected to provide a sustainable system that gets a majority of its power from photovoltaics but is still connected to the grid. The system is optimized by comparing a grid-tied system utilizing net metering with battery storage and without battery storage to provide the best economical energy solution for the homeowner. The presentation shows that a grid-tied photovoltaic system without battery storage can be a reliable economic investment in Carmel, Indiana.

Research Mentor:

Dr. Neil Hewitt, Centre for Sustainable Technologies, Ulster University

Time: 10:50:00 AM **Room:** 214C :: **Social Sciences/Humanities**

College of Education

Christian Teachers' Religious Beliefs Impact on Classroom Practice

Author:

Elisabeth Rohman

Abstract:

The purpose of this study was to identify how a public elementary school teacher's Christian beliefs, namely the sufficiency of Christ and the authority of Scripture, impact classroom practice. This study conducted open-ended, narrative interviews with five elementary school teachers from multiple different churches to identify specific implications for their Christian beliefs within their teaching profession. Many teachers identified the tension they feel between wanting to share what they believe is the solution and remedy to all problems, Christ, but being restricted due to the setting in which they work. Teachers also described the challenges presented while trying to address the root of behavior issues without discussing their beliefs regarding the Bible's teaching on the human's heart condition which is heavily impacted by sin. While there are many ways in which a Christian teacher cannot display his or her beliefs in a public-school setting, there are numerous principles a teacher can integrate into his or her teaching practice, classroom management, and general conduct which allow the teacher to remain faithful to his or her religious convictions while acting in a manner that is professional and respectful towards those who may believe differently.

Research Mentor:

Dr. Jason Ware, Clinical Assistant Professor and Director of the Faculty Honors Preceptors Program, Purdue Honors College

Time: 11:10:00 AM **Room:** 214A :: **Social Sciences/Humanities**

Polytechnic Institute

The Influence of Art Expertise on Emotion and Preference Ratings for an Artwork

Author:

Kanak Dhawan

Abstract:

The influence of art expertise on emotion and preference ratings for an artwork. Art has always been my passion. Emotional responses to art are now being subjected as an affective science. The aim of this is to study perceptions regarding frequency of aesthetic emotions, contributing factors, and motivation which characterize the experiences of looking at a painting. There is not much existing literature or visualizations to support this problem. There exists a critical gap in understanding the relation between art expertise, emotions and preference ratings for an artwork and this semester project will fill this gap. The research questions will not just offer a general perspective but use the data to calculate the actual factors and relations. Tableau, Excel and other visualization tools will be used to create a deeper understanding into the emotions evoked in the user by a given artwork combined with techniques learned in CGT 270 (Data Visualization) of the 7 stages of visualization. The influence of factors on emotions in a user for an artwork and interplay with art expertise and different types of artwork will be discerned. It is a unique project trying to calculate observations in users to find certain relations and data insights. This visualization will also greatly help artists understand what factors affect their work when viewed by a user. I hypothesize that the user's art expertise will largely affect the emotions in them while seeing an artwork. Also, other factors like positive emotions would increase the likability of a certain artwork.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Time: 11:10:00 AM **Room**: 214C :: **Life Sciences**

College of Engineering

Developing Programmable ELP-based Transcriptional Regulators for Dynamic Pathway Control in Microbial Systems

Author:

Juya Jeon

Abstract:

Microbes can be used to produce valuable drugs, chemicals, and biofuels, but their potential has not been fully realized due to low production yields. To improve biomanufacturing processes and yield, we are developing novel, transcriptional regulators using biosynthesis technology in order to improve cellular health and overall production. Our regulator contains elastin-like polypeptides (ELPs), which make ideal sensors since they exhibit a sharp, inverse phase transition to indicators of cell health such as intracellular pH and ionic strength, and external stimuli such as temperature. We hypothesize that ELP can be fused to transcription factors to control expression of target genes. As proof of concept, Tet repressor protein (TetR) was fused to ELP to control expression of the red fluorescent protein mCherry, which was cloned under a Tet repressible promoter. The ability of TetR-ELP to control expression was determined by measuring fluorescence above and below the transition temperature (Tt) of ELP. Below the Tt, TetR is free to repress mCherry production, but above the Tt, ELP should aggregate, preventing TetR from repressing mCherry. However, our results showed that fluorescence was not affected as expected. We hypothesize that the observed behavior is due to either TetR having temperature sensitivity or that the binding affinity of TetR to DNA is much stronger than ELP aggregation. Further steps include proving this hypothesis and finding alternative transcription factors to test. These tested gene regulators will allow us to optimize production yield of microbe and bring development in manufacturing of drugs, chemicals, and biofuels.

Research Mentor:

Logan Leadnour, Agricultural & Biological Engineering, Agricultural & Biological Engineering

Time: 11:30:00 AM **Room:** 214A :: **Innovative Technology/Entrepreneurship/Design**

College of Science

Addressing Confidentiality Issues in Supply Chains when Using Blockchain Technology

Authors:

Sihao Yin

Shivam Bajpayi

Abstract:

Traceability is a key component of supply chain sustainability. It helps mitigate risks and improves corporate social responsibility by allowing business to track, identify and trace components as they move along the supply chain. The use of blockchain technologies makes these supply chain management systems more efficient by providing a distributed, immutable chain of data for all entities - thereby reducing data redundancies and increasing transparency for related authorities. However, confidentiality issues arise with respect to the blocks in this blockchain network due to the fact that blocks might contain sensitive data accessible to all peers who possess a copy of the blockchain.

Our project work aims at solving this confidentiality issue through the use of a cryptographic approach. We can leverage the aforementioned approach to hide the transaction data in the block whilst providing the freedom in deciding the very data we want to conceal. In the meantime, we enforce protocols such as TLS (Transport Layer Security) to protect communication between all entities so that any private information is only intelligible to concerned authorities. In addition, by means of crafted access control policies, we can manage the access of the otherwise concealed data. Thus with the use of encryption along with access control policies, we can prevent malicious users, both inside and outside, from gaining sensitive information or from launching counterfeiting or duplication attacks.

This work is supported by Summer Stay Scholars and Summer Undergraduate Research Fellowships (SURF) programs at Purdue, and Ford Motors through Purdue-Ford Alliance.

Research Mentors:

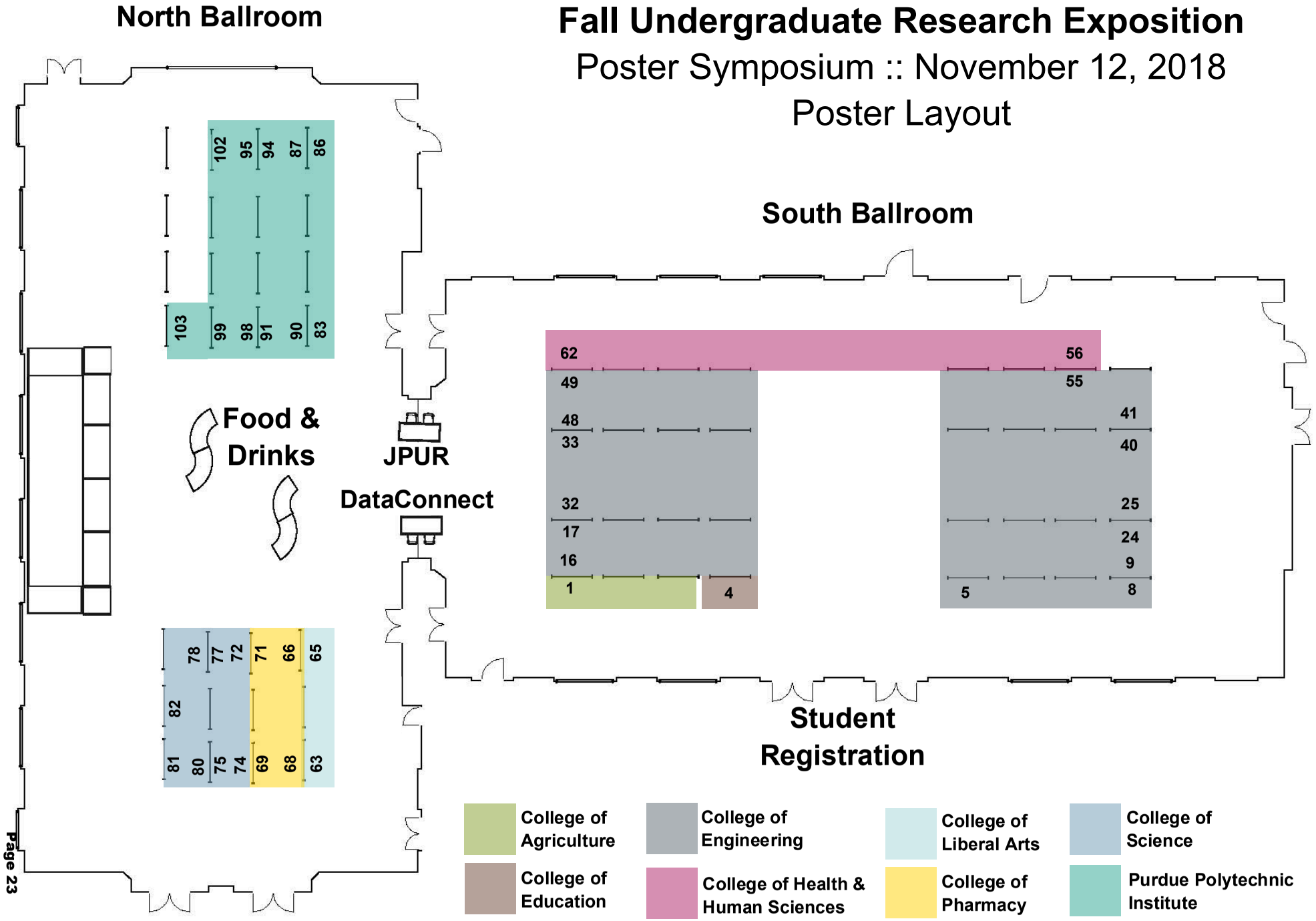
Aniket Kate, Computer Science, College of Science

Donghang Lu, Computer Science, College of Science

Fall Undergraduate Research Exposition

Poster Symposium :: November 12, 2018

Poster Layout



Purdue Fall Undergraduate Research Expo

Poster Symposium :: November 12, 2018

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College of Engineering

5 *Neil Adi, Qiwei Ye, & Nathan Gizaw*
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6 *Deepika Aggrawal, Brian Graves, & Anthony Agostino*
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7 *Mohamad Alani & Dimple Dhawan*
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14 *Samuel Dynako & Guoyang Zhou*
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Mentor: Mithuna S Thottethodi

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48 *Andrew Ulmer, Zohar Kapach, Daniel Merrick, Karthik Maiya, Abhay Sasidharan, Arshad Alikhan, & David Dang*
Mentor: Dr. Yung-Hsiang Lu

49 *Andrew Ulmer, Zohar Kapach, Daniel Merrick, Karthik Maiya, Abhay Sasidharan, David Dang, & Arshad Alikhan*
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50 *Tristan Watel-Dehaynin ♦*
Mentors: Dr. Lisa Bosman & Geetanjali Bihani

51 *Jiaxing Yang*
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54 *Kailu Zhuang*
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55 *Zane Zmola, Caleb Geissler, Abigail Beard, & Evan Shreiner ‡*
Mentors: Allen L. Garner & John A. Morgan

College of Health and Human Sciences

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Mentors: Dr. Jennifer Freeman & Dr. Jonathan Shannahan

57 *Laura Galles*
Mentors: Kristine Marceau & Emily Rolan

58 *Katherine Goulden*
Mentor: Dr. Thomas Redick

59 *Alec Graff & Kaushal Prasad ‡*
Mentor: Dr. Jae Hong Park

60 *Kaushal Prasad*
Mentors: Dr. Jae Hong Park & Dr. Mark D. Wilson

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Mentors: Richard Schweicker & Xiaofang Zheng

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Mentors: Xinran Y. Lehto, Alei Fan, Lihan Huang, & Tianyi Li

College of Liberal Arts

63 *Xuan Hu*
Mentors: Pin-Hsi Chen & Dr. Elena Benedicto

64 *Adam Kunkel*
Mentor: Professor Paul Danyi

65 *Louise Smith ■*
Mentor: Dr. Robert X. Browning

College of Pharmacy

66 *Chenghao Cui*
Mentor: Yang Yang

67 *Josh Jovevski, Michaela Todd, Stella Jung, & Rui Xu*
Mentors: Sandro Matosevic & Jiao Wang

68 *Kendall Mores*
Mentor: Dr. Richard M. M. Van Rijn, PhD

69 *Renee Oles* ♦
Mentor: Dr. Vincent Jo Davisson

70 *Anqi Shao*
Mentor: Dr. Vincent Jo Davisson

71 *Marija Stefanoska* ‡
Mentor: Patricia Darbishire

College of Science

72 *Riley Borgard*
Mentor: Tatsunari Watanabe

73 *Jiachong Chu & Fudan Zheng*
Mentor: Tonglei Li

74 *Emre Coskun* ‡
Mentor: Yuk Fai Leung

75 *Mars Gao*
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Mentor: Jon Rienstra-Kiracofe

77 *Samuel Hansen & Nicholas Sierzputowski*
Mentor: Gudrun Schmidt

78 *Bridget Kilbride*
Mentors: Dr. Julie C. Liu & Jessica Torres

79 *Amanda Ludwig*
Mentors: Dr. Tiffany Lyle, Dr. Gozde Uzunalli, & Dr. Alexandra Dieterly

80 *Paula Pandolfi*
Mentors: Kok Zhi Lee & Michael Mechikoff

81 *Joel Stauffer & Kimberley Grobien* ‡
Mentors: Stephen Coburn & Beomjin Kim

82 *Jeff Zhang*
Mentor: Name: Hilkka I. Kenttämaa

Purdue Polytechnic Institute

83 *Chance Alexander*
Mentor: Dr. Vetria Byrd

84 *Jacob Austerman*
Mentor: Dr. Vetria Byrd

85 *Weiyue Deng*
Mentor: Dr. Vetria Byrd

86 *Soyol Enkh-Amgalan* ‡
Mentor: Dr. Vetria Byrd

87 *Brandt Eytcheson*
Mentor: Dr. Vetria Byrd

88 *Nicolaus Fresh*
Mentor: Dr. Vetria Byrd

89 *Geoff Grimm*
Mentor: Dr. Vetria Byrd

90 *Wenkai Han* ‡
Mentor: Dr. Vetria Byrd

91 *Makayla Heemstra*
Mentor: Dr. Vetria Byrd

92 *Hsin-Pao Huang* ♦
Mentor: Dr. Vetria Byrd

93 *Keerti Kolakaluri*
Mentor: Dr. Vetria Byrd

94 *Elizabeth McGuckin*
Mentor: Dr. Vetria Byrd

95 *Braxton Minkey*
Mentor: Dr. Vetria Byrd

96 *Daniel Mitchell-Dix*
Mentor: Dr. Vetria Byrd

97 *Quoc Anh Nguyen Dinh*
Mentor: Dr. Vetria Byrd

98 *Jared Pilewski*
Mentor: Dr. Vetria Byrd

99 *James Rieser, Taylor Sorrell, William Longsworth, & Aaron Manio*
Mentor: Dr. Bill Hutzel

100 *Chelsie Rummage*
Mentors: Dr. Lisa Bosman, Sandhya Arumugam, & Abrar Hammound

101 *Zach Vallow*
Mentor: Dr. Vetria Byrd

102 *Divya Vempati* ♦
Mentor: Dr. Vetria Byrd

103 *Jinghe Zhu* ♦
Mentors: Dr. Vetria Byrd & Dr. David Hrusa

Legend:

■ – Honors College student researcher
♦ - Uses archival materials in project
‡ - Interdisciplinary project

Poster Number: 1 **:: Social Sciences/Humanities**

College of Agriculture

Food Safety Education among Health Professionals in China and Peru

Authors:

Han Chen

Valeria Tenorio

Abstract:

Introduction

Foodborne illness is a significant public health concern globally. WHO estimates that over 600 million people worldwide infected annually. However, not all health professionals are aware of patients' vulnerability to foodborne illness. Previously, we identified barriers to food safety education among health professionals in the US. In this study, we went further to examine the global perspective of this issue. The objective is to evaluate health professionals' practice and attitudes toward food safety education in China and Peru.

Method

A face-to-face semi-structured interview was conducted to collect data among doctors in China and Peru, using their native languages (Chinese, Spanish). In China, participants were recruited from local hospitals in Guangzhou, the capital city of Guangdong province. In Peru, participants were recruited from local hospitals in Lima, the capital city of Peru.

Results

Forty-one health professionals participated in this interview (China, n=30; Peru, n=11). The biggest food safety concern mentioned in China is food adulteration while in Peru is the use of contaminated water. All of the health professionals saw the necessity to deliver food safety education, but few of them delivered to patients. The majority of health professionals in China and Peru felt confident about microbial food safety knowledge. However, only eight participants had food safety training before. Lack of materials was ranked as the top barrier in both countries.

Significance

The findings provided evidence to guide the decision making of government, educators and health professionals, supporting the development of next-generation food safety education strategies for the public.

Research Mentor:

Yaohua Feng, Department of Agriculture, Food Science

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

College of Agriculture

Determining Origin of Northern Saw-whet Owls in Indiana Using Stable Isotope Analysis

Authors:

Landon Neumann

Ashley Higdon

Abstract:

The Northern Saw-whet Owl (*Aegolius acadicus*) is a highly migratory owl that occurs throughout North America. Banding stations have been used to study the migratory habits of this species, however these studies rarely recover data regarding the origin of this species in Indiana. While much is known about the timing of Northern Saw-whet Owls migration, little is known about the origin of these avian migrants from region to region. We used stable isotope analysis of δ18O and δ2H to determine breeding origins for Indiana Northern Saw-whet Owls. We collected feather samples from migrating owls at five different banding stations across Indiana from October to November 2017. We used a 2 cm sample from primary feather 1 from the right wing from each hatch-year owl (n=41) for analysis. Because of higher enrichment in adult owl feathers that would complicate analysis, we only used samples from hatch-year individuals for this study. Subsamples were sent in duplicate to the Stable Isotope Facility at the University of Wyoming for final analysis. The resulting isotope signatures will be compared with current isoscapes to obtain location estimates of breeding origin for Indiana owls. The results from this research will provide improved understanding of the migratory behavior of this species. This will provided needed information for conservation and management of breeding and stopover habitat for subpopulations of Northern Saw-whet Owl.

Research Mentors:

Dr. John Dunning, College of Agriculture, Forestry and Natural Resources Department

Dr. Elizabeth Flaherty, College of Agriculture, Forestry and Natural Resources Department

Poster Number: 3 **:: Life Sciences**

College of Agriculture

Passive Stomatal Responses in Ferns

Author:

Joshua Randall

Abstract:

Two theories exist to explain stomatal responses to water status in ferns. The first is that stomata in ferns respond passively to changes in water status.1 The second claims that hormones like abscisic acid (ABA) actively regulate stomatal responses just like angiosperms.2 This study tested whether stomatal responses in ferns are regulated by passive hydraulic processes rather than hormones. Using two varieties of Lady Fern Athyrium filix–femina, Mrs. Frizzle and wild-type, which have very different leaf morphologies, a model predicting stomatal behavior that assumes stomatal responses are passive, was developed and tested using stomatal responses to changes in vapor pressure deficit. Stomatal responses were measured using an infrared gas analyzer and the hydraulic properties of the leaves were quantified by the two-point rehydration method and pressure-volume curves. The variety Mrs. Frizzle had a higher leaf capacitance and hydraulic conductance compared to the wild-type. Stomatal responses to VPD in both varieties could be accurately predicted by the hydraulic properties of the leaf alone. No measured change in the levels of the plant hormone abscisic acid were detected when stomata closed following severe dehydration of fronds. These results suggest that fern stomata are passively controlled by leaf water status and not actively by hormones.

Research Mentors:

Professor Scott McAdam, Botany and Plant Pathology, Agriculture

Dr. Amanda Avila Cardoso, Botany and Plant Pathology, Agriculture

Poster Number: 4 **:: Social Sciences/Humanities**

College of Education

A Needs Assessment Survey to Investigate Indiana Elementary School Principals' Knowledge, Experiences, and Perceptions of Food Insecurity Among Their Students

Author:

Ellisa DeFur

Abstract:

Food insecurity is associated with adverse health and developmental outcomes in U.S. children; outcomes that include negative impacts on academic performance. Yet, current studies of school food environments and administrative perspectives on food insecurity are limited. We conducted a needs assessment survey across Indiana's public elementary schools to explore principal's knowledge, experiences, and perceptions regarding food insecurity at the local level. A questionnaire with both closed and open-ended items was administered to 1,177 principals across Indiana. When relevant, participants shared resources and/or programs used to address the issue of food insecurity at their school. These resources and/or programs will be an inventory of programs (local, state, and federal), that schools offer to help struggling students. Other responses were analyzed to investigate trends related to food availability, access, utilization, nutrition, and affordability across school demographics. We found that over 95% of respondents (regardless of local school factors) agreed that a child who grows up without adequate nutrition will face significant barriers to academic achievement and 70% of respondents knew of teachers at their school spending their personal money to provide food for students. Based on these and other findings, we can begin to understand and address the gaps of food security in public elementary schools so that all students having the adequate means to an appropriate and healthy diet at home and at school to promote better focus and academic achievement.

Research Mentor:

Dr. Virginia Bolshakova, Director of Out-of-School Programs Indiana GEAR UP & Assistant Research Professor, Agroecology & Science Education, Curriculum and Instruction, College of Education

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

College of Engineering

Autonomous Drone Video Leveraging Machine Vision and Learning To Open Doors

Authors:

Neil Adi

Qiwei Ye

Nathan Gizaw

Abstract:

As the usage of drones for indoor exploration increases, a solution for drones to open and close doors becomes more important than ever. Our team hopes to design a solution that allows a drone to autonomously detect a door and the type of handle and then proceed to open and door and fly into the room. We hope to leverage machine learning and machine vision in order to increase the flexibility of this solution that will allow us to incorporate this solution in solving other real-world problems. Our ultimate goal is to develop a software package that allows an autonomous drone to determine a door and handle and proceed to open the door all through machine learning and machine vision. Previous research groups have attempted this task and our team is looking to extend their research. It is important to develop a solution for assisting the unmanned aerial vehicle (UAV) to recognize and detect doors in indoor environment as this typical unmanned aerial vehicle (UAV) is expected to interact physically with the environment where humans are required to perform dangerous or time-consuming tasks in hard-to-reach places such as bridges, cell towers, power lines, and nuclear reactors.

Research Mentors:

Dr. Yung-Hsiang Lu, Electrical and Computer Engineering

David Cappelleri, Mechanical Engineering

Poster Number: 6 **:: Life Sciences**

College of Engineering

Earth History Visualization

Authors:

Deepika Aggrawal

Brian Graves

Anthony Agostino

Abstract:

With the humongous amount of geological data available today, it can be hard to keep track of the timelines and figure out the ages of the samples created. Timescale Creator, or TSCreator for short, is software that is used worldwide to create and edit charts of geological time. Our enhancements to the software consist of multiple “makers”. A "maker" is an online, in-browser interactive tool to create datapacks for visualization in the TSCreator software from raw geological data. In essence, a user starts with a raw image that charts some data against a time axis. They drag this image into a maker for an individualized type of data, extract the relative positions of data based on the time axis, and export a machine-readable datapack for visualization and comparing that data with other common timescale data.

Until now, it has been difficult for users to merge and re-use data across the individual data type-specific makers. Our team is working on multiple tasks this semester to address this deficiency.

1. Master Maker export: creating a single tool that exports timelines and and image once and is then re-usable across all makers.

2. Master Maker timeline management: allowing a user to delete timelines.

3. Reference timelines: enable users to automatically use the standard geologic reference timescale

We have built the software using Javascript and the React.js framework which runs in browser, removing the need to download and install the software to the user's computer. These features will improve the function of TSCreator and make it easier for geologists around the world to organize and share their data. These enhancements will add big improvements that result in increased productivity of the users, which helps spread new information about our world.

Research Mentor:

Dr. James G. Ogg, Department of Earth, Atmospheric and Planetary Science

Poster Number: 7 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Analysis of Automated Camera Discovery and Health Checking

Authors:

Mohamad Alani

Dimple Dhawan

Abstract:

Numerous network cameras exist on the internet, however, there exists no central place where all or even most network cameras can be found. In CAM2 (Continuous Analysis of Many CAMeras), we provide a cloud-based platform that provides access to many network cameras for other researchers. One of the biggest problems with having more than 130,000 cameras in our database is having to manually go onto traffic/camera data websites to extract information which they then put into the database. A proposed solution to automate this task is to use clustering techniques and natural language processing to build a generalizable solution which can then look for camera websites, navigate to the appropriate page with image data and be able to extract as much (geospatial) information as it can about the camera. Another major problem is having to make sure the data is kept up to date since website/camera attributes change over time, and/or there are duplicates because of a link change, etc. One way to solve this problem is to create a camera health checker that executes a set of functions on a weekly basis to check if a camera is “healthy”, which entails checking camera attributes such as the resolution, frequency of use/update, etc. The camera health checker would help us manage the cameras in our database and flag the “unhealthy” cameras to be fixed. Our optimal goal is to automate the camera health checker, and have it run on a weekly basis on all the network cameras in our database.

Research Mentor:

Ryan Dailey, Electrical and Computer Engineering, College of Engineering

Poster Number: 8 **:: Mathematical/Computational Sciences**

College of Engineering

Reinforcement Learning for Autonomous Structure Inspection

Author:

Tanner Andrulis

Abstract:

All civil structures, over time, are subjected to damage from aging, usage, or environmental hazards, making necessary regular inspection for damage and safe usage of the structures. Modern methods for inspecting large-scale structures involve a lengthy manual inspection process, and thus prove time and labor intensive. A potential remedy to this problem is to inspect buildings with robotic systems, such as autonomous drones. Recent developments in the fields of image processing and autonomous piloting make autonomous drones a viable option for quickly and efficiently inspecting civil structures for damage, with little to no input from human operators. Fully autonomous control of drones enables the usage of drone swarms, that can rapidly survey a structure and highlight points of damage and degradation.

An ideal autonomous drone system would be able to quickly survey a building, pick out potential points of damage, and make intelligent decisions on how to continue inspecting the building given these points. We propose using a Reinforcement Learning (RL) algorithm to control autonomous drones. The advantage of using RL in controlling drones is that it does not require manual labelling of a large dataset as do other machine learning algorithms, and it allows the AI to explore possibilities and find novel solutions to the damage searching process. By using an RL algorithm in controlling drones, the time and labor intensive process of manually inspecting buildings can be effectively replaced with rapid and autonomous building scanning by drones.

Research Mentors:

Rih-Teng Wu, Lyles School of Civil Engineering

Mohammad R. Jahanshahi, Civil Engineering

Poster Number: 9 **:: Social Sciences/Humanities**

College of Engineering

Examination of the Effect of a Game-Like Practice Tool on the Quality of Student Peer Evaluations

Author:

Maizey Benner

Abstract:

As employers seek out individuals with interpersonal, leadership, and team skills, instructors are using team-based learning and peer evaluation as methods to teach these skills. In modern work environments, employees are often asked to actively collaborate and communicate with their peers in a variety of settings, in which the skills they learned in college become increasingly valuable. Peer evaluation is valuable in team contexts because judgment from peers motivates individuals to deliver higher-quality work and can show improvement in a variety of skills.

This analysis examines the Rater Practice (RP) tool provided by the CATME peer evaluation system- a validated schema used for peer feedback. Convergence and dispersion analysis comparing the quality of peer evaluations before and after the update of the RP tool show similar patterns, indicating that results cannot be attributed to changes in the system. Analysis using the social relations model (SRM) across all CATME dimensions revealed an overall decrease in rater variance, increase in target variance, and increase in relationship variance. Individual dimension analysis using the SRM revealed that dimensions contributing [to the teams work] (C) and interacting [with team members] (I) showed an increase in target variance, and dimensions interacting (I) and having [relevant KSA's] (H) showed a decrease in rater variance. The decline in rater variance suggests that students are providing improved evaluations of their teammates, and the increase in target variance indicates students are being rated more consistently by their peers. These SRM results show positive changes occurred after the update to the RP system.

Research Mentor:

Dr. Daniel Ferguson, Engineering Education, College of Engineering

Poster Number: 10 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Cultivating Engineering Thinking through an Innovative Educational Approach to Address Relevant Community Problems in the Azraq Refugee Camp

Author:

Zachary Beyer

Abstract:

According to the 1951 Refugee Convention, refugees are among the most vulnerable people in the world. Currently, only one percent of refugees have access to tertiary education. There have been previous initiatives to address this enormous need, including courses focused on teaching world history in refugee camps. This presentation will describe a course developed to provide an introductory engineering design course for university-level learners in the Azraq refugee camp, Jordan. In this course, students were introduced to topics such as the engineering design process, electrical/electronic systems, programming, and solar energy. Throughout the course, students worked on an iterative design solution, that incorporated the engineering design process and technical skills, allowing them to apply these theoretical concepts through a final project that addressed a relevant problem within their community. The course utilized in-person activities, individual and group assignments, as well as an online platform to advance the understanding of these concepts for students. Content was delivered through an active, blended, collaborative, and democratic learning structure in order to provide a fully supportive and innovative course structure for students. The course presented a novel approach to the instruction of refugee learners primarily through human-centered design, as well as contextually aligned course content. Through this pedagogical approach, students in the course were able to demonstrate their abilities and fluency in the course content, but also exhibited improvements in professional development and social awareness as a by-product of the course.

Research Mentors:

Jennifer DeBoer, Engineering Education, College of Engineering

Claudio Freitas, Engineering Education, College of Engineering

Poster Number: 11 **:: Mathematical/Computational Sciences**

College of Engineering

Understanding Fashion Aesthetics: Training a Neural Network Based Predictor using Likes and Dislikes

Author:

Rachel Bilbo

Abstract:

With the rise of the digital shopping age, second-hand retail websites are becoming increasingly popular, particularly within the fashion industry. Websites such as these allow users to upload listings of articles they hope to sell, often including images of the object for sale. Photos taken by inexperienced photographers using unideal equipment such as a smartphone camera often have a very low aesthetic quality, an image feature that fashion websites cannot directly measure and prevent. In this work, we use human binary classifications of image aesthetic quality to train an aesthetic quality predictor. Image features that correlate with aesthetic quality are extracted and utilized in a machine learning algorithm. With a binary prediction output– either the image will be liked or disliked – our method proves to be a concise yet effective approach to predicting the aesthetic quality of fashion images. With the ability to predict the aesthetic quality of images uploaded with clothing article listings, fashion websites are able to notify sellers of images that will reduce customer interest in an item. This will encourage sellers to improve aesthetic quality of their images, improving business for both themselves and the fashion website.

Research Mentors:

Jan Allebachm, School of Electrical and Computer Engineering, College of Engineering

Zhi Li, School of Electrical and Computer Engineering, College of Engineering

Poster Number: 12 **:: Social Sciences/Humanities**

College of Engineering

Evaluating Recycling Within Greek and Cooperative Houses

Authors:

Dylan Buechler

Hillary Vrba

Michal Chrapek

Clare Schroeder

Diana DiPretoro

Christopher Arnold

Michelle Bischoff

Abstract:

Previous iterations of Purdue's Campus Master Plans have not included sustainable development within the Purdue Greek and Cooperative Life Community, which neglects sustainable development goals for approximately 6000 undergraduates at Purdue. This study is focused on establishing baselines for successful sustainable development programs in the Fraternity, Sorority, and Cooperative Life Houses. One of the key metrics being investigated is the adoption rate and perception of recycling programs within shared community spaces. We hypothesize that convenience (e.g., distance to recycling drop off points) and economic perceptions are the primary drivers impacting individual sustainable practices and broader implementation within Fraternity, Sorority, and Cooperative Life housing. This study will gather information on the successful implementation of existing programs and identify challenges and barriers to those without recycling initiatives. An educational targeted campaign will be implemented within houses. Electronic surveys will be conducted to identify and assess: (1) factors that influence diversion rates; (2) perceived barriers and challenges to implementing recycling programs, and (3) the impact of the educational campaign (i.e., to gauge changing attitudes). In focusing on Fraternity, Sorority, and Cooperative Life students, we hope to utilize this information to implement long-term sustainable practices that will encompass the entirety of Purdue's undergraduate community.

Research Mentors:

Andrew Huang, Industrial Engineering, College of Engineering

Michael Mashtare, Agronomy, College of Agriculture

Poster Number: 13 **:: Life Sciences**

College of Engineering

Urban Forest Biomass of Indianapolis and Chicago

Author:

Gillian Clark

Abstract:

Vegetation plays an important role in urban areas by reducing the urban heat island effect, sequestering carbon emissions, and providing socioeconomic benefits to the surrounding areas. However, the roles and distributions of urban forests have historically been ignored or underestimated. This project seeks to provide a first-order estimate of the quantity and spatial distribution of aboveground biomass in urban forests in the greater Indianapolis, Indiana, and Chicago, Illinois, areas. Tree biomass is calculated using street tree inventories and allometric relationships to create a map of biomass within each city. Land cover datasets and urban tree canopy data are compared to this distribution to develop a statistical relationship between land cover type, urban tree canopy, and aboveground biomass. This empirical model will be inverted to estimate biomass distribution across each multi-county metropolitan statistical areas.

This project will produce a biomass map for the Chicago Metropolitan Statistical Area and the Indianapolis Metropolitan Statistical Area at a higher resolution than is currently available from other sources. This map can be used to inform and improve atmospheric carbon cycling models by predicting the relative strength of the urban vegetation carbon sink. This information will also serve as a foundation for future studies investigating drivers of biomass distribution patterns such as socioeconomic factors, population density, neighborhood age, and demographic data and the impacts of these distributions on ecosystem services.

Research Mentors:

Dr. Brady Hardiman, Forestry and Natural Resources, College of Agriculture

Jacob Klaybor, Environmental and Ecological Engineering, College of Engineering

Poster Number: 14 **:: Physical Sciences**

College of Engineering

Botnets and IoTs: Harm, Regulation, and Attack Mitigation

Authors:

Samuel Dynako

Guoyang Zhou

Abstract:

Botnets, collections of Internet of Things (IoT) devices traditionally controlled by a Command and Control (C&C) server and directed towards unified and deleterious ends, such as Distributed Denial of Service (DDoS) attacks, constitute and cause significant harm to target individuals and corporations. Given the developing complexity of botnet networks and their amplified profile after recent high-profile attacks, such as the 2016 Mirai and 2014-2016 BASHLITE attacks, greater interest in understanding the social and economic harm resulting from these networks has emerged. Within this milieu, this paper seeks to further identify the extent of the harms caused by such attacks, and beyond this, to explore the intersection of public policy and regulation with IoTs producers to mitigate the severity of future attacks, while maintaining a reasonable policy framework—one that recognizes that economic and practical restrains exist that influence the implementation of such policies. In particular, this paper investigates the effects of the Mirai and BASHLITE attacks, potential policies that might mitigate future attacks, and the feasibility of any such regulations.

Research Mentor:

Professor Ian Samuel, Maurer School of Law: Indiana University

Poster Number: 15 **:: Mathematical/Computational Sciences**

College of Engineering

A Bird's-Eye View of What Learners Like and Dislike about MOOCs across Subject Areas Using Topic Modeling

Author:

Abigail Gentry

Abstract:

Massive Open Online Courses (MOOCs) are offered on many different subject areas, that involve different pedagogies and course design. In order to design MOOCs to encourage engagement, it is important to understand whether learners have similar or dissimilar expectations based on the subject area of MOOC. The purpose of this research is to understand learners' likes and dislikes by analyzing end-of-course evaluation surveys of MOOCs from different subject areas.

We analyzed open-ended responses to three post-survey questions from about 800 courses offered on the FutureLearn platform in different subject areas: STEM, Arts, Business, and Healthcare. These questions asked learners which aspects of MOOCs were they satisfied with, dissatisfied with, and wanted improvements.We used the Latent Dirichlet Allocation (LDA) topic model to determine prominent topics in the responses and interpreted these topics using qualitative analysis. For interpreting the topic themes, we qualitatively examined a) top words that defined the topic, and b) learners' responses most representative of the topic.

We discovered that there were few topics common across subject areas for all post-survey questions, such as, course content, real life applications, and peer and mentor interactions. Additionally, learners from different subject areas wanted improvements on the course length and weekly time commitment. Topics specific to subject areas provided better insight on learners' experience. Instructors, instructional design staff and MOOC platforms can use the results from this study recommendations for improving course design to improve the learning experience for MOOCs in different areas.

Research Mentors:

Dr. Kerrie Douglas, Engineering Education, Engineering

Gaurav Nanda, Engineering Education, Engineering

Poster Number: 16 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Autonomous Aerial Drone

Author:

Alex Goldberg

Abstract:

The purpose of this research team is to construct a drone to be capable of flying a predetermined path as well as having operational capabilities with a remote controller. Once these objectives have been reached the primary goal is to implement a facial recognition system within the drone's operating system. Research was conducted to discover software capable of programming and calibrating the device that controls the drone, methods for calibrating connections between the drone and remote for manual flight operation, and charging/connecting the batteries that power the drone and remote. Two versions of software that were discovered to be capable of loading the firmware to the drone. The remote was connected to the drone through calibrations using the software and the binding setting on the remote. Battery charging was discovered to be capable when set at 5 volts and less than 5 amperes. It was found that the current battery is not supplying enough voltage to power the drone and its motors. Through these results it was discovered that most of the main steps in preparing the drone have been accomplished. The last steps are to replace the battery and test liftoff with a tether to stabilize flight, then without a tether in the Purdue Armory.

Research Mentor:

Samuel Midkiff, School of Electrical and Computer Engineering, Purdue University

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

College of Engineering

Communicating STEM Principles through Media and the Engineering Gift Guide

Author:

Connor Hage

Abstract:

As learning engineering and other STEM ideas becomes more popular and more imperative, there is a search for how these ideas can be taught to the public in a way that is both informative and entertaining. This search has expanded in many ways, including using video and media to spread STEM concepts and teaching engineering skills to children through play. Every holiday season INSPIRE (an engineering education research group) releases an Engineering Gift Guide, which highlights STEM based toys. During the release, video reviews are created for many of the toys. This project explores how STEM ideas can be communicated to a wide array of people through design, video, and social media, specifically through the Gift Guide's video reviews. To begin the process, engineering toys (sent to INSPIRE by toy companies) were tested by a variety of individuals, ranging from young children to college students. The reviewers detailed what was entertaining about the toys along with what engineering concepts it encouraged, such as spatial reasoning, creative thinking, design, problem solving, and more. This information was then used to create scripts for video reviews. For each toy, an individual was recorded speaking the script and the toy itself was filmed while being played with. The gathered footage was then edited to create short, cohesive narratives about the toys. In the past, these reviews have garnered attention on social media, even being shared by toy companies. Further work with the videos aims to reach a larger audience, which may consist of parents as well as educators, children, and anyone else interested in the intersection of STEM, play, and media.

Research Mentor:

Elizabeth Gajdzik, INSPIRE, Engineering Education

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

College of Engineering

Unmanned Ground Vehicle for Aerial Reconnaissance Support

Authors:

Brian Helfrecht

Drew McCutchan

Bryan Jimenez

Xinran Li

Abhi Dharanipragada

Abstract:

The IEEE Purdue Aerial Robotics VIP team is responsible for designing and building an unmanned aerial system (UAS) for use in a simulated search and rescue mission. The system must capable of performing various tasks including fully autonomous flight, computer vision, obstacle avoidance, and a payload drop. This semester's work focused on the payload drop, in which an autonomous ground vehicle (UGV) had to be dropped from the UAS from at least 100 feet, land safely within a specified distance of a target, and autonomously navigate to another predefined location, all while carrying an eight-ounce payload.

The UGV chassis was constructed using lightweight yet rigid LEGO Technic beams to prevent damage during deployment, landing, and locomotion. Large wheels provided sufficient ground clearance to avoid small obstacles along the vehicle's path and allowed it to traverse uneven terrain without being pushed off course. For electronics, an Arduino microcontroller was used to power four DC motors with a 5V battery. The microcontroller ran a PI control algorithm that used feedback from motor encoders and an onboard GPS to control the vehicle to its desired location.

After testing, the UGV was able to survive a drop from 100 feet without sustaining any damage. The GPS and control algorithms also enabled the vehicle to travel to its desired location. However, the terrain was more uneven than expected, which interfered with the system's ability to move consistently, and the unstable grass surface on which the UGV was driving caused the wheels to slip and the encoders to fall out of sync. In total, the system met expectations for robustness, but underachieved on its navigation abilities.

Research Mentor:

Professor Samuel Midkiff

Poster Number: 19 **:: Social Sciences/Humanities**

College of Engineering

Engineering Undergraduate Academic Policies: Standards over Time

Authors:

Dan Irby

Wil Stuckey

Hamza Tanzeem

Tom Cody

Abstract:

Multiple Institution Database for Investigating Engineering Longitudinal Development (MIDFIELD) sought to compare educational policies across universities in order to identify existing trends in the past 30 years. In this project we obtained the catalogs for various universities across the United States and analyzed them utilizing NVivo. We hypothesized that as time has progressed, colleges have better refined and specified their policies and catalogs, generally in such a way that has led to higher academic standards. In conclusion, across multiple years, there is not much of a difference, but across colleges, more definitive trends can be observed. The result of these comparisons are illustrated on our poster.

Research Mentor:

Hossein Ebrahiminejad, Engineering Education, Engineering

Poster Number: 20 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Mapping Sustainability to University Goals

Author:

Emily Johncox

Abstract:

As Purdue University's Office of Sustainability developed a new Sustainability Master Plan for the next 10 years, it became clear that presenting this plan in isolation from the goals of the university would not lead to an optimal implementation. There was a lack of connections being made between sustainability, the student experience, and the success of a higher education institution. This report begins to bridge that gap with a case study at Purdue, which connects the sustainability solutions found in the Sustainability Master Plan to the university administration's Purdue Moves objectives. The method of this research blended an analysis of both of these administrative strategic plans with a literature review. Potential connections between sub-targets of the Sustainability Master Plan and the Purdue Moves goals were hypothesized, and then journal articles and case studies were reviewed to support or negate these connections. The analysis and synthesis of previous research resulted in the substantiation of over 65 connections demonstrating the role of the Sustainability Master Plan in achieving the Purdue Moves goals. The impact of this research is not only a path for improved implementation for Purdue's Sustainability Master Plan, but also the creation of a guide for other higher education institutions to make similar connections of stakeholder interests in sustainability.

Research Mentors:

Max Driscoll, Office of Campus Master Planning and Sustainability

Bhagyashree Warad, Graduate Student, BCM

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

College of Engineering

Creating MATLAB Based Graphical User Interface for ADEPT-m

Authors:

Sanna Kapoor

Josh Oderkirk

Yidi Du

Xinrui Zhang

Yifu Ding

Abstract:

Increased emphasis has been placed on researching photo voltaic cells to improve the efficiency of solar panels and ease the transition into renewable energy sources. A Device Emulation Program and Toolbox (ADEPT-m) is a user-based MATLAB toolbox that has the visualization and data manipulation capabilities focused on simulating and modeling photo voltaic cells. Despite ADEPT-m being an effective tool to research photo voltaic cells, it is difficult to use due to the extensive amount of input variables and commands. Therefore, we want to develop a way to make the program more user-friendly. Our goal is to design a Graphical User Interface (GUI) that is easy to use and detailed enough such that any user, irrespective of their experience with MATLAB, can easily use ADEPT-m to design and analyze photo voltaic devices. Initially, we will create a main page which directs the user to each of the three prominent function menus; Build, Test, and Examine. After merging these basic functionalities into the GUI, we believe it will make modeling and examination more effective for research purposes. We expect users with little to no knowledge of MATLAB commands to be able to build any solar cell they wish to simulate. As a result, the GUI will increase the ease of simulation by reducing the need to enter every MATLAB command, thereby allowing a wider range of users with knowledge of renewable energy to utilize this research tool.

Research Mentor:

J. L. Gray, School of Electrical and Computer Engineering

Poster Number: 22 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Efficient Pipeline for Real-Time Feature Vector Storage and Retrieval

Authors:

Rahul Kartick

Paras Adhikary

Abstract:

The Embedded Vision team is a sub-team in the Continuous Analysis of Many Cameras (CAM2) research group and consists of juniors and graduate students. The purpose of the team, as of the last semester (since Summer 2018), has been to investigate into efficient and scalable methods for querying feature vectors of images, thereby enabling near real-time object re-identification in camera systems.

The embedded vision team has created a 2-phase pipeline for processing feature vectors. In the 1st phase or node phase, Raspberry Pi's are connected to cameras to act as triggers to indicate the presence of a new object in the frame and route a fixed number of frames with the object to the 2nd phase or the server phase. In the server phase YOLOv3, a state of the art object detection algorithm, is used to isolate unique objects and Locality Sensitive Hashing (LSH) is used to store feature vectors corresponding to the unique object. These feature vectors can be retrieved to reidentify objects when another object has similar feature vectors. This pipeline was tested on data collected from security cameras in the Electrical Engineering building and allows very fast feature vector retrieval and object identification.

This pipeline can be used to create smart camera systems that can re-identify known objects very quickly. This allows for an efficient response in finding misplaced items and pedestrian re-identification. The embedded vision team would like to present this research in the Fall 2018 Undergraduate Research Fall Expo through a poster session under the supervision of our advisor Dr.Yung Hsiang Lu in the College of Electrical and Computer Engineering.

Research Mentor:

Dr. Yung Hsiang Lu, ECE, College of Engineering,

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

College of Engineering

Reduced Annotation with Transfer and Active Learning

Authors:

Ashley Kim

Damini Rijhwan

Nobelle Tay

Shijin Wang

Abstract:

Deep Convolutional Neural Networks have yielded state of the art performance in various applications of image identification problems. In supervised learning, successful model requires a large scaled annotated data. In our paper, we propose to reduce the number of required labeled data by actively adapting a pre-trained model with less labeled examples. The availability of data greatly reduces in the context where the data require experts to label. Medical sector is one such area, where the sparsity of data is critical, and can lead to pre-screening diagnostic problems that easily affects health abnormalities at later stages. This deep learning problem requires solutions that target the limited availability of labeled instances. We approach this problem with pool based batch-mode active learning sampling using a combined criterion of informativeness and distinctiveness of an instance. We utilize the power of low level features to boost and adapt our model, and include the redundant behaviour from the source to the target task as a distinctiveness metric. The unique feature transformation through the layers implies a behavior from general to specific. Exploiting this data differentiability from source to target task provides evidence of knowledge that the model has not acquired yet. The higher the distinctiveness, the higher the difference between the feature transformation. In our approach, we prove that annotations can be reduced by querying the most representative and task specific instances.

Research Mentor:

Dr. Yung Hsiang Lu, Electrical and Computer Engineering, Purdue

Poster Number: 24 **:: Social Sciences/Humanities**

College of Engineering

Mitigating Student Opportunity Gaps: First Generation College Students Predicted to Perform Better when Exhibiting Certain Online Behaviors

Author:

Ian Kinney

Abstract:

This study examines how groups of students defined by demographic differences (i.e., gender, ethnicity, first-generation college student status) interact with online resources, to see if certain groups receive differential benefits from utilizing certain resources. We estimate interaction terms between demographics and key behaviors, such as starting homework assignments early and watching course website videos, while controlling for base effects of background and behavior. Based on prior literature, it was hypothesized that significant interaction effects would exist, especially involving gender. To test our hypothesis, data were collected from the students' use of online resources associated with an introductory physics course, which allowed us to track every click the students made. Results from inferential statistics show two significant interaction effects involving first-generation students. This specific group of students is predicted to perform better when spending shorter periods of time on the course website and working on multiple homework problems simultaneously. Future quantitative work is required to test these results in subsequent semesters, and qualitative work is required to discover the cause of these effects. Ultimately, this research can be a starting point for discovering ways to support students who enter college with fewer opportunities to succeed than most.

Research Mentors:

Jennifer DeBoer, Engineering Education, College of Engineering

Mohamed Aziz Dridi, Engineering Education, College of Engineering

Poster Number: 25 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Autonomous Land Vehicle

Authors:

Chuyen Le

Eric Cocanig

Derek Tenny

Elijah Kline

Matt James

Pratik Bansal

Salma Pool

Ziyu Guo

Abstract:

The demand for the autonomous land vehicle industry has been increasing tremendously, and continues to grow; nearly 30 million autonomous vehicles are expected to be sold by 2040. 1 The VIP Autonomous Land Vehicle Project is a project where students get to practice the integration of hardware and software. Developing both the hardware and software helps enhance knowledge and gain experience in vehicle autonomy. An automatic pilot has been built 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 starting point to the finishing point, without hitting unforeseen obstacles or leaving the vicinity of the planned path. Together, we have transformed an electric remote-controlled vehicle into an autonomous vehicle incorporating self-navigation through image processing based on Gaussian smoothing, Canny Edge Detector, and Hough Line Detection. Hard data on sensors and vehicle characteristics have been tested for in order to tailor software specifications. The speed of the vehicle is interconnected with the ability of the cart's sensors and steering. Vehicle self-navigation is performed using a microcontroller, motor controller, ultrasonic sensors, and a wireless camera with computer-aided vision.

Research Mentor:

Sam Midkiff

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

College of Engineering

Image and Video Database Management System for a Global Network of Cameras

Authors:

Sunghy Lee

Joseph Coleman

Sai Venkata Sravan Putikam

Lawrence Lee

Karan Oberoi

Abstract:

The Continuous Analysis of Many CAMeras (CAM2) project aims to create a system for performing analysis on data streamed from a global network of cameras. However, the image data collected is widely scattered and disorganized which limits its potential use in analytics. In order to solve this issue, our team, the CAM2 Image Database Team, is working to create a database system that would organize the data into a database and make the images easily and efficiently accessible. Through the implementation of a solution, teams within the CAM2 would gain greater accessibility to the files for utilization on their separate projects. However, there are several factors that the database management system must fulfill in order to develop a useful solution for the CAM2 project. The database management system implemented must be able to query data of several images and video formats, along with Extensible Markup Language (.xml) files. The database also will utilize the ability to query data of various nature. The database management system must be capable of organizing the data based on a variety of metadata and parameters: time, location, indoors/outdoors, rural/urban, etc. Clients should not only have the capability to search and access files based on these parameters but also be able to insert labels into the database as well, such as objects or conditions that are observed within a file. This paper proposes a potential solution to the problem by utilizing PostgreSQL, an object-relational database management system, as the selected database for the project. PostgreSQL utilizes ANSI SQL while providing extra functionality and support to increase the longevity and scalability of our system. Accompanying the database management system will be a hardware server implementation that will use a raid controller, LVM, and multiple drives in order to maximize performance, disk space usage, and storage space. Users of the database will be able to use SSH access to upload and download image files. With a plan set out for the development of the solution we have described above, the CAM2 is looking to get a working solution by the end of this semester. With the creation of a database management system, large-scale analysis of photos and videos gathered from around the world would be possible for the CAM2 project.

Research Mentor:

Prof. Yung-Hsiang Lu, Electrical and Computer Engineering, Purdue University

Poster Number: 27 **:: Mathematical/Computational Sciences**

College of Engineering

Automatic Attendance Camera for Classrooms

Authors:

Carol Lo

Jiachen Wang

Xinhui Wang

Yao Chen

Zhenxun Yuan

Wenzhong Duan

Abstract:

Topic/Purpose:

The purpose of this project is to create a system for automatically taking attendance in classrooms using off-the-shelf cameras and facial recognition techniques, thus eliminating the time and effort needed for teachers to take attendances and for students to view their attendance history.

Methods:

We utilized face detection, facial recognition, and machine learning techniques to achieve automatic identification of people in a classroom with high accuracy. All image processing is performed on our back-end server. The attendance results obtained from the facial recognition will be uploaded to the Firebase Database. In order for our users to interact with our system, we used React Native to build a cross-platform (iOS & Android) mobile application that gets all attendance related information via the Firebase Database, which will be constantly updated by our back-end server.

Results:

The initial goal was to demonstrate proof-of-concept for small classroom settings (6-12 students), and at the moment we were able to expand that to a classroom size of 20-30 students.

Given a high resolution image (4000*6000 pixels), our system can detect and recognize all faces in 20-30 students' classroom with high accuracy. We have also experimented with a classroom size of 36 students and have been able to consistently detect and identify all the faces so far.

Implication:

With a well-designed user experience, we hope to significantly reduce the time needed to take attendance. Students only need to submit one image of their faces onto firebase through the app at the beginning of the semester, and the system will generate the face database automatically during the first lecture. Our system is convenient for all users.

Research Mentor:

Mithuna S. Thottethodi, Electrical and Computer Engineering, Purdue University

Poster Number: 28 **:: Mathematical/Computational Sciences**

College of Engineering

Inkjet Printing of Continuous-Tone Images using Tone-Dependent Fast Error Diffusion Based on a Neugebauer Primary Area Coverage Framework

Authors:

Zhen Luan

Altyngul Jumabayeva

Abstract:

Color images are a ubiquitous part of our daily lives. We generate them easily with smartphone cameras, and share them widely via social networks. When we want to make a hard-copy print of a color image, inkjet printers can be used to print high-quality color photographs at low cost. However, most printing technologies, including inkjet, require the image to be printed first be halftoned, halftoning refers to the process of representing tonal values that, in a monochrome context, range from highlight (plain media with no colorant) to shadow (full coverage of the media with colorant) by varying the size and/or spacing of colorant dots. Such halftone patterns can be classified along two dimensions: clustered-dot vs. dispersed-dot, and periodic vs. aperiodic. To generate a color image, halftoned separations, each printed with one of three or more colorants, may be superimposed. With three-colorant systems, typically cyan, magenta, and yellow are used. Error diffusion is a halftoning method that is widely deployed with inkjet printing systems, since such systems can stably generate dispersed-dot, aperiodic halftone patterns. And if they can be printed well, such patterns will provide the best halftone image quality for a given printer resolution. In a monochrome halftoning context, Tone-Dependent Fast Error Diffusion (TDFED) has been shown to yield image quality that is comparable to that of the gold standard dispersed-dot, aperiodic halftoning algorithm Direct Binary Search (DBS), which TDFED is trained to mimic. However, no color version of TDFED has been published in the open literature. In this poster, we describe an implementation of TDFED that is based on the concept of Neugebauer Primary Area Coverage (NPAC), which has previously been shown to yield excellent color image quality with DBS

Research Mentor:

Jan Allebach, Electrical and Computer Engineering, College of Engineering

Poster Number: 29 **:: Mathematical/Computational Sciences**

College of Engineering

Integration of a Floating-Point Unit Into A RISC-V Core

Author:

Niraj Menon

Aditya Chakraborty

Bojun Huang

Jingchen Lei

Yiming Ma

Youtian Chen

Liangyu Chen

Abstract:

The floating-point unit (FPU) is an integral part of a processor since it handles floating point calculations, which are used extensively in scientific computing. A specialized floating-point unit was designed in collaboration with the Naval Surface Warfare Center Crane Division. This paper details the methods used in order to integrate the FPU into RISCVBusiness, an open source project that provides an easily configurable and extendable implementation of the reduced instruction set computer (RISC)-V core for university researchers. The process will begin by first setting up the RISCVBusiness code, which includes the necessary tools and software required to test, debug and run simulations on the core, including simulations for floating point instructions. When the FPU's capability is verified, it will be integrated into the RISC-V core using an interface called RISC-Management, which is used to add non/standard instruction set architecture (ISA) extensions, essentially additional components for the system, to the RISC-V core. After verifying that the integration was successful using floating point tests, the updated RISC-V core will be integrated into Purdue's SoC (system-on-a-chip), developed by the SoCET team, and the entire system will be tested with the new FPU to ensure it works. The integration of floating-point instructions into the core is vital to providing computational power for scientific purposes, such as precisely measuring different quantities and calculating values which need to have a high degree of accuracy. The real world relies on precise information, including exact values, and our technology needs to match that.

Research Mentors:

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

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

Jacob Stevens, Electrical and Computer Engineering, College of Engineering

Jacob Covey, Electrical and Computer Engineering, College of Engineering

Manik Singhal, Electrical and Computer Engineering, College of Engineering

Poster Number: 30 **:: Mathematical/Computational Sciences**

College of Engineering

Analyzing the Sophistication of CATME Security Using a Black-Box Vulnerability Scanner

Author:

Daniel Meulbroek

Abstract:

CATME is a peer evaluation tool used to privately rank peers on various behavioral dimensions. To gain the trust of new users and old users alike, CATME must maintain high levels of security; avoiding common weaknesses apparent on free competitors as well as other high traffic websites. Using a Black-Box vulnerability scanner, 10 websites, including CATME, were scanned for 12 different common exposures. By analyzing the average frequency as well as the severity of each of these vulnerabilities, a comparison was made between each individual websites. The black-box scanner data was used in conjunction with the Common Vulnerability Scoring System to create an overall weighted average vulnerability score. In comparing the scores, it was found the CATME had

considerably better security performance than many high traffic websites and slightly better security performance to one of it's direct competitors.

Research Mentor:

Dan Ferguson, Engineering Education, College of Engineering

Poster Number: 31 **:: Mathematical/Computational Sciences**

College of Engineering

3D Tone-Dependent Fast Error Diffusion

Author:

Adam Michals

Abstract:

As 3D printing becomes more prevalent, more attention is being paid to its ability to adequately reproduce the appearance of surfaces. Research into methods to accurately represent grayscale images through halftoning is well-developed in 2D printing, but work in the halftoning of surfaces in 3D printing is less developed. The halftoning method of tone-dependent fast error diffusion has been shown in 2D printing to be an effective means of achieving both high image quality and computational efficiency, making it an ideal algorithm to run in printing units where computational power is restricted. This work seeks to adapt tone-dependent fast error diffusion to halftone the surfaces of three-dimensional objects. Here, the ideal tone-dependent error diffusion parameters will be calculated for an image. Then, a surface traversal mechanism will be implemented to navigate the surface of a three-dimensional object while error diffusion is applied to halftone it. The expected result is an algorithm that can halftone the surface of an object with quality approaching that of iterative methods, with a fraction of the processing that they require. Iterative methods currently produce the highest halftoning quality for 3D surfaces, but their use is limited due to the amount of computation they entail. The development of a tone-dependent fast error diffusion algorithm allows 3D halftoning to represent a continuous-tone surface with comparably high quality, but the computation it requires is more appropriate for standard printers; thus, it improves the quality of surface halftoning that most printing units can produce.

Research Mentors:

Jan P. Allebach, Electrical and Computer Engineering, College of Engineering

Altyngul Jumabayeva, Electrical and Computer Engineering, College of Engineering

Poster Number: 32 **:: Life Sciences**

College of Engineering

Fluidic Control with Wax Valves for Paper-based Diagnostics

Authors:

Emilie Newsham

Katherine Clayton

Abstract:

Paper-fluidic devices are a common platform for point-of-care disease detection in under-resourced areas because of their low cost and minimal instrumentation requirements. Limited fluidic control in paper-fluidic devices has hindered the incorporation of multistep reactions that are necessary for more sensitive disease detection. One potential fluidic control mechanism is the incorporation of thermally actuated wax valves to separate assay stages. Such valving would expand the detection capabilities of these devices by permitting fluid obstruction for sustained reactions and facilitating controlled volume release within a fully-automated, self-contained device. Despite the potential to exploit wax valves for innovative paper-fluidic diagnostics, a thorough, quantitative analysis of how they can best be used has not been performed. Here, in parallel macroscopic and microscopic analyses, we show that wax valves' geometry and surface area in paper test strips influence flow behavior when thermally actuated. Macroscopic analysis evaluated the flow rate past the valves of the visible fluid front across the width of the membrane; microscopic analysis used particle image velocimetry to evaluate trends in particle flow before and after valve actuation. Preliminary results indicate that geometry and size influence valve opening times and the rate of fluid flow past the valves. Future analyses will compare the macroscopic and microscopic velocity profiles in various assay spaces and times to provide quantitative insight to the inner workings of paper-fluidic devices. This information will facilitate intelligent and efficient design of multistep paper-fluidic detection technologies with potential applications in lateral flow immunoassays, two-dimensional paper networks, and other point-of-care diagnostics.

Research Mentors:

Jacqueline Linnes, Department of Biomedical Engineering, College of Engineering

Elizabeth Phillips

Poster Number: 33 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Capturing ORBCOMM Satellite Transmissions for Earth Remote Sensing

Authors:

Chibuikem Ohanele

Krina Jhala

Patrick McDonnell

Zifeng Liu

Sanphot Thiewprasertkul

Abstract:

Analysis of the Earth’s surface from space usually requires satellites with large, high power transmitters and sensitive receivers. The Earth Remote Sensing (ERS) VIP team is developing a method of using existing satellites in orbit and their signal reflections off the Earth’s surface to determine certain qualities of surface topography such as soil moisture. Utilizing the ORBCOMM satellite network, the team is aiming to capture these low Earth orbit satellite transmissions and their reflections. With these captured signals, the Root-Zone Soil Moisture (RZSM) of soil is determined by computing the electromagnetic reflectivity of each sample. Using a USRP E310 software defined radio, the system captures both the direct transmitted signal from a satellite and the corresponding reflected signal from the earth's surface. The team is using Matlab to perform cross-correlation on the two signals to determine the reflectivity constant of the incident surface and map this reflectivity to a known soil moisture. This method of surface sensing requires significantly less power and physical space than a full transmitter-receiver system. This means future satellites implementing this method can be much lighter and therefore much cheaper to build and operate.

Research Mentor:

Jared Covert, Aeronautics and Astronautics, Graduate School

Poster Number: 34 **:: Mathematical/Computational Sciences**

College of Engineering

GOSET: A Computationally Efficient Genetic Algorithm for Multi-Objective Optimization

Author:

Christopher Potter

Abstract:

Traditional methods of design are increasingly being replaced by formal multi-objective optimization based design processes. Such an approach reduces the amount of engineering time required to achieve a design and at the same time yields superior designs. The challenge of such an approach, however, is that it requires significant computational resources as even for modestly complex components. It is not uncommon for 104-107 design evaluations to be required. For this reason, the computational effectiveness of the optimization engine is paramount. GOSET is a new elitist genetic algorithm proposed for solving multi-objective optimization problems. The primary strength of GOSET is that rather than focusing on more complex algorithms to ensure diversity among the final solution set, this approach instead targets the formulation of the multi-objective nature of the problem. To promote a broad exploration of the Pareto optimal front, this algorithm constructs a vector of random weights for each generation, then uses these weights to scale the normalized fitness values for each population member. Through this successive alteration of the shape of the level sets, exploration of the Pareto optimal front may be encouraged with minimal computational overhead. To quantify the performance of this approach, a comparison is offered against both NSGA-II (Deb, Pratap, Agarwal, and Meyarivan 2002) and SPEA2 (Zitzler, Laumanns, and Thiele 2001)—two common benchmark algorithms. Initial results indicate that GOSET has superior convergence properties when compared to NSGA-II, though significant additional testing is required.

Research Mentor:

Scott Sudhoff, Electrical and Computer Engineering, College of Engineering

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

College of Engineering

Mapping Pedestrian and Vehicle Traffic through Object Detection and Multi-frame Processing

Authors:

Rohan Prabhu

Paul Chang

Abstract:

Mapping traffic from both pedestrians and vehicles can become a significant problem in that occurs in the early stages of planning for land development. With current methods of mapping only confined by manual recordings in a nine to five work schedule, the range and accuracy of data can be questionable. Implementing a newer, faster, and more efficient method is a highly needed as more and more areas are being changed by the population. The Human Behavior Sub-Team of CAM2 developed a solution by delving into object tracking and recognition by machines for creating movement maps of larger areas throughout the entire day. We looked at two very popular object detection frameworks: Regional Convolutional Neural Network (R-CNN) and You Only Look Once (YOLO). By addressing the benefits and negatives of each frameworks and meshing the networks together by using probabilistic methods, a more accurate object detector and classifier was made specifically for tracking humans. However, to be able to track a single object in multiple frames we created a method of utilizing a group of frames from a live feed, analyzing each detected human and mapping the movement changes (delta) between each frame. Distances were additionally calculated for non-consecutive frames for creating probability maps. As a result, we were able to map movements of several people across a given segment of live video, as of which can be applied to much longer and continuous videos given the correct hardware. Using this software would be very beneficial in aiding in the discovery of traffic flow in different types of areas, information that would help contractors save significant amount of capital due to space efficiency.

Research Mentors:

Dr. Yung-Hsiang Lu, Electrical and Computer Engineering, Computer Science, Purdue University

David Barbarsh, Horticulture and Landscape Architecture

Poster Number: 36 **:: Physical Sciences**

College of Engineering

Retracted.

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

College of Engineering

Novel Configurations of Membrane Distillation Systems for Water Desalination

Authors:

Akshay Rao

Hanwen Gu

Abstract:

Significant knowledge gaps exist in the ability of membrane distillation (MD) systems as a method of water desalination. Scientists at the Warsinger Water Lab in the Birck Nanotechnology Center have developed a number of experiments to study the potential industry viability of membrane distillation technology. Previously, the design of the experimental set up had a variety of issues around the ability to collect sensory data, calculation-based design decisions, and manufacturability. The current module apparatus is designed to conduct MD research with fouling properties, nanoengineered surfaces, and nanofluidics. The module is designed to fit into a larger system controller that will be used to control input and output conditions. The design constraints of the module apparatus were derived from control variables and data collection requirements of each study. A comparative geometry analysis of fluid flow through the feed channel was done to maximize uniformity of flow over the diffusion gap of the membrane. Calculations for optimal geometry for flow and heat transfer conditions are being done using ANSYS Finite Element Analysis software. Gaskets and o-rings are featured between each layer to ensure a sealed path through the system and allow for non-destructive use of the membrane. An important feature, implemented to reduce time between experimental trials, is the modularity and ease of disassembly of the apparatus. Several components are able to be removed quickly without needing to fully disassemble the structure. Clear polymer surfaces are used as insulating materials to allow for an optical visualization of the vapor diffusion process through the membrane surface. The lab is working with industry representatives all over the world to pursue projects involving MD on a large scale, MD for heavy metal separation and disease identification, and special materials in MD.

Research Mentors:

Dr. David Warsinger, Heat and Mass Transfer, Mechanical Engineering

Albraa Alsaati, Mechanical Engineering

Poster Number: 38 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Accessibility Compliance - CATME

Authors:

Koustav Samaddar

Zhibo Hou

Jiaxin Wang

Abstract:

Modify production software to Conform to Federal Accessibility Requirements WCAG 2.21 Level A, AA

Accessibility in computer programming refers to making sure that a piece of software – usually an application or a software suite – is designed to be reasonably usable by all people regardless of any disabilities or handicaps. This is especially important for web sites and web based applications since the internet is designed to be usable by everyone agnostic of their computer hardware, browser software, language and/or locale, or abilities. As such, accessibility is a crucial element of web design and development for anyone wanting to conform to federal accessibility standards.

Over the past two years the CATME web service initiated a project to revise our User Interface pages [UI's] to make our application accessible and compliant to Federal Accessibility Standards. The CATME web site system was developed over 13 years ago and runs extremely well supporting 10's of thousands daily users but is not fully WCAG compliant. This project requires students to learn the WCAG Standard; to learn the CATME system; to review in great detail its hundreds of UI pages, to learn to use GitHub and functional testing procedures and to learn multiple programming languages that the CATME system uses in order to upgrade/revise CATME's UI pages.

Research Mentor:

Prof. Daniel Ferguson, Engineering Education, College of Engineering

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

College of Engineering

Explaining And Improving A Machine Learning Based Printer Identification System

Authors:

Karthick Shankar

Alexander Gokan

Abstract:

Counterfeiting of currency globally remains a significant problem to this day and according to the authorities, a large portion of this fake currency is produced by Small Office or Home Office inkjet printers. The purpose of this study is to explain why a previously developed machine learning based Printer Identification System works with high accuracy and to investigate about improving the stability and generalization of the classifier.

We look at the features of the data by reducing its dimensions using Principle Component Analysis. This shows significant separation between printers which implies that the Deep Neural Network was able to pick up on key differences. The results are also comparable with that of reducing dimensions with Linear Discriminant Analysis. The model however does have some limitations regarding ink density and print media. It always classifies an image amongst the trained printers and doesn't show anomalies. For this, we consider the Gaussian distribution of target printers to see how the probabilities fared when trained and fitted separately for each printer, thus having a set of images that don't fit in with any of the printers for which the classifier was trained.

The results acquired from these methods have contributed to making a more real-world implementation of our classifier for printer forensics and helps us identify key features in the neural network instead of treating it as a black-box. This can have widespread use in reducing the use of counterfeit currency around the world.

Research Mentors:

Jan P Allebach, Electrical and Computer Engineering, College of Engineering

Zhi Li, Electrical and Computer Engineering, College of Engineering

Poster Number: 40 **:: Mathematical/Computational Sciences**

College of Engineering

Optimize Learning Tool through Data Analysis

Author:

Ikna Shillingford

Abstract:

Creation of an effective learning tool relies on having a clear understanding of the student's thought process and strategies. A student's experiences, study strategies, and assumptions influences their use of said learning tool or the impact it has. Research has shown that direct measurement of a student's behavior is the optimal way to evaluate the effect a learning tool has on its students. Observing is limited to the perception of the observer. DeBoer Lab has created open source courses integrated in an interactive learning platform. These courses are created to educate "street youth" in Eldoret, Kenya to learn engineering and problem-solving skills. For these courses to be effective feedback needs to be collected on the performance of the learning platform being used. Since this project is happening in Kenya self-observation cannot be obtained. At present the team is reliant on information attained from the teachers in Kenya. The purpose of this research is to analyze user data attained from the learning platform called Qdex currently being used for an engineering course at an alternative school in Keyna to gain a better insight on usage and performance of the application. This research will help to identify how to best optimize the app for the current audience and to gain observations without having to be in the classroom.

Research Mentors:

Dr. Jennifer Deboer, Assistant Professor of Engineering Education & Co-Director, International Institute for the Development of Engineering Academics

Dhinesh Radhakrishnan

Poster Number: 41 **:: Life Sciences**

College of Engineering

Golden Gate Bridge Research

Author:

Vidush Singhal

Abstract:

For the proposed project we are researching with UCLA to create an inexpensive and accurate method to capture the harmonic oscillations of the golden gate bridge. The purpose of capturing these oscillations is for the structural health monitoring of the
golden gate bridge. Monitoring the structural health is an extremely important job as timely repairs can be done in time which will ensure a longer life of these bridges. Conventional methods to track the structural health of bridges are expensive and labor intensive to install. Even after they have been installed a lot of labor time is used to maintain these conventional sensors, hence the need for a less expensive and simple way to track these oscillations. The system that we are proposing will make use of image processing at its heart, the hardware that we will be using will use a conventionally available camera and a computational device (laptops, PC) in order to capture the video of the bridge over time and then specific image filtering algorithms will be used to finally track the motion of the bridge. Hence this system will enable a three-dimensional tracking method to capture the movement of the bridge over time. The pixel distance movement from the video image will be converted to the corresponding actual distance in metric units to get the actual displacement of the bridge. This method will reduce equipment and labor costs and ensure an extreme accuracy at the same time. Also, another advantage is that multiple points on the bridge can be captured using a camera and not just one. Thus, eliminating the need for multiple sensors.

Research Mentor:

Mohammad Reza Jahanshahi, Electrical and Computer Engineering

Poster Number: 42 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

IP law affecting Innovative Biotech, Good or Bad?

Authors:

Vincent Skochdopole

James Gradowski

Abstract:

This semester we were introduced to the idea of patent law regarding the health care industry. We spent the first couple weeks researching examples of artificial intelligence and deep learning methods within health care technology. We have focused in on the innovative technology that assists visually impaired patients. We have a particular interest in examples where the users of a service or product are also involved in decisions about how their data is governed. When we investigated the legal side of this, two primary concerns of policy came up. The first concern of policy is the issue of privacy. Privacy could be breached when a system must use visual recognition (like Face ID) to identify people and objects around the user. The second concern of policy deals with the vast databases that these artificial intelligence systems acquire. We are seeing a trend that big tech companies (such as Google) self manage this information that could be personal to the user. Especially with visually impaired patients, the AI systems are constantly gathering information about the patients surroundings and daily routine. Going forward, we will continue to investigate the line between visually impaired people becoming more self-sufficient in daily life and invading another person's privacy. We have a list of eleven research groups/companies that we will continue to research about how they have dealt with these issues. Our plan is to compare the way these companies' products relate to the previous instances where privacy and proper management of data have been violated such as when Google Maps ran into trouble not blurring out faces.

Research Mentor:

Emily Bartusiak

Poster Number: 43 **:: Mathematical/Computational Sciences**

College of Engineering

Estimating Flood-Risk Models with Deep Learning

Authors:

Clayton Steele

Miguel Kulisic

Abstract:

There has to be a way to dramatically reduce the effects of waterborne natural disasters. The purpose of this project is to create accurate flood-risk models for coastal buildings in order to reduce damage and death severity. This sub-team of the Data Analytics for Smart Cities Team is using convolutional neural networks in conjunction with deep learning Python models to classify Google Street View images of buildings. This autonomous analysis method allows over 40,000 images to be passed through the model and classified in 1 of 6 categories (in reference to the building): fully visible, partial view, blocked view, not centered, undefined bounding box or no Google Street View image. Thus far, it has been decided to use multiple Inception Layers to introduce sparsity into the network. These allow for “multiple parts” of the image to be processed at once, and then the model can decide which is most important. This reduces the number of layers and computations necessary. Due to hardware constraints, image size is limited to 160 by 160 pixels and batch size to 20 images. As a result, model accuracy has been much lower than expected, averaging 74%. When similar classes are merged ([1, 2], [3, 4, 5], [6]), the accuracy increases to 87%, but it is still as not as good as it should be. A larger GPU may be available through Google Cloud Platform, so then full size images (640x640) and larger batch sizes (100+) can be implemented. Additionally, because limited RAM doesn’t allow images to be preloaded into the model, they will need to be loaded from a sold-state drive. This could reduce training speed but would tremendously help accuracy. The goal is over 95% validation accuracy of the given training images. Near-perfect classification accuracy is crucial in accurately estimating building attributes and flood risks.

Research Mentors:

Fu-Chen Chen, Electrical and Computer Engineering, Purdue University

Mohammad R. Jahanshahi, Civil Engineering, Purdue University

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

College of Engineering

Forest Inventory Analysis

Author:

Jiahao Sun

Abstract:

There are developing technologies and expanding usage of objects identification used in auto-driving car, facial recognition. However, the traditional method to do the forest survey, measuring tree diameters and heights, is low-efficient and manpower-consuming. The improved measurement would use photogrammetry and video recording as data collection, then machine learning would be used to calculate the parameters of a tree based on the data collection. For the hardware parts, lidar system is selected to measure the distance from the user to the tree and it can collect data points from the tree. For the machine learning part, tensorflow was chosen to identify the target tree in the photo and select effective data points that on the edge of the tree stem. The expected result would be that the error of tree dimeter measurement should be within one centimeter.

Research Mentors:

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

Dr. Keith Woeste, Forestry and Natural Resources, College of Agriculture

Guofan Shao, Forestry and Natural Resources, College of Agriculture

Poster Number: 45 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Indoor Positioning System

Authors:

Muhtadyuzzaman Syed

Rohan Srivastava

Haotian Zheng

Tianjie Jia

Xiang Li

Prithvi Velpuri

Abstract:

The current demand for localization extends beyond what GPS can provide as it is limited to outdoor settings. Radio signals used in the Global Positioning System offer global coverage but are unable to penetrate obstacles and buildings. Our system is designed to solve this problem by implementing an Indoor Localization System using ultra-wideband RF-based localization based on the recent 802.15.4a standard. At a high level, the system is modeled after the architecture of the global positioning system by utilizing anchors as the satellites and tags as the receivers. With the use of cloud technology, an end-to-end system is created that achieves security as well as usability. The hardware packaging is encapsulated within a miniature PCB design at a low cost, aimed as a plug-and-play integration within other systems in need of indoor detection. Applications of our IPS design include domains such as navigation (room-to-room assistance in a building), national defense (search and rescue operations, underground tracking, surveillance), commercialized zones (indicators for specific products on shelf, asset tracking in warehouses), and robotics (autonomous vehicles, drone detection). We demonstrate that all of the components mentioned are essential to effectively carry out successful indoor positioning with a focus on user flexibility and efficiency in response.

Research Mentor:

Mithuna S Thottethodi, Department of ECE, College of Engineering

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

College of Engineering

Autonomous Aerial Drone

Authors:

Roy Teo

Jinyoung Myung

Bryan Holt

Jiaqi Yang

Alex Goldberg

Abstract:

The purpose of this research team is to construct a drone to be capable of flying a predetermined path as well as having operational capabilities with a remote controller. Once these objectives have been reached the primary goal is to implement a facial recognition system within the drone's operating system. Research was conducted to discover software capable of programming and calibrating the PixHawk that controls the drone, methods for calibrating connections between the PixHawk and remote for manual flight operation, and charging/connecting the batteries that power the drone and remote. Two versions of software that were discovered to be capable of loading the firmware to the PixHawk were Qgroundcontrol and MissionPlanner. The remote was connected to the PixHawk through calibrations using Qgroundcontrol and the bind setting on the remote. Battery charging was discovered to be capable through an iMax B6AC set at 5 volts and less than 5 amperes. It was found that the current battery is not supplying enough voltage to power the PixHawk and motors. Through these results it was discovered that most of the main steps in preparing the drone have been accomplished. The last steps are to replace the battery and test liftoff with a tether to stabilize flight, then without a tether in the Purdue Armory.

Research Mentor:

Samuel P Midkiff, Electrical and Computer Engineering

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

College of Engineering

Engineering Undergraduate Academic Policies: Core Courses Over Time

Authors:

Nicholas Tomlin

Nate Eckhart

Anna Francis

Abstract:

Our poster is exploring the required courses among various engineering schools across the country. We did this by accessing MIDFIELD, which is a database of over 20 engineering schools, and looking at how the course requirements change over time. We expected to see an increase in the required math and science courses as the years went on. However, when we looked at the data, there were more complex relationships than we had originally predicted

Research Mentor:

Hossein EbrahimiNejad, Engineering Education

Poster Number: 48 **:: Mathematical/Computational Sciences**

College of Engineering

Actively Preventing Negative Transfer

Authors:

Andrew Ulmer

Zohar Kapach

Daniel Merrick

Karthik Maiya

Abhay Sasidharan

Arshad Alikhan

David Dang

Abstract:

Transfer learning is a common technique used in a wide variety of deep learning applications. Transfer learning methods are typically used to make use of a source domain, where there is an abundance of labeled data, to make inferences in a target domain, where labeled data is scarce. A basic transfer learning technique involves resetting the weights and biases associated with the last few layers of a deep learning model that has been trained on the source domain, and then re-training the model on the target domain. This a very widely used technique, but can often times result in a phenomenon known as negative transfer. Negative transfer occurs when the knowledge gained in the source domain proves to be harmful when transferring to the target domain. In order to prevent this phenomenon, our team is focusing on making a systematic method for determining which weights and biases should be reset when transferring knowledge. The basic idea is that if the source and target domains are similar, then most of the models knowledge gained in the source domain will be transferred to the target domain. However, if the source and target domains are different, the model will forget that knowledge which would be harmful in its learning the target domain.

Research Mentor(s):

Dr. Yung-Hsiang Lu, School of Electrical and Computer Engineering, Purdue University

Poster Number: 49 **:: Mathematical/Computational Sciences**

College of Engineering

Model Pruning for Transfer Learning

Authors:

Andrew Ulmer

Zohar Kapach

Daniel Merrick

Karthik Maiya

Abhay Sasidharan

David Dang

Arshad Alikhan

Abstract:

Transfer learning is a common technique used in a wide variety of deep learning applications. Transferlearning methods are typically used to make use of a source domain, where there is an abundance of labeleddata, to make inferences in a target domain, where labeled data is scarce. In the digital age, improvinga model's ability to generalize knowledge gained from the massive amount of data available online to newcontexts is crucial. Most new contexts of interest, like radiological scans, have very few labels, an obstaclethat can be overcome with improved transfer learning methods. A basic transfer learning technique involvesresetting the weights and biases associated with the last few layers of a deep learning model that has beentrained on the source domain, and then re-training the model on the target domain. This a very widelyused technique, but can often times result in a phenomenon known as negative transfer. Negative transferoccurs when the knowledge gained in the source domain proves to be harmful when transferring to thetarget domain. In order to prevent this phenomenon, our team is focusing on making a systematic methodfor determining which weights and biases should be reset when transferring knowledge. The basic idea isthat if the source and target domains are similar, then most of the models knowledge gained in the sourcedomain will be transferred to the target domain. However, if the source and target domains are different,the model will forget that knowledge which would be harmful in its learning the target domain.

Research Mentor:

Dr. Yung-Hsiang Lu, Electrical and Computer Engineering, Purdue University

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

College of Engineering

Validating the Performance and Valuation of Photovoltaic Energy Systems

Author:

Tristan Watel-Dehaynin

Abstract:

In 2010, the U.S. Department of Energy announced the SunShot Initiative, which aims to reduce the total installed cost of solar technologies by 75% between 2010 and 2020, from $0.214/kWh to $0.06/kWh. This implies that solar energy, and specifically photovoltaics (solar electric), is a top priority in the U.S. and many other countries, in the race to maximize efficiency of incoming solar irradiation. However, little is known about how PV systems impact the demand and supply of grid electricity managed by utility companies. Although net-metering requires utility companies to provide a one-to-one credit for excess electricity generated by PV systems, there is currently limited forecasting information to allow utility companies to properly respond to extreme and unexpected weather conditions causing peaks and valleys in energy usage and demand. The purpose of this project is to show how weather stations can be used to estimate PV generation for individual systems and collectively estimate the potential impact on the grid to utility companies. The data analytics will incorporate real-time weather data (obtained from local weather stations), historical weather data, and past energy generation data to predict “near-future” solar energy performance in a variety of climates and geographic regions. Not only will this information will be beneficial to PV system owners to verify the system is working properly, it will also benefit utility companies (who own solar arrays and/or have customers who own solar arrays) to level out load demand and supply.

Research Mentors:

Dr. Lisa Bosman, Assistant Professor, Department of Technology Leadership and Innovation, Purdue Polytechnic Institute

Geetanjali Bihani, Graduate Student Research Assistant, Department of Computer Science, College of Science

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

College of Engineering

Data Analysis and Visualization, Word2Vec

Author:

Jiaxing Yang

Abstract:

There is always a lack of connection between our neutral languages. For example, how does the word “king” and “queen” related to each other. Therefore, the project is on connecting the words, classifying each sentence based on the relevance of each words into different categories. This process is also called Word2Vec, a process of the transferring words to vectors and connect them based on the numerical value. The Word2Vec is a group of related models that are used to produce word embeddings. In our case, especially, the project’s goal is mainly on manipulation of machine learning technique with the application of NLP (Natural Language Processing) to apply filters to the sentences into the type that the user likes (in this case it is disaster). In order to achieve the goal, a back-end and front-end cooperation are required. The back-end algorithm is to build a model, then trains it with the database retrieved from Twitter. The front-end is to create a user-interface website to allow users to select what they are more interested in to refine the model in order to improve the accuracy of the whole model, then create a map to show where do these sentences got tweeted from. For example, the tweets about the disaster, by creating the map of a certain region (West Lafayette especially) can allow the policemen to know where the disaster happens so they take actions immediately.

Research Mentor(s):

Yi-Shan Lin, Department of Computer Science, College of Science

Poster Number: 52 **:: Mathematical/Computational Sciences**

College of Engineering

Visualization of Subjective Rating Employees

Author:

Yitong Zhao

Abstract:

The visualization of subjective rating employees is making evaluation of employees more precisely with visual representations. The research is focusing on the visualization of subjective rating employees and is collecting multidimensional data from different context and aspects based on employee's performance. To visualize the multidimensional data in 2D space, PCA (principal components analysis) is applied as a dimension reduction algorithm and then the results are visualized in a scatter plot.

The clusters and outliers are visualized based on their closeness in the 2D space. In this research, the data contain different context and aspects is transformed into a scatter plot. Lasso is applied to find the similar and outliers of data. By applying lasso, the data points can be circled and selected in a loop. The data points will be gathered (highlighted) and data points are enlarged. To make data easier to be analyzed, the corresponding points will be transformed as a table. The data point's distribution is showed on the html page.

Research Mentor(s): Morteza Karimzadeh

Poster Number: 53 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Evaluating Surgeons' Physical Workload During Live Robotic Assisted Surgery Through Electromyography

Authors:

Guoyang Zhou

Jackie Cha

Abstract:

Robotic assisted surgery is becoming more prevalent but little knowledge exists on the technology's effect on surgeons' physical workload. This research focus on investigating the relationship surgeons' upper body muscle activity and self-perceived workload while on the Da Vinci robotic assisted surgery console while performing surgical procedures. Electromyography (EMG), commonly considered as an objective measure of muscle activity, was used as an index of surgical workload in this study. Attending and assistant surgeons' muscle activities were measured while performing robotic-assisted procedures (e.g., partial nephrectomy, proctectomy). Eight EMG sensors were attached on surgeons: left and right forearm, bicep, and lower and upper trapezius. After the end of each procedure, participants completed the NASA-TLX, a workload questionnaire. We hypothesize that EMG signals are positively correlated to self-perceived workload scores. Self-perceived workload of surgeons working on the Da Vinci robotic assisted surgery console can be better evaluated through investing its relationship with EMG signal, which can also help surgeons better evaluate their physical conditions during the operation and thus improve their surgical performance.

Research Mentor:

Denny Yu; Industrial Engineering; College of Engineering

Poster Number: 54 **:: Innovative Technology/Entrepreneurship/Design**

College of Engineering

Visualization of Project Management

Author:

Kailu Zhuang

Abstract:

The Arequipa Nexus Institute is a collaborative project between Purdue University and the Universidad Nacional de San Agustín that targets to ensure a sustainable development in Arequipa. One sub-project of Nexus is the milestone management project. This project is a single-page web application that tracks the progress of all the projects managed by the NEXUS. A user interface is constructed using the MVC (model-view-controller) framework to provide an effective project milestone management view with structural codes and real-time stable performance. The web page is split into three views. Each view is implemented with a model to represent the project data in different forms. React and D3.js are JavaScript libraries that are used to display the dynamic interaction between data displayed in different views: the milestone view, the dependency view, and the detail view. In the milestone view, the temporal events are displayed in a gantt chart. The user can select and see activities, milestones, and deliverables of different projects. Sorting feature is provided so that the events are sorted based on the start time or the end time. The dependency view contains activities, projects, and components in a column form. Each column contains a list of cell items. By clicking on any cell in the table, the dependency view will show the connection between the related cells in the other columns with lines. The details view displays the detailed information (e.g. the image and the video of a project) of the project when a project is selected in any of the views.

Research Mentors:

Jieqiong Zhao, School of Electrical and Computer Engineering

Morteza Karimzadeh, School of Electrical and Computer Engineering

Poster Number: 55 **:: Physical Sciences**

College of Engineering

Electric Pulse Treatment of Microalgae for Enhanced Lipid Extraction

Authors:

Zane Zmola

Caleb Geissler

Abigail Beard

Evan Shreiner

Abstract:

Microalgae are a source of biofuels coming that can provide a carbon neutral alternative to fossil fuels; however, the process for extracting the lipids to produce this fuel requires optimization to make this an economically viable alternative. While microsecond electric pulses (EPs) increase lipid extraction in microalgae by creating membrane pores in a process called electroporation, a systematic study of EP parameters and microalgae strains remains lacking. For instance, nanosecond EPs (NSEPs) target intracellular structures in addition to creating smaller membrane pores that permit smaller ions, but not the larger molecules characteristic of electroporation, to transit the membrane. This study assesses the lipid extraction and viability of cyanobacterium Chlorella protothecoides following treatment by either microsecond EPs or NSEPs. Nanosecond and microsecond pulses increased lipid yield with increasing applied electric field E for a given EP duration t before reaching a peak yield and dropping below the control yield for higher field strengths. Scaling for applied energy (~E2t), the peak lipid yield occurred at a higher energy for NSEPs than microsecond EPs, likely due to the smaller pores created by NSEPs. Another aspect of treatment assessment involves measuring microalgae viability. Trypan blue, a membrane exclusion dye that enters nonviable mammalian cells, failed to provide consistent results for Chlorella protothecoides. Future research will assess Sytox, a fluorescent marker that differentiates dead cells from live cells, for determining microalgae viability and preliminary protocols and results will be presented.

Research Mentors:

Allen L. Garner, Nuclear Engineering, Purdue University

John A. Morgan, Chemical Engineering, Purdue University

Poster Number: 56 **:: Life Sciences**

College of Health and Human Sciences

Binding Interactions between the Herbicide Atrazine and Functionalized or Nonfunctionalized Graphene Nanoplatelets

Author:

Nudar Bhuiya

Abstract:

Atrazine, the second most common agricultural herbicide used in the U.S., is often reported to contaminate drinking water sources above the current U.S. EPA regulatory level of 3 parts per billion (ppb), resulting in human exposure. Graphene nanoplatelets (GNPs) are an emerging nanoparticle with potential uses for the remediation of environmental contamination. This study's aim is to determine binding interactions between atrazine and GNPs to mimic a mixture composition. To evaluate binding interactions, GNPs with different functional groups (none, carboxylated, aminylated) were evaluated. GNPs at concentrations of 0, 0.5, 1, 2, or 3 mg/ml were incubated with atrazine at 3 ppb for 24 hours. Following incubation samples were centrifuged and supernatant was collected. The supernatant was used to quantify the concentration of atrazine using an Abraxis Atrazine ELISA assay. The assay detected the unbound atrazine, therefore a subtractive method was used to calculate the percent of atrazine bound to the GNPs. The data demonstrated that as the concentration of GNPs increased, the percent of atrazine bound increased until it plateaued between 2-3 mg/ml of GNPs. The nonfunctionalized GNPs bound the most atrazine compared to the functionalized GNPs. Future directions include beginning chemical exposures with mouse macrophages and the zebrafish model system to determine possible alterations in toxicity resulting from atrazine association by GNPs.

Research Mentors:

Dr. Jennifer Freeman, Health Sciences, HHS

Dr. Jonathan Shannahan, Health Sciences, HHS

Poster Number: 57 **:: Life Sciences**

College of Health and Human Sciences

Role of Parent-Adolescent Autonomy Perception in Predicting Adolescent Adjustment

Author:

Laura Galles

Abstract:

Adolescents who perceive inadequate autonomy-support from parents feel incapable of controlling their activities and subsequently have higher externalizing behaviors and depression (Pinquart, 2017). Perceptual discrepancies in autonomy are related to lower adolescent well-being (Butner et. al, 2009). Most studies focus on parental or adolescent perception of adolescent autonomy, but few examine both, whether discrepant perceptions influence adolescent adjustment, or if maternal and paternal perceptions are uniquely impactful (Kowal & Kramer, 1997; Marceau, 2018). Therefore, the current study investigated whether differences between maternal-adolescent and paternal-adolescent perceptions of adolescent autonomy influence adolescent adjustment. We hypothesized that mothers and adolescents' perceptions would be more aligned than fathers' and adolescents' perceptions, and if an adolescent perceived more autonomy relative to her/his parent, the adolescent would experience increased antisocial behavior and depression. Utilizing 395 families (Father, mother, older sibling [OS] and younger sibling [YS]) from Wave 2 of the US-based Nonshared Environment in Adolescent Development study (Neiderhiser et al., 2007), on average, maternal perception of adolescent autonomy was closer to adolescent perceptions than paternal perceptions were (OS M=134.59, SD= 29.17, mothers M=134.38, SD=29.17, fathers M=122.28, SD=29.781; YS M=124.91, SD=29.212, mothers M=127.66, SD=28.28, fathers M=118.02, SD=30.441). We conducted a series of regressions examining whether parent-adolescent relative difference scores of adolescent autonomy significantly predicted adolescent adjustment. Higher difference scores indicated that adolescents perceived greater autonomy than their parents perceived of them. Father-OS scores predicted antisocial behavior (β=.24, p=.01), and mother-OS scores predicted adolescent depression (β=.26, p<.01). Mother-YS scores predicted adolescent antisocial behavior (β=.26, p=.02). Essentially, when adolescents perceived greater autonomy than their parents, they reported greater rates of depression and antisocial behavior.

Research Mentors:

Kristine Marceau, Human Development & Family Studies, College of Health and Human Sciences

Emily Rolan, Human Development & Family Studies, College of Health and Human Sciences

Poster Number: 58 **:: Life Sciences**

College of Health and Human Sciences

Working Memory and Reasoning: A Meta-Analysis and Investigation of the Relationship between Complex Span Tasks and Number Series

Author:

Katherine Goulden

Abstract:

In intellectual ability assessments, series completion tasks are used as a measure of inductive reasoning. Individual differences in working memory capacity and general fluid intelligence are correlated with success on these tests, but current research on why subjects make specific mistakes is limited. Working memory is moderately correlated with performance on number series and the purpose of this study was to examine what drives that relationship. We systematically reviewed the literature and then conducted a meta-analysis for the first in depth examination of number series' differentiating aspects and their respective relations to working memory. The meta-analysis aggregated across 23 independent samples of healthy, young adults. A random-effects model meta-analytic correlation indicates that individuals higher in working memory were more likely to solve number series problems correctly. In the attempt to account for the variability found in the correlations of the 23 samples used, complex span tasks were examined as a moderator. However, the verbal versus spatial nature of the items to-be-remembered on the complex span tasks did not explain the variability across the samples, as the number series correlation with verbal complex span did not differ from spatial complex span tasks.

Research Mentor:

Dr. Thomas Redick, Psychological Sciences, Health and Human Sciences

Poster Number: 59 **:: Life Sciences**

College of Health and Human Sciences

Size Distribution of Nicotine Aerosol Particles Produced Using a Vibrating Mesh Nebulizer

Authors:

Alec Graff

Kaushal Prasad

Abstract:

With the rising popularity of electronic nicotine delivery systems (ENDS) such as electronic (e-) cigarettes with young people, continued research needs to be conducted with health effects and alternatives in mind. Even though E-cigarettes are known to be safer than traditional cigarettes, toxic metal contents generated or leached from metallic heating coil have been found in e-cigarette fumes. One possible alternative to conventional ENDS could be a vibrating mesh nebulizer (VMN), which would eliminate contaminants given off by these metallic coils. The VMN containing 5% and 10% nicotine solution was tested to generate the nicotine aerosols. The size distributions of produced nicotine aerosols were measured by a NanoScan scanning mobility particle sizer (SMPS) for nano-sized particles and an optical particle sizer (OPS) for micro-sized particles. Each measurement was conducted for 90 minutes. Modes were found for the NanoScan SMPS and OPS at 81.6nm and 337.0nm, respectively. Total number concentrations from the NanoScan SMPS and the OPS were 9.7e4 particles/cm3 and 1.2e3 particles/cm3, respectively. From these results, it was determined that the vibrating mesh nebulizer could be a suitable ENDS alternative on this basis. Further work needs to be done with various operational conditions.

Research Mentor:

Dr. Jae Hong Park, Occupational and Environmental Health Science, College of Health and Human Sciences

Poster Number: 60 **:: Life Sciences**

College of Health and Human Sciences

Characteristics of Nanoparticles Emitted from Kanthal Coils in Electronic Cigarettes

Author:

Kaushal Prasad

Abstract:

Electronic cigarettes (E-cigarettes) consist of a metallic heating coil, a wick, and a reservoir containing nicotine solution. The purpose of this experiment was to characterize the nanoparticles from the coils, a potential source of exposure to toxic metals. Metal vapor can be produced by the hot coil, cooled by air flow, and then form a nanoparticle due to condensation and nucleation. The Kanthal (Fe+Al+Cr alloy) coil was installed in a lab-made e-cigarette generation system without the wick and the nicotine solution. The e-cigarette generation system was operated with various conditions (coil resistance of 0.1-1.0 Ω and applied power of 10-70 W). The size distribution of particles emitted from each coil was measured using a Scanning Mobility Particle Sizer (SMPS) for 30 minutes. When the coil resistance increased from 0.1Ω to 1.0Ω, the initial number median diameter (NMD) were maintained 40-52 nm and the initial total number concentration (TNC) were increased from 2.1× 106 particles/cm3 to 2.4 × 105 particles/cm3. When the applied power increased from 10 to 70 W, both NMD and TNC were increased. In all cases, Particle number concentrations were decreased over time because surface oxidation (aluminum oxides layer on coil surface) could prevent further nanoparticle formation. Used coil may reduce the risk of the metal exposure.

Research Mentors:

Dr. Jae Hong Park, School of Health Sciences, College of Health and Human Sciences

Dr. Mark D. Wilson, School of Health Sciences, College of Health and Human Sciences

Poster Number: 61 **:: Life Sciences**

College of Health and Human Sciences

Automatic Content analysis of Dream Reports: Comparison of Methods and Test of Continuity Hypothesis

Author:

Vasudha Shah

Abstract:

According to the continuity hypothesis, dreams reflect the dreamer's waking life. A few studies have reported gender differences in waking life. For example, males seem to be more analytic, to have better spatial ability, to be more reward-oriented, more likely to take risks (e.g., Charness & Gneezy, 2012), to have more sexual fantasies, and more likely to be physically aroused by their sexual thoughts (e.g., Ellis & Symons,1990). By contrast, women tend to have higher levels of distress and more likely to have depression and anxiety (World Health Organization, 2002), to be more emotional, and to reserve more cognition in family and home issues (Sharma, Chakrabarti, & Grover, 2016).

Will these differences be reflected in the word usage in dream content?

The Linguistic Inventory and Word Count (LIWC), developed by Pennebaker, Boyd, Jordan, and Blackburn (2015), has been widely used in data analysis in psychology.

When a text is put into LIWC, it automatically analyzes and tabulates the frequencies of word usage for about 100 different categories, including emotion, grammar and vocabulary,social processes, and so on.

As a powerful automatic content analysis tool, LIWC has been widely used, although not much in dream studies. Using two-sample t tests in a large collection of dream reports, we tested the consistencies between waking life and dream in terms of gender differences, with output of words' frequency from LIWC 2015. Our study provides a stringent methodology for studying dream reports. We find evidence for continuity, regularity and order in dreams.

Research Mentors:

Richard Schweickert, Department of Psychological Sciences, Health and Human Sciences

Xiaofang Zheng, Department of Psychological Sciences, Health and Human Sciences

Poster Number: 62 **:: Social Sciences/Humanities**

College of Health and Human Sciences

Content Marketing Strategies: A Cross-cultural perspective

Author:

Kexin Wang

Abstract:

The project addresses a significant literature gap in hospitality and tourism marketing with the use of counterfactual thinking strategy, a content strategy that form effective brand storytelling mechanism. Hospitality and tourism business offerings are complex with multi-components and a high degree of intangibility. Therefore, content marketing when well executed will plays a critical role tangiblizing our experience-based products and building brand equity.

In this project, we aim to identify specific visual traits in brand story telling that can optimally engage consumers. These identified traits will become useful parameters for hospitality business in their effort to create compelling brand stories. Additionally, given hospitality and tourism businesses tend to serve a wide population with various cultural backgrounds, we hope to identify culturally specific content traits that will assist companies to build emotional bonds with customers from various cultural backgrounds.

Empirical study will be conducted on people's perception of images that are representative of various visual traits and data will be gathered through eye tracking equipment that allows researchers to document subjects' eye movement, arousal levels, and heart rate. There will be also a qualitative research component where researchers will examine the current practices of online visual story telling of hospitality and tourism businesses. This second step in conjunction with the results of the experiment, will allow researchers to provide suggestions in hospitality brand story telling practices.

This research shall provide evidence-based recommendations for the industry practitioners in better structuring their brand stories, and in better communicating their brand value to a global audience.

Research Mentors:

Xinran Y. Lehto, School of Hospitality and Tourism Management, College of Health and Human Sciences

Alei Fan, School of Hospitality and Tourism Management, College of Health and Human Sciences

Lihan Huang, School of Hospitality and Tourism Management, College of Health and Human Sciences

Tianyi Li, School of Hospitality and Tourism Management, Colle

Poster Number: 63 **:: Social Sciences/Humanities**

College of Liberal Arts

Motion Predicates in Mandarin and Hakka

Author:

Xuan Hu

Abstract:

The purpose of this research project is to investigate how human language encodes motion events. Specifically, we looked at how Mandarin and Hakka speakers express a motion event in terms of the three basic planes of the Cartesian coordinate system (i.e., the vertical, horizontal, and deictic planes) and the endpoint of the motion (i.e., telicity). Three Mandarin native speakers and three Hakka native speakers participated in this study. They were asked to watch a series of videos that depicted various types of motion events and describe those events separately. Their responses were audio-recorded. After language data were successfully collected, they were imported into ELAN (a software for linguistic analysis) and coded. My responsibility is to focus on the coding process, included tokenization, glossing, transcription, and marking word category, trajectories of motion, and telicity. We then systematically analyzed the linguistic patterns and the types of motion they correspond to. Analysis of the coding confirmed the existence of the following patterns: 1) the structure of motion predicates in both languages is a Serial Verb Construction, 2) that in both Mandarin and Hakka, only two planes are allowed in a given motion predicate, and one of them must be deictic, and 3) that both languages have a dedicated marker (“dao” in Mandarin and “do” in Hakka) that denotes the ending of a motion event. This study provides a deeper understanding of the motion predicate structure in Mandarin and Hakka in particular, and the structure of human language in general.

Research Mentors:

Pin-Hsi Chen, Linguistics /School of Interdisciplinary Studies, College of Liberal Arts

Dr. Elena E Benedicto, English Department, College of Liberal Arts

Poster Number: 64 **:: Social Sciences/Humanities**

College of Liberal Arts

A Tale of Two Countries: Norway, Denmark, and Renewable Energy Politics

Author:

Adam Kunkel

Abstract:

Denmark and Norway are two countries that are very similar. They have comparable population sizes, technological abilities, and are located geographically close to one another. However, in terms of their renewable energy policy, they could not be further from each other. Why are these two countries that should have similar renewable energy policies so vastly different? There has been much research on the renewable energy policies of these countries independently. My work analyzes the histories of both countries and the reasons their energy policies are not more closely aligned due to historical factors. I will also be using the current data surrounding the overall numbers around energy sources to clarify where the policies have lead Norway and Denmark. To answer this question, I will be examining the renewable energy capacities of and the total percentage of renewable energy produced in each country. The key to the next energy transition is granting tax/monetary incentives and providing updated infrastructure that can facilitate the transportation of the produced renewable energy.

Research Mentor:

Professor Paul Danyi, Liberal Arts, Political Science

Poster Number: 65 **:: Social Sciences/Humanities**

College of Liberal Arts

The Public Interest Debate and the FCC

Author:

Louise Smith

Abstract:

Since its inception, the Federal Communications Commission (FCC) has been tasked with ensuring that broadcast licensees operate in the public interest, convenience or necessity. Where rationalists believe the public interest merely means providing a foundation for governmental decision making, platonists believe the the public interest means providing for the achievement of lofty moral goals. The back-and-forth battle between these two primary philosophical camps has yielded an FCC history punctuated by distinct eras of public interest regulation and correspondingly distinct policies. Contrasting opinions about prominent FCC regulations highlight the relevance of the public interest debate in the realm of communications policy. Through analyzing existing literature and expert commentary, this project examines the FCC's attempts to regulate in the public interest, the perspectives ideological groups hold on the different eras in FCC regulation, and the FCC's entry into a new regulatory era. This paper expands on previously existing research by effectively synthesizing information and providing unique analysis on the FCC's movement through regulatory regimes. It is hoped that this research project will inform scholars and students in the fields of political science and communications about the FCC's past and present stances on creating communications policy in the public interest.

Research Mentor:

Dr. Robert X. Browning, Departments of Political Science and Communications, College of Liberal Arts

Poster Number: 66 **:: Life Sciences**

College of Pharmacy

Structure Modeling of The Voltage-gated Sodium Channel Nav1.2

Author:

Chenghao Cui

Abstract:

Voltage-gated sodium (Nav) channels are vital in the nervous system since they contribute to the generation of action potentials. Nav1.2, one isoform expressed in the brain, plays critical roles in neuronal excitability. Mutations of Nav1.2 are highly related with Ohtahara Syndrome (OS), Benign familial infantile epilepsy (BFIE) and Dravet Syndrome (DS) when malfunctioning. Human Nav family has nine family members and the cryo-EM structure of a few different types of sodium channels have been solved. However, the structure of Nav1.2 is still elusive, which prevents us from understanding how distinct mutations found in Nav1.2 changes the structure and function of Nav1.2. In this poster, I will compare published sodium channel structures to generate insights regarding the critical regions of human sodium channels and its interactions with other molecules. I will also generate a structural model of Nav1.2 based on the published cryo-EM structure of sodium channels, especially its close relative Nav1.4. These new data will help us elucidate how different types of disease-causing mutations cause changes to Nav1.2 channel and provide insights for rational drug discovery and personalized drug targeting based on the 3D structure of mutant Nav1.2 channel.

Research Mentor:

Yang Yang, Department of Medicinal Chemistry and Molecular Pharmacology, College of Pharmacy

Poster Number: 67 **:: Innovative Technology/Entrepreneurship/Design**

College of Pharmacy

Development of Nanoparticles to Deliver a Biocompatible Cryoprotectant to Natural Killer Cells for Immunotherapy of Solid Tumors

Authors:

Josh Jovevski

Michaela Todd

Stella Jung

Rui Xu

Abstract:

Adoptive immunotherapy with natural killer (NK) cells leverages cells that have been genetically-engineered to more effectively find, and kill, cancer cells. However, NK cells must be cryopreserved before they can be administered to the patient. The cryopreservation process exposes the immune cells to harsh conditions that can change their functionality, ultimately damaging their anti-tumor immunity. Cryoprotectants can minimize the damage cells experience during cryopreservation, with the most common being dimethyl sulfoxide, or DMSO. While DMSO is effective at protecting living cells, it has been associated with significant post-infusion toxicity.

Trehalose has emerged as a potential replacement for DMSO due to its increased biocompatibility and safety, but it cannot penetrate the cell membrane by diffusion. We are developing a nanoparticle system, which is biocompatible, safe and relies on endocytosis to enter the cell and deliver effective concentrations of trehalose to NK cells. To that end, we have generated nanoparticles using chitosan and tripolyphosphate via ionic gelation to form a crosslinked network of polymers that can associate with trehalose. We characterized the nanocarriers using dynamic light scattering, transmission electron microscopy, and zeta potential. These nanoparticles showed an average size of ~200 nm, with a polydispersity index of ~0.25, and a positive surface charge of 20 mV, indicating stable, monodisperse structures that have a high trehalose loading capacity. We are currently investigating the effects of trehalose delivery on the function of NK cells and plan to employ this cryopreservation technique in adoptive transfer immunotherapy studies currently ongoing in our lab.

Research Mentors:

Sandro Matosevic, Department of Industrial and Physical Pharmacy, College of Pharmacy

Jiao Wang, Department of Industrial and Physical Pharmacy, College of Pharmacy

Poster Number: 68 **:: Life Sciences**

College of Pharmacy

Rubsicolins are Naturally Occurring G-Protein-Biased Delta Opioid Receptor Peptides

Author:

Kendall Mores

Abstract:

The impact that β-arrestin proteins have on G-protein-coupled receptor trafficking, signaling and physiological behavior has gained much appreciation over the past decade. A number of studies have attributed the side effects associated with the use of naturally occurring and synthetic opioids, such as respiratory depression and constipation, to excessive recruitment of β-arrestin. These findings have led to the development of biased opioid small molecule agonists that do not recruit β-arrestin, activating only the canonical G-protein pathway. Similar G-protein biased small molecule opioids have been found to occur in nature, particularly within kratom, and opioids within salvia have served as a template for the synthesis of other G-protein-biased opioids. Here, we present the first report of naturally occurring peptides that selectively activate G-protein signaling pathways with minimal β-arrestin recruitment. We find that rubiscolin peptides, which are produced as cleavage products of the plant protein rubisco, bind to and activate G- protein signaling at delta opioid receptors. However, unlike the naturally occurring delta opioid peptides leu-enkephalin and deltorphin II, the rubiscolin peptides only very weakly recruit β-arrestin 2 and have undetectable recruitment of β-arrestin 1 at the delta opioid receptor.

Research Mentor:

Richard M. M. Van Rijn, PhD, Medicinal Chemistry and Molecular Pharmacology, College of Pharmacy

Poster Number: 69 **:: Life Sciences**

College of Pharmacy

Breast Cancer Subtype Differentiation Through Genetic Mutation Analysis

Author:

Renee Oles

Abstract:

This study analyzed genetic mutations in breast cancer patients to discover correlations within subtypes to allow quick and accurate subtype identification. Mutation signatures, which differentiate breast cancer subtypes, were studied using biomedical informatics through R programming. Data mining led to the development of frequency graphs displaying which chromosomes and more specifically, which genes, have high rates of mutation in one subtype over another. These motifs not only are useful in subtype identification but are also useful in further stratification of subtypes. This is especially impactful in triple negative breast cancer (TNBC), the most lethal breast cancer subtype. Other forms of breast cancer can be targeted through attacking specific protein markers, but TNBC contains all forms of breast cancer that do not have these markers. Instead of classifying TNBC by what markers a patient does not have, this program attempts to find important mutation signatures that patients within this category do have. From here subtypes within subtypes can be found to diagnose individual breast cancer patients. Not only is this method extremely specific, but also cost-effectively and efficiently classifies the cancer subtype compared with the typical, expensive gene expression analysis. In future research, the mutation signatures found can be used to create more targeted drug therapies.

Research Mentor:

Dr. Vincent Jo Davisson, Medicinal Chemistry and Molecular Pharmacology, College of Pharmacy

Poster Number: 70 **:: Life Sciences**

College of Pharmacy

Mechanistic Approach to Interrogate Nuclear EGFR and DNA Double Strand Breaks Repair Pathways

Author:

Anqi Shao

Abstract:

Epithelial Growth Factor Receptor (EGFR) has been extensively investigated as an important target in cancer therapy over decades. EGFR mainly regulates four major signal pathways and inducing cell proliferation, angiogenesis, cell cycle progression, and transformation. Due to gain-of-function mutations, EGFR acquires enhanced intrinsic tyrosine kinase activity to distort the signal pathways regulation by elevation its nuclear translocation. The exact mechanism of this elevation of nEGFR remains unrevealed and treating nEGFR inside the cell becomes more difficult due to the sequestration of EGFR. Utilizing a nuclear localizing sequence derived from viruses and peptoids, we developed a nuclear-targeting tag to conjugate with gefitinib, a first generation EGFR inhibitor, to treat nEGFR within the nucleus. The result showed an efficient compartmentalization of gefitinib as well as selective inhibition of STAT3 phosphorylation without interrupting ERK1/2 signaling, or other cytosolic signal cascades. However, more exploration is needed to verify the actual interaction in vivo. Considering the roles of EGFR plays in transcription and as a co-factor to DNA repair complex, we proposed that the nEGFR may affect DNA damage repair pathway. By inhibition of its ATP binding site, we may push cancer cells toward apoptosis by down-regulation of repair pathway.

Research Mentors:

Dr. Vincent Jo Davisson, Medicinal Chemistry and Molecular Pharmacology, College of Pharmacy

Poster Number: 71 **:: Social Sciences/Humanities**

College of Pharmacy

Interprofessional Health Promotions Project

Author:

Marija Stefanoska

Abstract:

The purpose of this research was to study the impact of interprofessional teamwork on health professional students, including their perspectives on the benefits and challenges of working with each other. A secondary objective was to highlight the impact of their collective work toward public health. Groups of three students in pharmacy, nursing, public health, dietetics, or health/kinesiology (n=801) at Purdue University researched, designed and delivered an interdisciplinary health promotions project targeted toward a specific community-based population. Students reflected on their experience and evaluated their peers' contributions to the project. The researchers categorized the students' group projects into 20 health-related topics, with the most common being bone health, followed by mental health, substance abuse, nutrition, and cold/flu prevention. The researchers also analyzed quantitative and qualitative student feedback, noting that 92% of students found value in the collaboration, while 90% believed they taught useful, discipline-specific information to their group members. The most common benefit described by students was the ability to present their project or service to the audience in a well-rounded matter, with expertise coming from each of the different disciplines. The most commonly noted challenge was logistical – arranging planning meetings. This research provided insight into successes and challenges when students from multiple disciplines work together toward a common goal. It also highlights the significance of each student's individual contributions, and the collective magnitude that interdisciplinary, student-driven projects can make toward public health.

Research Mentor:

Patricia Darbishire, College of Pharmacy

Poster Number: 72 **:: Mathematical/Computational Sciences**

College of Science

Construction of σ^+-Game Solutions on a Rectangular Grid

Author:

Riley Borgard

Abstract:

The σ^+-game is played on a directed graph where the vertices (lights) are assigned a state of 0 (off) or 1 (on). The player can press any light, thereby toggling it along with its neighbors. The objective of the game is to turn all lights off given an initial configuration. Of particular interest in this paper are rectangular grid graphs with all lights initially on. In this paper, we explore different classes of grid sizes and dimensions with unique solutions, and we construct the solutions to grids of size (2^n-1) x (2^n-1) with all lights initially on.

Research Mentor:

Tatsunari Watanabe, Mathematics

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

College of Science

Exploring the Dissolution Difference between Crystalline Warfarin and Amorphous Warfarin in Buffer

Authors:

Jiachong Chu

Fudan Zheng

Abstract:

On average, over 274 people died every day from blood clots, and warfarin is a medication to treat blood clots. However, warfarin exhibits multiple solid-state forms, which differ in physicochemical properties, and it can potentially lead to different efficacy and by-effect of the medicine. Our experiment is focused on the dissolution pattern difference between crystalline and amorphous warfarin. 80 mg of each sample were added to 300 mL K2HPO4-citric acid buffer at pH 5.9. HPLC was used to measure the concentration of warfarin during the test period. The result shows that both crystalline and amorphous warfarin have a trend that the concentration of warfarin will increase and then decrease after ten minutes, while amorphous warfarin has a bigger decreasing slope. The result of the experiment shows that there is a disagreement of the dissolution patterns between these two solid-state forms of warfarin.

Research Mentor:

Tonglei Li, Industrial and Physical Pharmacy, College of Pharmacy

Poster Number: 74 **:: Life Sciences**

College of Science

A Pharmacological Model of TRPA1-Mediated Nociception in the Zebrafish for Therapeutic Discovery

Author:

Emre Coskun

Abstract:

NIH estimates that 25.3 million adults are suffering from chronic pain as of August 2012. With the increasing prevalence of chronic pain, the use of narcotic painkillers to relieve it has also been increasing. These drugs are associated with side effects, overdose, and dependence. The Transient Receptor Potential Channel, subfamily A1 (TRPA1) is a channel involved in chronic neuropathic pain transmission (nociception) in humans, and it is also expressed in zebrafish. Agonizing TRPA1 channels via pharmacological treatment in zebrafish larvae results in a locomotor swimming response. The goal of this project is to utilize this nociceptive-like swimming behavior to develop a behavioral assay that models chronic neuropathic pain in humans and use it to identify novel non-narcotic treatment options. We have identified a TRPA1 agonist (ASP7663) that results in a sustained locomotor response when zebrafish larvae at 5 days post-fertilization (dpf) are exposed to the chemical. We interpret this nociceptive behavior as a chronic pain condition in human patients. To determine if this behavior can be blocked by antagonizing TRPA1, we pre-treated 5 dpf zebrafish larvae with the TRPA1 antagonists HC30031 and TCS5861528 before challenging them with the ASP7663 agonist. These antagonists blocked the agonist-mediated swimming response and prevented the nociceptive-like behavior in the zebrafish. Utilizing this developed behavioral assay, we will screen drug libraries to identify compounds that can block the nociceptive-like swimming behavior induced by agonizing TRPA1 in zebrafish. We aim to provide both novel therapeutics for chronic pain treatment, and mechanistic insight into TRPA1-mediated pain transmission.

Research Mentor:

Yuk Fai Leung, Department of Biological Sciences, College of Science

Poster Number: 75 **:: Mathematical/Computational Sciences**

College of Science

Learning By Collaborative Neural Network Groups by Reflection

Author:

Mars Gao

Abstract:

For the current architecture of neural networks, it usually requires a high training cost in time and computation. From our perspective, the current methods in deep learning might not be optimal in architecture and it fails to have an efficient learning strategy. To solve these problems, in this paper, we would like to introduce the Collaborative Neural Network Group (CNNG). CNNG is a series of neural networks that work collaboratively to handle different tasks separately in the same learning system. It is evolved from a single neural network by our designed algorithm — Reflection. In this way, based on different situations extracted by the algorithm, the CNNG is able to perform different strategies when predicting the input data. In our implementation, the CNNG is combined by several relatively small neural networks. We provide a series of experiments to evaluate the performance of CNNG compared to other learning methods on three public datasets. The CNNG is able to get a higher accuracy with a much lower training cost. With CNNG by reflection, we can reduce the error rate 74.6% by average and reach a high accuracy for many tasks, which is superior to VGG and ResNet on the tested datasets. For Fashion-MNIST and EMNIST, it can reach 98.81% and 90.88% which is the best performance currently. More- over, the required training time is usually less than 40 minutes in our experiments. Details can be found in the experiment part.

Research Mentor:

He Wang, Department of Computer Science

Poster Number: 76 **:: Physical Sciences**

College of Science

How Much Iron is in My Cereal?

Authors:

Jian Gao

Matthew Hartman

Abstract:

We have developed a new method of determining the amount of iron in cereal. This work is suitable for use as a first semester General Chemistry laboratory experiment and is part of a larger initiative to revise Purdue's General Chemistry experiments to be environmentally friendly and to have better technology integration. The main challenge in this particular procedure was to find a method of extracting the iron from the cereal without first "ashing" the sample with a Bunsen burner. Our method extracts iron from the cereal magnetically. The extracted iron is dissolved in hydrochloric acid to form Fe(II) ions. Addition of hydrogen peroxide oxidizes the iron to form Fe(III) ions, which can be complexed with thiocynanate ions (SCN-) to form a dark-red colored complex. The concentration of the complex, and therefore the iron content of the cereal, is easily determined by UV-Vis spectroscopy using standards of known concentration and applying a Beer's law analysis. Our initial results are able to determine the iron content in cereal within 10-20% when compared to the manufacturer's nutrition information.

Research Mentor:

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

Poster Number: 77 **:: Physical Sciences**

College of Science

Characterization of Plant Protein -Tannic Acid Compositions

Authors:

Samuel Hansen

Nicholas Sierzputowski

Abstract:

Tannic acid is a plant-based polyphenol with many functional groups. When used as additive or cross-linking agent, tannic acid can provide mechanical strength and thermal properties to protein polymers. The resulting properties are useful in designing nontoxic polymer adhesives and degradable packaging materials. Here we present Differential Scanning Calorimetry (DSC) data that show changes in thermal properties for films made from various corn protein / tannic acid compositions. The changes in glass transition values for these compositions are related to the interactions between the protein polymer chains and the functional groups in tannic acid. As the tannic acid concentration increases so do the interactions with the protein polymer. Fourier transform infrared (FTIR) spectroscopy is used to provide some molecular information regarding cross-linking reactions that may have taken place during drying and curing. Regions of particular importance are those characteristic for protein, tannic acid and combinations thereof. We compare our results to the cross-linking chemistry of catechol.

Research Mentor:

Gudrun Schmidt, Department of Chemistry

Poster Number: 78 **:: Life Sciences**

College of Science

Mechanical Characterization of Resilin-Based Hydrogels

Author:

Bridget Kilbride

Abstract:

Every year, millions of individuals suffer from tissue loss or extensive tissue damage. Common treatment methods include tissue transplantation which depends upon the unpredictable availability of donors. Tissue engineers have been studying donor-independent methods to better help those affected by tissue loss and injury. One way to address this is to use elastomeric, protein-based hydrogels which may be mechanically and chemically tuned to enhance their role in cell behavior and regulation in the tissue healing process. Resilin, an elastomeric protein naturally found in areas of highly-repeated movement within insect cuticles, is a material of high interest for its mechanical characteristics including low stiffness and high fatigue lifetime. In previous studies, recombinant resilin-based hydrogels, or cross-linked protein networks, have shown promise as tissue scaffolds. To understand how hydrogels may interact with their environment, we must tune our materials to ideal mechanical properties depending on application. In this study, our lab has characterized mechanical properties of resilin-based hydrogel scaffolds. We developed protocols to assess 14 wt% resilin hydrogels crosslinked with tri(hydroxymethyl)phosphine (THP). TA Instruments AR200 rheometer and a Bose Electroforce 3220 series III were used to identify compressive, shear, and storage moduli. Our findings have identified a resilin-based hydrogel exhibiting interesting mechanical properties for tissue engineering applications.

Research Mentors:

Dr. Julie C. Liu, Chemical Engineering, College of Engineering

Jessica Torres, Chemical Engineering, College of Engineering

Poster Number: 79 **:: Life Sciences**

College of Science

Pathology of the Blood-Tumor Barrier in Brain Metastases of Lung Cancer

Author:

Amanda Ludwig

Abstract:

More than 25% of people with non-small-cell lung cancer will develop brain metastasis during the course of the disease. Despite this high incidence, prognosis and life expectancy following diagnosis remains poor. One of the major hurdles that treatment of brain metastasis presents is difficulty in effectively delivering drugs necessary for treatment across the blood-brain barrier (BBB), a selective barrier that protects the brain from neurotoxic compounds. Upon brain metastasis, however, the BBB shifts to the blood-tumor barrier (BTB). In this study, we aim to evaluate differences in the pathology of the BBB as it undergoes brain metastasis. It was hypothesized that as metastasis persists, there would be a change in the pathology of the BBB into the BTB. To address this hypothesis, athymic nude mice were given an ultrasound-guided intracardiac injection of brain-seeking human non-small cell lung cancer cells, and brain metastasis validated via bioluminescence imaging. Six weeks after the injection, the mice were sacrificed and their brains were harvested. Using immunofluorescence staining, we analyzed the components of the BBB and BTB. Our preliminary findings demonstrated that capillaries in the BTB are diluted and tortuous. The organization of tight junction proteins also changed in the presence of brain metastasis. These findings will allow us to facilitate effective delivery of chemotherapeutics to treat metastases and improve patient survival.

Research Mentors:

Dr. Tiffany Lyle, Comparative Pathobiology, College of Veterinary Medicine

Dr. Gozde Uzunalli, Comparative Pathobiology, College of Veterinary Medicine

Dr. Alexandra Dieterly, Comparative Pathobiology, College of Veterinary Medicine

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

College of Science

Directed Evolution of Novel Endonuclease

Author:

Paula Pandolfi

Abstract:

Genome editing is the optimization of traits of interest by introducing specific changes to the genome of organisms. This rapidly growing field can be applied in disciplines ranging from medicine to agriculture. Such process requires the aid of tools called programmable endonucleases, such as CRISPR, which can cut the DNA in distinct places and lead to the insertion, deletion or modification of the targeted sequence. The limitation of CRISPRs is that they require a sequence-specific motif (protospacer adjacent motif, PAM) to bind DNA. This issue can greatly limit the choices of target site and may be problematic in a GC-biased genome. A novel endonuclease we called ASGARD, that was modified in our lab, has the potential to be an alternative tool due to its ability to cut dsDNA without motif requirement, which means it could have more flexibility when choosing target DNA than CRISPRs. Previously, we showed modest level of gene-editing in E. coli with ASGARD. However, there are some factors that limit ASGARD's efficiency, such as off-target activity and insolubility. Our aim is to increase the efficiency of ASGARD by performing directed evolution and selecting mutants with higher on-target activity and higher solubility. This could lead to the discovery of an ASGARD mutant that can efficiently cut dsDNA without the limitation of a binding sequence. Collectively, our research could improve genome editing from medicine to agriculture, which include treatment of diseases, the improvement of crops as well as other applications.

Research Mentors:

Kok Zhi Lee, Bioengineering, College of Engineering

Michael Mechikoff, Bioengineering, College of Engineering

Poster Number: 81 **:: Innovative Technology/Entrepreneurship/Design**

College of Science

Interactive Interface Designed for Visualizing the Animation of Compartmental Models

Authors:

Joel Stauffer

Kimberley Grobien

Abstract:

One of the largest obstacles to making ground-breaking conclusions is the presentation of data from which interpretations are made. The way in which collected data is compiled and presented can either assist researchers in the acquisition of knowledge or allow valuable information possibly hidden in the data to be missed. This research project is aimed at creating a visual interface under which a mountain of data can be interpreted to produce new revelations via graphical illustration. The project's motivation was generated from an interest to investigate the metabolites of the vitamin B6 and how it traverses the body. A physiologically based pharmacokinetic (PBPK) model was created using the SAAM II program (The Epsilon Group, Charlottesville, VA) to describe vitamin B-6 metabolism in the mouse. However, the presentation of data in SAAM II is limited to a maximum of ten variables at a time. This presentation restricts the interpreter's ability to make conclusions or inferences about the generated data considering they must compare the graphed compartment levels to the static model, remember the previous graphs if comparing more than ten compartments, and distinguish at most ten different lines on a single graph. This difficultly is compounded given the model is of a large size and very complex. To combat this restriction, this research project was commissioned to create a visualization program designed to graphically illustrate the dissemination and passage of the vitamin B6 metabolites through a body's compartment aided by the raw data generated by SAAM II. The animation program represents metabolic compartments with circles and fluxes between compartments with arrows. The circle's and arrow's color gradients change to reflect the number of metabolites or tracers present in the given compartment (circle) or transition (arrow). The progression of the time, which controls the animation, can be controlled to produce a rapid time-lapse or a slow animation. By compiling the SAAM data into this single cohesive time-lapsed animation, it assists the user's understanding of the entire data leading to greater efficiency and accuracy in the analysis of this complex data. With these features now released to a selective group of professionals for evaluation of the developed visualization system, the project team is waiting to hear the feedback of this larger audience of domain experts.

Research Mentors:

Dr. Stephen Coburn, Chemistry, College of Science

Dr. Beomjin Kim, Computer Science, College of Science

Dr. Douglas Townsend

Poster Number: 82 **:: Physical Sciences**

College of Science

Complete Chemical Analysis of Crude Oil Bound to Kaolinite

Author:

Jeff Zhang

Abstract:

Knowledge on the classes of compounds in crude oil that preferentially bind to kaolinite, a clay commonly found in oil reservoirs, can aid in enhanced oil recovery efforts. In this study, the composition of crude oil bound to kaolinite (COBK) was compared to the composition of non-bound crude oil (NBCO) in order to identify the molecular species that preferentially bind to kaolinite. Two different crude oils were each mixed for seven days with kaolinite followed by centrifugation to obtain two COBK and NBCO samples. Each sample was fractionated into three compound classes by using an auto-column with hexane, dichloromethane, and isopropyl alcohol eluents. Fourier-transform infrared spectroscopy and thermogravimetric analysis of COBK samples demonstrated most of the crude oil was removed from COBK samples after fractionation. High-resolution mass spectrometry was utilized to obtain elemental composition and structural information for compounds in each fraction obtained for COBK and NBCO. The mass spectra show that the hexane and dichloromethane fractions of both crude oils contain more heteroatom containing compounds for NBCO than for COBK. Also, the average RDBE values are greater for compounds in the hexane fraction of COBK than in the same fraction for NBCO, while the average RDBE values are smaller for the DCM fraction of COBK than for NBCO. These results provide the first insights into the types of molecules in crude oil that prefer to bind to kaolinite.

Research Mentor:

Hilkka I. Kenttämaa, Department of Chemistry, College of Science

Poster Number: 83 **:: Life Sciences**

Polytechnic Institute

Reported Label Misprints & Allergic Reactions

Author:

Chance Alexander

Abstract:

Food allergies are a common issue that many people are forced to face in their day-to-day lives. In the United States, an estimated 15 million people have food allergies, with 5.9 million of those people being children under 18. With food allergies being a common and rising issue, the safety of those suffering from food allergies should be taken carefully into consideration. The research question this work will address is: What food causes the most allergic reactions as a direct result of a mislabeled product? Research has already been documented consisting of the total percentage of people allergic to the different types of food allergens. There is also research on the total number of reported allergic reactions to common food allergens. Through my research this semester, I found that the critical gap that this field suffers from is what actually caused the allergic reaction. It's easy to determine the allergen as the culprit of the reaction, but determining whether the reaction was airborne, cross-contaminated, or another cause is more difficult to analyze. I plan to gather data from multiple sources to analyze food allergens, reported mislabeled products, and the action taken on that product to determine how many reactions to mislabeled products were reported. The expected outcome of this research is the frequency of mislabeled products causing allergic reactions, which allergen was mislabeled, and whether or not this problem is being resolved over time.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

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

Polytechnic Institute

What Automotive Industry Should You Invest In?

Author:

Jacob Austerman

Abstract:

The research addresses evaluating which automotive company has the most efficient business operations. The reason for the research is to give investors more knowledge when choosing to invest within a certain company. Research has been done to evaluate automotive companies operations financially. However, no research addresses information assisting investors in making decisions when investing. I plan to give investors more knowledge on financial projections for the automotive industry. The expected outcome is to create visualizations to represent financial projections in clearer contexts for investors.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Poster Number: 85 **:: Social Sciences/Humanities**

Polytechnic Institute

Examining Mental Illness Tendencies, Suicide Rates, and Their Relationship to Economic Development

Author:

Weiyue Deng

Abstract:

This work will address two research questions: 1) how is mental health going? and 2) what is the relationship between mental illness, suicide rates and economic development?

There are previous researches showing the tendency and the distribution of mental illness by states. For its impact to the society, some researches study how the mental illness impacts the substance uses and alcohol consumption. Others show how the mental illness relates to the violence. Some also study the relationships between genders and mental illness.

I will compare the levels of economic development in each state to its mental illness situation/percentage to see whether there are co-relationships. I plan to find the data of the annual total number of people with mental health problems, the suicide rates and the economic data by states. I think I will use both Pivot table and Tableau. Pivot table can first filter the data and manage the data, giving me inspiration for following steps, like represent stage. Then I will use Tableau for geographically showing the visualization. I expect that areas with higher level of economic development will have higher mental illness rates and higher suicide rates.

I want to emphasize that mental illness is a serious problem in the contemporary society. The development of the economics and industries which cause the heavier daily stress has something to do with the mental illness. I also expect that people can really notice the part of the health which is important but has been ignored for a long time.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

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

Polytechnic Institute

Drugs vs. Alcohol: The Effect of Drug Policy on Substance Use Disorders

Author:

Soyol Enkh-Amgalan

Abstract:

The purpose of this project is to compare the adverse health effects of alcohol abuse relative to illicit substance abuse, and the effects of different drug policies on alcohol dependence. This project hypothesizes that countries with different drug policies (harsh vs. tolerant) have different rates of prevalence and disease burdens of substance dependence. Since the policy changes involve illicit drugs, most research on the effectiveness focused on illegal substances. However, tolerant or harm-reduction policies may pay more attention to all substances, including alcohol. Therefore, this project will examine the drug policy impact on alcohol use disorders through data visualization. The substance use disorder prevalence and disease burden data from World Health Organization (WHO) and Institute of Health Metrics and Evaluation (IHME) as well as survey data from National Survey on Drug Use and Health (NSDUH) will be used as main data sources. The implications of this visualization include insight about the scope of alcohol abuse issues. Examining the effectiveness and impact of different drug policies will lead to further consideration on reallocating resources to improve public health. Additionally, the interactive features of this data visualization will give the audience and users the control to focus on aspects which interest them the most.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

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

Polytechnic Institute

Who Sold More Shoes in 2017? Nike or Adidas?

Author:

Brandt Eytcheson

Abstract:

Nike and Adidas have lead the sports apparel industry for years and continue to do so today. Both brands make shoes at the top level as well as their other apparel, but this is what brings in the most money for these companies. There are currently a lot of data sets available for both Nike and Adidas charting their success over the years, but there isn't a lot (if any from what my initial research has shown) comparing just Nike and Adidas shoe sales in a single fiscal year. I plan to take a closer look and see which specific shoes sold the most units for each company. Then, by looking at trends and maximums at certain points throughout the year, I'll do further research to possibly find out what could have caused this. My further research should develop some behind the scenes looks at why this could have happened. Whether it be an athlete that promoted a shoe at the time or a similar design concept release; I think there is a story to be told here. I plan to represent all of this with a single visualization to represent the units sold for the two companies, as well as a closer look at specific products that did extraordinarily well. Using interactions, I will represent what underlying factors could have affected the number of units sold. Hopefully these visualizations will be able to show what works when it comes to promoting a product or picking a release date. It could be helpful to these companies in their continuing battle to be on top of the sports apparel market. I hope to reveal some underlying stories from the past few years of brands that a lot of people can relate to.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Poster Number: 88 **:: Social Sciences/Humanities**

Polytechnic Institute

Video Game Console Lifecycle

Author:

Nicolaus Fresh

Abstract:

My project will investigate the sales of video games and video game consoles and the prices of these consoles throughout history. I want to investigate this topic because consumers that are not familiar with the video game industry are unsure which console to get or buy one right before its price gets reduced or a new generation come out. This is frustrating for these consumers, this leads to my research question. The research question this work will address is: When is the best time to buy a video game console throughout its lifecycle?

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Poster Number: 89 **:: Social Sciences/Humanities**

Polytechnic Institute

Does Your Environment Affect How You Game?

Author:

Geoff Grimm

Abstract:

In my research I will be exploring the relationship between a player's rank in popular online video games and their geographical locations, and through their locations I hope to find patterns pertaining to how a player's environment can affect their performance. I feel this research could offer valuable insight into some of the factors that help shape high level gamers and some of the traits that help them preform at such a high level. Some examples of these traits are problem solving, communication, adaptability, and teamwork. While there has been research into professional gaming before, this research will also include high rank armature gamers as well. I think this leaves room for discovery, as professional gamers adapt their surroundings to give themselves the best chance at high performance, while casual players may not. Using data visualization principles, I plan on expressing insights found when comparing a player's rank and where they grew up as well as where they currently live. Though I have no expectation as to where the majority of high level players grew up, I do expect that many now reside within or close to the city that houses their game's servers, as this would provide an extra edge in terms of internet speed.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Poster Number: 90 **:: Social Sciences/Humanities**

Polytechnic Institute

Influences of Mental Health and Related Social Factors on Life Expectancy in Different Countries

Author:

Wenkai Han

Abstract:

When we look at most developed countries in the world, the traditional factors like average income and air quality are usually similar. However, their life expectancies are still rather different sometimes. For example, with similar median income and environmental factors like air quality, the United States (78) and Canada (82) still have rather different life expectancy. A study from Oxford suggests that mental health might be an important influencing factor - serious mental illness may reduce life expectancy by 10 to 20 years – which is equivalent to or worse than that for heavy smoking, while the social factors like gender equality, and national character that might influence mental health haven't been studied in the context of life expectancy. Thus, the research question this work will address is: how would mental health and related social factors influence life expectancy in different countries?

Studies on social and mental factors on life expectancy within individual countries has been done before. Additionally, related comparisons between different countries on the traditional factors like income, healthcare and physical diseases also have been done. However, there has been very few comparative studies on how social and mental factors influence the life expectancy in different countries. These types of studies would help us to see how the different social dynamics and models in different countries influence life expectancy, and if these they are more important than other factors in some specific regions.

We'll focus on mental health and social environment rather than traditional factors like average income in this study. Also, we'll zone in countries with similar income and compare them within group to get a more accurate comparison. SPSS will be used to analyze the relationships between the datasets, and Tableau will be used to finalize the visualization.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Poster Number: 91 **:: Social Sciences/Humanities**

Polytechnic Institute

The Costs of College Related to Graduation Rates

Author:

Makayla Heemstra

Abstract:

Not every student who wishes to pursue a college degree has the financial means to do so, despite receiving financial aid. People who can receive the education they desire become people who can make the world a better place. The purpose of this research is to examine the costs of college as a barrier to educational attainment.

Similar research compares degree completion rates between low and high income students or it assesses the effectiveness of financial aid. These studies use methods such as selecting a handful of schools to conduct a randomized experiment, or they use Census data.

My research will highlight the average costs of universities and compare these numbers to household income and to the amount of money distributed by the Pell Grant, per area. To explore this research topic, I will acquire data to represent four pieces of information: household income, disbursement of financial aid, average costs of colleges, and area of the United States. Things I will be looking for include which areas of the country have the highest average tuition fees, the average household income, how much money is awarded by the Pell Grant, and the graduation rates for universities.

I hypothesize that locations representing lower household income and lower distribution of the Pell Grant will show lower graduation rates for local universities. My findings will be illustrated as a data visualization.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

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

Polytechnic Institute

Correlation between the Number of Passengers in an Airport and Flight Delays

Author:

Hsin-Pao Huang

Abstract:

Flight delays are one of the most frustrating experiences a traveler can have. Many studies have found different insights and solutions to reduce the delay; however, there is still one aspect of flight delays that have not been explored deeply – the correlation between the number of passengers in an airport and flight delays.

The research question this work will address is: How does the number of passengers in an airport affect flight delays? The main objective of this research is to explore the potential correlation between the number of passengers in an airport and the total minutes in flight delays of that airport. Potential airports to explore include San Francisco International Airport, John F. Kennedy Airport, Los Angeles International Airport, and Chicago O'Hare International Airport. The datasets of flight delays and the number of passengers at each airport in each month are recorded and published by different government agencies, specifically Bureau of Transportation Statistics and Data.gov. By using data visualization tools such as Tableau and Python, In this research, I expect to discover a new causation to flight delays and develop a systematic method to address this issue to reduce the time delayed of each flight.

There are very few researches done on this topic, as such, this work is an original work that has not been previously submitted, is not under review for publication, and is not under consideration for submission in another class.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Poster Number: 93 **:: Social Sciences/Humanities**

Polytechnic Institute

Healthcare Insurance Comparison between Illinois and Indiana from 2014 to 2016

Author:

Keerti Kolakaluri

Abstract:

Healthcare is one of the most debuted topic in our country as it is a fundamental need for people. The choice of healthcare insurance plays a major role in decision people make regarding their health. However, there is not enough transparency and readily available insights that enables individuals to make the right decision based on their needs. Most of the detailed research done in the past goes specific to Medicare and Medicaid plans as they are paid by government for subscribers such as the Types of Health Insurance Coverage Rate Change by State: 2013, 2016, and 2017 located in the US Census.

The research question this work will address is: How does various criteria used in insurance options and cost benefits vary between Illinois and Indiana during the duration of 2014 to 2016?

I will create an interactive visualization that depicts a trend for change in insurance cost from 2014 to 2016 specific for the two states, Illinois and Indiana by using Excel to parse my data as well as to do the mining stage to ensure the data is consistent and complete as well as using tableau to help assist me in creating a clear and concise visualization that answers the question. This would help people to drill down into the report to learn how insurance cost changes overtime in two states. The report will show which criteria are used to determine insurance cost and how each criterion influences cost.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

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

Polytechnic Institute

Secondary Data Analysis of Juvenile Systemic Lupus Erythematosus: Identifying areas of unmet needs using data visualization

Author:

Elizabeth McGuckin

Abstract:

The research which I will be conducting is in relation to adolescents who suffer from a disease called Systemic Lupus Erythematosus (SLE). SLE is an autoimmune disease in which the immune system mistakenly attacks the body. Some of the effects of SLE are inflamed skin, kidneys, lungs, nervous systems, and other organs. Adolescents who suffer from this disease lack complete physical and psychological development. To-date, the research conducted on adolescents who suffer from SLE is limited. Al-Mayouf et al., discussed how age and gender can have an effect on children with SLE. The research, which will be conducted, will focus on one of many unmet needs in SLE research. This includes the comparison of treatments between male versus female adolescents diagnosed with early onset SLE. This research will respond to the research questions: What are the unmet needs of male and female adolescent SLE patients? What is the comparison between male versus female treatments for adolescents diagnosed with early onset SLE? The data for this research is provided by collaborators from Riley's Children Hospital, Drs. O'Neil and Rodriguez. The data has been de-identified and IRB approved at Purdue. I have not found, to my best ability, published research on the correlation between gender and lupus treatments in adolescents. I will use data visualization techniques to examine differences between male and female adolescent treatment. We anticipate the outcomes from this research will inform SLE research beyond adolescent treatment and contribute to gender specific SLE treatment.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Poster Number: 95 **:: Mathematical/Computational Sciences**

Polytechnic Institute

State College Tuition & Their Comparisons

Author:

Braxton Minkey

Abstract:

The question I'm addressing follows the similar guideline of: Are college tuition rates changing and what trends are States following? This concept I will hypothesize on the ever-changing views and articles about the "increasing" tuition rates and the ridiculousness of the fluctuation by states. One of the questions I will focus on is what states fluctuate the most and what states remain statistically low. This will allow an increase awareness into views on states and gather more information for students, parents, and universities. This will lead to educated decisions on resource management and what school's education system is paired with a low rate of tuition to benefit student's area. The research question this work will address is: The changing tuition rates and how they are represented amongst states. An article by Rick Seltzer, renowned reporter of business, relates a similar feel to the common reporter of tuition. They tend to focus on the national averages that are constantly changing with room and board and U.S tuition. They show the staggering numbers that increase on a national scale but leave out a portion of the big picture. (https://www.insidehighered.com/news/2017/10/25/tuition-and-fees-still-rising-faster-aid-college-board-report-shows) I hypothesize a new understanding of the personality of tuition rates and maybe clarify what states are contributing most to the increase in tuition and what states are able to "brave the storm" of a fluctuation of tuition rates. I hypothesize and predict an interactive state to state visualization that will differentiate myself from the common analysis of a country trend.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

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

Polytechnic Institute

GDP and Wage Growth: How Increases in Productivity Affect Life in Each State

Author:

Daniel Mitchell-Dix

Abstract:

The GDP of the United States is on the rise, and with that we'd like to assume that most people are better off now than the were in the past. However, between 50 different states and 50 years, that may not necessarily be the case. While there has been research done on a nationwide scale regarding the relative stagnation of wages versus GDP growth, there has been little research done regarding individual states. The purpose of this project is to use the visualization process in order to determine how state GDPs and statewide median wages can help paint a picture of wage stagnation over time in certain parts of the country.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

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

Polytechnic Institute

Household Median Income Versus Median Home Value in the State of Indiana

Author:

Quoc Anh Nguyen Dinh

Abstract:

The American Dream is essentially to have a good job, a nice family and a house. However, in recent year, the last criteria seem harder to achieve due to the rise of cost. This project is aiming to showcase and analyze the correlation of Home Value and Household Income over the last 5 years in the state of Indiana. There is study has been done on the comparison of US and Indiana Housing market as well as the comparison of US and Indiana ratio between median sale price and income by The Indiana Business Review. However, there is a gap of study into this area. Previous researchers did not consider of different cities or counties have different level of income as well as home value. Those extreme data, whether high or low, could skew the finding and won't give the full picture into the trends, pattern of the correlation as well as be able to predict the future trend correctly. The data sets for my study have individual county and city and I will conduct individual analytics and visualizations into different counties. My goal is to create a closer examination to the correlation in question is going to be made, rather than just an overall trend of the whole state, a more appropriate presentation of how the trend of cost and income without worrying about the extreme data skewed the results. These results can draw a more accurate picture of the relationship between the home values with the respected income.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

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

Polytechnic Institute

Improving the United States' Energy Supply Infrastructure

Author:

Jared Pilewski

Abstract:

I want to compare the power consumption of The US to find what the demand for energy looks like, how demand shifts, and how they answer their energy demands. The US is using more energy than ever, and year after year demand only increases. The research questions this work will address is; has The US provided the best solution to their power demand, and if not, how can we improve energy supply?

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Poster Number: 99 **:: Innovative Technology/Entrepreneurship/Design**

Polytechnic Institute

Biowall Research

Authors:

James Rieser

Taylor Sorrell

William Longsworth

Aaron Manio

Abstract:

A biowall is a botanical air filtration device used to filter the air in a building. The biowall research project is currently taking place in Whirlpools ReNEWW house located near campus. The biowall is able to filter Volatile Organic Compounds (VOCs) out of the air by pulling the air through the plants root system and activated carbon pellets. The purpose of the research is to develop a product that can eventually be commercially made and sold. The biowall uses an automated system to maintain the plants that are used by the biowall by providing the plants with light and water. There is currently research being conducted to reduce the physical size of the automated control system for the biowall which would also reduce the cost of the biowall. There is also research being conducted to make an accurate model for determining the size that the biowall would need to be in order to properly filter the air for the size of the building.

Research Mentors:

Dr. Bill Hutzel, Mechanical Engineering Technology, Purdue Polytechnic Institute

Poster Number: 100 **:: Innovative Technology/Entrepreneurship/Design**

Polytechnic Institute

Applying Participatory Research Methods to New Degree Development

Author:

Chelsie Rummage

Abstract:

Educational institutions and researchers are not keeping up with the pace of many organizations locally and globally in the area of new program/new degree development processes. New product development processes are significant because the adoption and the use of processes such as, design thinking and lean start-up methodology, allow organizations to improve and create new products, designs, and ideas. To remain competitive and promote economic growth organizations all around the world are embracing these processes. This research investigates how students can be used within the new program development process. The sample of this study consist of eleven students enrolled full time. The method consists of including students in the collection of data and analysis process. For the collection of data photo-voice, photo elicitation, and focus groups were utilized. The results from this research highlight the themes and associated attributes related to the new degree program.

Research Mentors:

Dr. Lisa Bosman, Department of Technology, Leadership, and Innovation, Polytechnic Institute

Sandhya Arumugam, Department of Technology, Leadership, and Innovation, Polytechnic institute

Abrar Hammound, Department of Technology, Leadership, and Innovation, Polytechnic Institute

Poster Number: 101 **:: Life Sciences**

Polytechnic Institute

Crypto Versus Paper

Author:

Zach Vallow

Abstract:

The purpose of me researching this topic was to compare the overall growth of crypto currency in these pasts few years to trends of actual paper currency backed by governments. By analyzing the data between the two different currency's I can draw out if crypto is here to stay or just a recent fad that took off. The research question this work will address is compared to paper currency does crypto currency have a chance in becoming a widely used currency.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

Poster Number: 102 **:: Life Sciences**

Polytechnic Institute

Influential Factors of Obesity in the United States

Author:

Divya Vempati

Abstract:

It has been stated that three-fourth of the American population will be obese by 2020, which is an issue. Each state has different obesity rates, posing the question - why? It has been said that 80% of weight loss is dependent on nutrition and 20% is dependent on physical activity. Every state has different food patterns, income levels, and restaurant distances, which could play into the roll of increasing obesity. There are states which are becoming more health conscious, and states that are known for using butter in every dish. This variety of food and culture creates just one part of the reasons that every state has a different obesity rate. Income levels play a major factor in that lower income families would be more willing to buy cheaper food from fast food restaurants that are nearby. People are also on different food programs depending on income, varying the levels of nutrition they receive. This also brings up proximity of restaurants to people's homes, which plays a major role as well. All of these are factors in each state that add to the obesity rates in America being so high.

Research Mentor:

Dr. Vetria Byrd, Computer Graphics Technology, Purdue Polytechnic Institute

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

Polytechnic Institute

Relationship between Trends in Cancer Death Rates and Trends in Risk Factors/Screenings Rates

Author:

Jinghe Zhu

Abstract:

Each year, the Indiana government collected the data of cancer deaths, incidences and other information about cancer in Indiana. Also, the trends in factor risks/screening rates were also collected. To find out whether or not there is a causal link between the trends in risk factors/screenings and the trends in death rate of cancer, I would like to connect the both trends in death rate and in risk factor/screenings with leading causes, so that I can compare the relationship between these two trends. I hope to analysis and visualize all the data I have, and then explore if there's an obvious causal relationship between the trends in leading risk factor and the trends in death rate. Based on the result, I'm able to see whether or not there are some possible actions taken to lower the risk of getting cancer. Also, I can make some reliable suggestions to reduce risk with regard to specific type of cancer.

Research Mentors:

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