POSTER ABSTRACTS

Basic and Medical Sciences

1 A. **Analysis of Mutagenicity of Common Household Substances by Modified Ames Test**

Rachel Boedicker, Liisa Dollinger, Tiffany Nguyen, Youngjun Park
Case Western Reserve University

Exposure to mutagenic substances can cause mutations in DNA, detrimentally affecting cell activity and potentially having carcinogenic effects. A modified Ames method test was used to determine mutagenicity of three commonly consumed foods -- Kool-Aid, jam, and ketchup -- and one non-food, a lotion. It was predicted that high fructose corn syrup (HFCS) in the foods would have mutagenic potential, causing mutations allowing bacteria to grow in the presence of streptomycin, based on a study linking HFCS with pancreatic cancer. We found that Kool-Aid displayed the most mutagenicity, jam and lotion displayed a slight amount, and ketchup displayed no mutagenic properties. The pattern of increasing mutagenicity correlated with increasing amounts of HFCS present, providing evidence for its mutagenic potential.

2 B. **Distinguishing Beneficial Pollinator Garden Locations in Urban Landscape Using Geospatial Information Systems**

Jordyn Stoll
Cleveland State University   *Wentworth Clapham, Mentor*

Insect pollinators (honey bees) are considered keystone species because they have a large impact on floral communities. However, their reduction or extirpation can have far reaching, negative effects on the whole ecosystem. Based on beekeeping data, the number of western honeybees (*Apis mellifera*) has decreased to half since the 1950s, while the demand for their ecosystem services has continued to increase. Numerous non-profit groups, such as Wild Ones, have set out to establish pollinator gardens and encourage native plant landscaping to support insect communities. Research in Cleveland, Ohio utilizes geospatial information systems (ERDAS®) to classify abandoned parcel data by size, density and distribution. Vegetated areas and location data from beekeeping permits are overlaid on six inch resolution imagery of land cover and soil maps, applying distance algorithms, classification selection, and normalized difference and vegetation indices (NVDI) within a multilayer analysis.

3 A. **The Effects of Poverty on Healthy Eating Choices**

Kaylee Dworning, Nadia Grynykha, Jacob Brenkus
Cleveland State University   *David Foley, Mentor*

Obesity has long since been an issue plaguing the US. Studies over the past few decades have shown that, while in some areas of study, the rate of obesity if plateauing, the general trend is upwards. Here, we examine what the major components causing this increase could be. The areas of focus will be socioeconomic status and resources available to the families.

4 B. **The Problems and Challenges presented in the synthesis of new Fluorinated Linkers for MOF Chemistry**

Samuel Dickson
Youngstown State University   *Doug Genna, Mentor*

Fluorinated Linkers have become a subject of extensive research due to the exclusive properties exhibited and the opportunities it can create for Metal Organic Framework chemistry. The difficulty arises in the synthesis of these Linkers due to the electronegative and inductive effects that are exhibited by the starting molecules. The work done details attempts to make fluorinated linkers for MOF chemistry, and the problems that arose in the each of the pathways.

5 A. **3D Printed Educational 3D Puzzle**

McKenzie Scheckelhoff, Nicholas Walker, Logan Weinreber, Edward K Ellks

Youngstown State University   *Snjezana Balaz, Mentor*

We designed and made hand size puzzle toys to promote STEM (Science, Technology, Engineering, and Mathematics) fields. Instilling an interest in the STEM fields in younger learners should be held as a top priority among educational institutions across the country. Our project promotes an interest in those fields by demonstrating various principles of mechanics and kinematics while promoting our university. Additionally, our project is produced primarily with 3D printing technology, emphasizing our university's advances and focus on additive manufacturing methods.

6 B. **The Restoration and Internal Mapping of a Subcritical Assembly**

Martin Strong, James Hayes, Nicholas McGuigan

Youngstown State University   *Donald Priour, Mentor*

Subcritical assemblies are devices which undergo a chain-fission reaction only when an external neutron source is present. For this experiment, a Nuclear Chicago Model 9000 chamber was restored to proper working conditions. An apparatus was then constructed and installed above the chamber in order to wirelessly maneuver a multi-probe detector throughout the flooded system. Beta and gamma particle counts were read and an overall neutron flux determined. The system was then modeled via Monte Carlo simulations in order to compare and fit the experimental data to the theory. Assembly and detector modifications necessary for future research are also discussed.

7 A. **Comparative Study of Citrus Pectin and Cancer Cell Death**

Alexander Shimek, Andrew Wiecek, Gavin Wu, Aaron Yun

Case Western Reserve University   *Jim Bader, Mentor*

An expository study of how citrus pectin may play a role in cancer cell death. An Ames Test using E. Coli was performed to establish mutagenicity and those results were extrapolated to existing research regarding cancer cells.

8 B. **Effects of Sediment From Recreational Horse Trails on Aquatic Macroinvertebrate Communities**

Briana Sealey

Case Western Reserve University   *Elizabeth Dobbins, Mentor*

Excess sediment can damage aquatic habitats. Previous studies show sediment from walk trails and off-road vehicles has caused unfavorable conditions in aquatic habitats. Macroinvertebrates, specifically those outlined in EPT, areused to test for water quality because some species are more sensitive to changes to water quality than others. We collected water quality, macroinvertebrates, total suspended solids, and bedload samples from 10 pools below and 2 pools above a horse trail. We hypothesized that pools below the trails will have poor water quality as opposed to those above the trails. However, we found that horse trails had no significant effect on the macroinvertebrate community. The relationship between macroinvertebrates and its environment may be the factor that determines the distribution of species within a stream.

9 A. **Transposon Mutagenesis of Stenotrophomonas Maltophilia Oak Ridge strain 02**

  Haley Gianfrancesco, Gabriella Hosack, Hanna Gilligan

  Youngstown State University   *Jonathan Caguiat, Mentor*

A multi-metal resistant strain of Stenotrophomonas maltophilia OR02 (S. maltophilia 02) grows when exposed to toxic salts of gold and selenite. An E-Z Tn5 transposome was introduced into S. maltophilia 02. Transformants were replica plated onto plates containing copper sulfate, sodium selenite, mercuric chloride, sodium arsenite, and M-9 minimal salts medium to see if the transposon interrupted genes required for selenite resistance, arsenite resistance, mercury resistance, chromate resistance or growth on minimal media. 12 mutants were discovered. The genomic DNA from the mutants was purified, digested, ligated and transformed into E. coli. These transformants will contain new plasmids with transposon flanked by the interrupted genes. We expect DNA sequencing to identify genes involved in oxidative stress response, metal efflux, metal transformation and sequestration.

10 B. **Behavioral Health Implications as it Relates to Childhood Obesity and Vitamin D Levels**

  Ramandeep Gill, Evan Leek, Sreya Brahmandam, Ashley Amendol, Hannah Haynie

  Youngstown State University   *Charles McGowen, Ronald Dwinnells, Mentor*

As part of Dr. McGowen's group, we have had the opportunity to reverse behavioral issues such as depression and substance abuse (percentage of success) ultimately concluding that they are inversely proportional to the proximity of its discovery and treatment; i.e. the shorter the interval in months or years the greater the percentage of success. Children with obesity and decreased vitamin D levels have a higher incidence of behavioral health issues. Through this project, we evaluated the relationship between Obesity, Vitamin D Levels, and CRAFTT(short clinical assessment tool). This well be accomplished by the means of the students tabulating and evaluating the data based on relative ICD codes. Overall, our results contained information that was confirmed by the codes, to show that there is a solid correlation between obesity, vitamin D levels, and behavioral issues in children.

11 A. **Metabolic Properties of Sloth Muscles**

  Paije Kiraly, Taylor Rogers, Amanda Svenson, Abdel Ruhman Yusuf

  Youngstown State University   *Michael Butcher, Mentor*

Sloths exhibit suspensory behaviors that require both strength and endurance, yet their muscle mass is reduced. Thus, their limb form has been extremely modified. Previously we found that one modification is the expression of slow-twitch and one isoform of fast-twitch fibers in the forelimb musculature. Here we use biochemical assays to measure muscle metabolism in two-and three-toed sloths to understand factors that provide sustained force. Overall, enzymatic activity is suppressed. Sloths are less reliant on β-oxidation of fat for oxidative metabolism and show little dependence on glycolytic metabolism. Faster-contracting muscles are found to be more oxidative by the enzyme activities studied, which may not be correlated with fiber type. These findings match the low metabolism of sloths, but do not completely explain their fatigue resistance.

12 B. **The Changes in the Myoblast Proteome during Myogenesis**
    Allison Guerrieri, Samantha Mock, Tayah Turocy
    Youngstown State University   *Gary R. Walker, Mentor*
Myogenesis is the generation of muscle tissue from the fusion of myoblasts resulting in the formation of functional and contractile myotubule, which are myofibers in an animal muscle. C2C12 cells are mouse embryonic myoblasts, commonly used in researching muscle development. The purpose of this study was to identify proteins that are central during muscle development as well as identify the micromolecular sequence of events that occurs during muscle development. In this time course study, cells were grown in a fetal bovine serum growth media. Once the cells were confluent, they were transferred to differentiation media, which triggered myogenic differentiation. Then the cells were imaged and harvested, and proteins were analyzed at various time points during myogenesis. At day 16, the cells were fully functional and expressed myotube morphology. Proteins were analyzed by SDS-PAGE.

13 A. **Light Theory and Light Through Matter**
    Christopher Churley, Korin Vaughn, Hannah Lipka, Alexandria Prox
    Cleveland State University   *Nicole Strah, Mentor*
As science progress, one of the main limitations on the ability of the human race to expand and explore is the inability to travel faster than the speed of light. Before faster than light travel can be understood, light itself must first be understood with all its properties. This project seeks to compare the properties, such as speed and refraction, that light exhibits as it passes through different medians.

14 B. **Methods to Increase the Efficacy of Pro-Balance Training Among Older Adults**
    Taylor Santelle
    Cleveland State University   *Ann Reinthal, Mentor*
Fall risk increases with advancing age. Injurious falls and fall-related fatalities in older adults have risen significantly in the past decade, raising concerns about the efficacy of programs to prevent falls. Even non-injurious falls can significantly impact activity and functional mobility due to fear of future falls. This is problematic since a fear of falling can seriously reduce activity in older adults and cause a decrease in quality of life. The purpose of this study was to implement a pro-active balance training program in older adults to determine if balance could be improved by looking at total excursion, and max acceleration and velocity over the span of 10 weeks.

15 A. **Immunizations and Herd Immunity**
    Renee Justus
    Cuyahoga Community College   *Cathleen Rossman, Mentor*
In recent years, immunizations or vaccinations have been a major contention for debate. The purpose of my presentation is to explain how immunizations work, not only on an individual basis, but on a global scale. I will explain how herd immunity works through immunization. In particular, I will focus on the prevention of spreading a contagious disease within a population. I will also describe how choosing to not vaccinate affects herd immunity. I will also detail studies that discuss the debate of the potential danger of vaccinations for children.

16 B. **Purification of Water by the Removal of Metal Cations Using Thiophene Containing UiO-66**
    Dante DeChellis, Jordan Zackasee, Bailey Varga, Courtney Platt, Monther Nassar
    Youngstown State University   *Douglas Genna, Mentor*
The construction of a Thiophene-containing version of the common Metal Organic Framework (MOF) UiO-66 was performed by a linker exchange using 2,5-thiophenedicarboxylic acid. This MOF was targeted due to its projected ability to absorb metal cations from aqueous media into the MOF's pores from contaminated water. The purpose of this is to be able to use this framework to purify water which could then avoid incidents such as the unsanitary water conditions in Flint, Michigan.

17 A. **Effect of latent catalyst-containing (2-CA)PH-a on the curing of BA-a benzoxazine**

Matthew Szigeti, Wilmel Cosme, Paul Palumbo

Case Western Reserve University   *Daniela Iguchi, Mentor*

A latent catalyst-containing benzoxazine ((2-CA)PH-a) was homogenously mixed with BA-a benzoxazine in proportions of 2, 3, 5, and 10 wt% (2-CA)PH-a, and the effect of (2-CA)PH-a on the curing temperature and activation energy of BA-a was studied. Activation energy was determined using the Kissinger and Ozawa methods. It was found that the presence of (2-CA)PH-a catalyzes the polymerization of BA-a, lowering the curing temperature and activation energy.

18 B. **Erosion Treatment Effectiveness Based on BEHI Score Comparison**

Faraaz Hussain, Ogo Okolo

Case Western Reserve University

Metro Parks have taken efforts to install rain gardens in order to increase permeable surface area of urban environments and reduce run off. BEHI scores are used as a measure of the rate of erosion of streams. We will see, by comparing BEHI scores of treated streams to control ones, if the rain garden installations have been effective; and if they have/have not, what implications does this hold.

19 A. **The Effects of Electric Fields on Plant life**

Hamza Abouabdalla, James Ellis, Olivia Hammons, Hussam Taha

Cleveland State University   *Kiril Streletzky, Mentor*

100 radishes were grown in a controlled environment to study the effects of electric fields on plant life. 50 radishes were exposed to a large electric field every day for 8 hours. The other 50 served as a control group. After two weeks the yield between the two groups of radishes were compared. No significant difference was found between the two groups, which provides evidence that electric fields are in no way harmful to plant life.

20 B. **The Relationship of Social Media/Network Usage and Mental Health Outcomes**

Claude Palaganas, Dan Londrico, Andrea Wardeiner, Luke Candow

Cleveland State University

Social media, albeit a relatively new phenomenon, is becoming more and more prevalent in society, especially among millennials. Part of this reason is due to an increase of technological advancements and their availability (e.g., smartphones, laptops). Today's most used social media platforms include Facebook, Instagram, Snapchat, and Twitter, all of which incorporate a system of self-expression, explicit positive feedback, and implicit negative feedback. A meta-analysis of recent pre-existing peer-reviewed research shows that there is a positive relationship between negative mental health outcomes and social media usage. Since social media is a relatively new phenomenon, the long-term effects of social media has not been examined. With further research, once a correlative relationship has been solidified, a causative relationship can be examined.

21 A. Kinetics and Thermodynamics of Gellan Gum in Solid State

Randah Abuhashim, Veronica Marcella, Bryan Ortiz, Salam Picard, Rehmaan Rafique, Alexis C El-Khouri

Youngstown State University   *Ganesaratnam Balendiran, Russ Moser, Mentor*

Advanced thermal technology, pyrolysis, has been widely applied for reducing the quantity of ash and flue gas volume as well as recovering energy. Recently, biomass decomposition has attracted significant attention for the one single process of pyrolysis, which is the leading method for producing biofuel/bio-oil due to various advantages1-3. Biomass pyrolysis is an efficient and promising process to convert biomass into liquid products and chemicals4. High carbon containing materials can be extracted in a form4 of biofuel/bio-oil with up to 80% yield from dry biomass feedstock. The oily organic fraction (pyrolysis oil, bio-oil), which can contain 75% of the starting energy content, is typically the desired product5, is very easy to transport, and helps cut down about 87% of biomass transport costs6. Polysaccharide material Gellan Gum is studied in this research project.

22 B. Observing the Changes in Muscle Contractions with the Addition of Various Stimuli in Frogs as a Model Organism

Aaron Yun, Adelraham Rahmy, Faraz Hussain
Case Western Reserve University

The muscles of the body react according to the stimuli that is promoting the movement. However, the way the muscles behave is based on the type of signal that is stimulating the muscle fibers. In most organisms, chemical, electrical or hormonal signals encourage various muscle fibers to contract or relax promoting diversified movements within the body. To observe how the various stimuli effect the muscles of the body, model organisms (frogs) with similar muscle structures as humans were used to observe how the muscles would react to the varying stimuli. Where the gastrocnemius and heart muscle of the model organism were used to observe how different muscle fibers react to hormonal, electrical, and chemical signals.

23 A. Restriction Digestion and Analysis of Lambda DNA

Tessa Askew, Julia Gaspare-Pruchnicki, Patrick Bonano
Case Western Reserve University

This report shows the outcome of cutting lambda DNA, the genomic DNA of a bacterial virus, and then determining the size of the DNA pieces using gel electrophoresis. The lambda DNA used has been extracted from a bacteriophage, a bacterium-invading virus, and is cut using three restriction enzymes - PstI, EcoRI, and Hindlll - that separate DNA fragments based on specific palindrome sequences. DNA splicing, along with Polymerase Chain Reaction (PCR), can be combined to "amplify" small sections of DNA which can then be used to generate a unique "fingerprint" for an individual. This can help us understand how genes are passed down from generation to generation and can help create gene linkage maps.

24 B. Diversity of Small Mammals Cacao Agroforestry and Tropical Broadleaf Forest Habitats in the Bladen Nature Reserve

Claire Holliday, Beoline Uwampamo, Kelsey Bartholomew, Jonathan Stebbins, Julia Westermann,
Case Western Reserve University

The intent of this research is to study and compare the small mammal diversity between the Bladen Nature Reserve subtropical broadleaf forest and the cacao farms. Data will be collected by trapping and observing small mammals in the Bladen Nature Reserve forest and cacao farms during day and night hikes. This research hypothesizes that there will be a higher success rate for traps in the cacao farm and a higher diversity of mammals in the unforested broadleaf forest. The sample data gathered will be compared to long-term studies, so the distinctions found can be backed by previous years data.

25 A. **Type-2 Diabetes Mellitus (DM) with Attention Deficit Disorder (ADD) and/or ADHD in Pediatric Population as it is Related to BMI**

Ashley Labatte, Brandy Peprah, Isna Khaliq, Jason Lee

Youngstown State University *Charles McGowen, Mentor*

In China, a study showed that children with Type-2 Diabetes were more likely to have ADHD/ADD. In our research, we evaluated pediatric patient charts and codes to look for obese children to see if they have been tested for pre-diabetes/diabetes. We also evaluated patients who have ADD and/or ADHD to see if they have been tested as well.

Engineering and Technology

26 B. **Environmental Design of Soft Drink Bottling Plant**

Kyle Bryan, Carmen Acierno, Hussein Al-Muhandes, Jared Bohr, Joey Canann,

Youngstown State University *Tony Vercellino, Mentor*

This project is directed at properly and creatively applying civil engineering knowledge to generate a safe and practical environmental design for the construction of a new soft drink bottling plant in Youngstown, Ohio. Aspects of such a design include pollution prevention plans, environmental analysis reports, and the design of all pumps, pipes, and appurtenances to deliver water to the site as well as direct effluent back to the main sewer line. In addition, the goal of reusing all bottling wastewater will be achieved via sufficient water treatment processes to be performed on-site. This environmental design was completed in conjunction with other individuals' designs for the remaining civil scopes of work: geotechnical, structural, transportation, and water resources.

27 A. **A Study of Thermal Damage to the Blood Brain Barrier During a Rat Craniotomy**

Jen Paiz, Mikhaylan Price, Sarah Mortier

Case Western Reserve University

Intracortical microelectrodes suffer from inconsistent recording performance and lifespan, thought to be caused by a multitude of factors both biotic and abiotic in origin. These failures have been linked to neuroinflammation initiated by blood-brain barrier (BBB) damage during insertion. We observed that increased BBB permeability was correlated with longer drilling times. There was significant variation in trials due to force, feed-rate, angle inherent in hand-drillng technique. Few studies mention specific techniques to prevent drill overheating (10%). Our experimental data showed that craniotomy drilling is capable of increasing the temperature of the brain surface more than 25℃ over the span of 15-20 seconds of contact. To lower the risk and potential impact of drill overheating, it is recommended that craniotomies be performed at a low drill speed with cold saline irrigation.

28 B. **Conic Compass: An Advanced Compass**

Stephen Kennedy, John Liggett

Cleveland State University *Tushar Borkar, Mentor*

The compass is a significant mathematical tool that was initially created by the ancient Greeks. Our poster presents a new advanced compass, called Conic Compass, that allows individuals to create any and all conic section functions with the compass. It can trace circles, ellipses, hyperbolas, and parabolas. This compass is easy to use, compact, and durable. The poster presents a brief background on compasses and the mathematics behind the compass, part creations that we designed in SolidWorks, and future work to be explored for the project. We plan to also present a 3D printed model of the compass.

29 A. Conversion of Flanger to Joggler

Michael Kunzer, Johnny Medina, Jonathan Kanos, Jonathan Fortney

Youngstown State University *Anthony Viviano, Mentor*

YSU students were to re-engineer an existing machine and make it do a different process. A company located in Youngstown, Ohio asked for the assistance of YSU students to convert a flanging machine into a joggling machine. Joggling a process done to pressure vessel tank heads that allows the tank heads to fit inside the pressure vessel body in order to make an easier weld. The students converted a large, non used flanging machine and converted every component of it in order to joggle their product.

30 B. Green Infrastructure for Runoff Control

Benjamin Nimrod, Jalecia Fair

Cleveland State University *Kocher, Mentor*

A combined sewer system is a sewer system where the runoff,domestic sewage, and industrial sewage flows into the same sewer system. CSO's occur in combined sewer systems when there is an abundance of rainfall.As a result of the rainfall excess rainfall the sewage system cannot contain the excess rainfall. The untreated sewage and the rainfall spills over into lakes and rivers. One of the causes of CSO's are due to the lack of infiltration because of impermeable surfaces. We are investigating how Green infrastructure helps to mitigate CSO's. Specifically Green Infrastructure that helps with the infiltration of water.

31 A. Tri-C's Exreme Green Ecosystems

Steven Fairley

Cuyahoga Community College *Bilal Bomani, Mentor*

I am researching an eXtreme Green solution that can potentially optimize the world's water and food resources. EXtreme Green is a concept originally developed at NASA's GreenLab Research Facility where renewable, alternative, and sustainable techniques were researched and implemented. I am utilizing two portable, self-sustaining renewable ecosystems containing three plant species (Lima camelina, Salicornia europea, and Salicornia subterminalis). I am also investigating a climatic adaption technique by salinitizing each ecosystem from freshwater to beyond seawater levels and only use Poecilia species fish (Freshwater Mollies) as a natural fertilizer to provide essential nutrients for the plants. I am conducting a 24-week study with a goal of developing reliable, portable, self-sustainable, renewable ecosystems that can be implemented worldwide.

32 B. Additive Manufactured Fractal Antenna

Samuel Cappelli, Jonathan Mudrinich, Cameron Syersak, Robert Dixon, Mason Shaulis

Youngstown State University *Pedro Cortes, Mentor*

Fractal antennas are communication systems that are used in commercial and military sectors. One potential application of these fractal antennas is the incorporation into an aircraft's structure as a means to enhance communication performance. To accomplish this, it is necessary to embed the antenna into a 3D structure, which can be achieved with additive manufacturing. Hence, this project investigates this consideration based on a 3D printing technique to create the prototype. A fractal design has been assembled inside a polymeric printed specimen, with the antenna being constituted by a conductive ink. It is expected that this prototype can be enhanced into a more robust structure via 3D printed binder jetting process. Ultimately the fractal design will be embedded into an aerodynamically shaped TiO_2 structure, with the antenna created using a casted molten metal.

33 A. Bent Knee Adapter For Experimental Testing

Santino Bianco
Cleveland State University   *Hanz Richter, Mentor*

Novel prosthetic devices must be undergo testing as part of their development. Testing with amputees is problematic at the development stage due to safety and administrative burdens. A bent-knee adapter allows able-bodied individuals to perform preliminary testing. A bent knee adapter made by the Cleveland Clinic to conduct experiments was available for modifications. Although it was very well made, it did not provide an accurate depiction of a walking motion. This was due to the prosthetic leg being mounted laterally instead of inferior to the knee. Because it was mounted laterally, the experimental prosthetic would encounter unnatural forces that do not occur in a normal walking motion. A more natural bent knee adapter had to be engineered to account for these issues.

34 B. Signal Strength Evaluation for 3D Printed Sand Casting Molds

Benjamin Wilson, Lucas Garland, Hugo Mendel
Youngstown State University   *Eric MacDonald, Mentor*

A study of the Received Signal Strength Indicator (RSSI) from a blue-tooth low energy(BLE) nano device placed inside a sand casting mold. Research was conducted to see if any RSSI loss occurred while inside various sized spheres. This information gathered will be used to see if using BLE devices inside sand casting molds is a viable means to collect data while a sand mold is being cast with molten metals. Data intended to be collected includes things such as temperature, humidity and any shift in sand mold cavities.

35 A. Effect Of Chronic Intracortical Microelectrodes Implanted In The Motor Cortex On Rat Motor Behavior and Neuronal Density.

Justin McMahon, Monika Goss, Keith R. Dona, Andrew J. Shoffstall, Evon S. Ereifej
Case Western Reserve University   *Jeffrey Capadona, Mentor*

Implanted intractortical microelectrodes have shown success in the field of neural engineering, but there is limited knowledge of how they affect the brain and associated body functions. We hypothesize that the intracortical stab wound and chronic foreign body reaction resulting from microelectrode insertion can result in a decrease in motor function.To test our hypothesis, rats performed custom grid and ladder tests for a period of 16 weeks. We recorded baseline scores prior to surgery, then acquired bi-weekly scores for each test. At the conclusion of our study, brains were harvested for histological examination, and labeled using GFAP to image astrocytes and NeuN to stain for neuronal nuclei. Our preliminary data shows that rats with intracortical implants perform more poorly at motor tasks, when compared to those without implants.

36 B. Reverse Paralysis

Michael Conroy, Nathan Fine, Susan Almashni
Cleveland State University

Paralysis is the inability to move part or most of the body. This has been a delicate, yet difficult problem that scientists and engineers have tried to solve. Paralysis has made daily tasks challenging and at most times requires help from others. But there may be a solution to cure paralysis. Late November of 2016, a developing technology was used on a monkey with one paralyzed leg. This technology is the size of a postal stamp and supposed to help transmit the electric pulses that were sent from the brain to the part of the body being used. This is achieved by implanting the chip into the spinal cord by a neurosurgeon. After running some tests, scientist got the chip to work. First the monkey began to limp with his paralyzed leg, but soon could walk normally. The objective is to use the chip on humans to hopefully restore the damaged nerves that are causing the paralysis.

37 A. **Revitalization and Calibration of an Aerolab Three Component Pyramidal Balance**
Matthew Hamman
Cleveland State University   *Wei Zhang, Mentor*
This work summarizes the steps taken to revitalize an Aerolab Three-Component Pyramidal Balance made in 1966. The balance served to measure two forces in horizontal and vertical directions as well as the bending moment acting on a scaled model mounted in the test section of the wind tunnel. The balance was first rebuilt by fixing structural and wiring damage. Then a LabVIEW program was created to conduct the data acquisition. A new calibration procedure is developed to correlate the voltage output to the strain sensed by fine metal rods in the balance. The entire balance and data acquisition system was examined by measuring the drag coefficient of a steel circular cylinder (diameter of 1 inch). Preliminary result of the drag coefficient vs. Reynolds number is well aligned with data in literature.

38 B. **Optimized Rim for Spring Tires**
Antonio DiSalvo, Mark Plant, Elizabeth Urig
Youngstown State University   *Jae Joong Ryu, Mentor*
The objective at hand was to design for NASA a rover tire rim that was able to be prototyped and tested at NASA Glenn Research Center in Cleveland, Ohio. The Mars Curiosity rover's rigid wheels have been experiencing wear and damage from the rocky terrain of the planet. This in turn has decreased the projected lifetime of the rover's ability to successfully navigate Mars. To maximize this lifetime for the Mars 2020 mission, engineers have been investigating the performance of spring mesh tires. Subsequently, the rim was designed to be used in spring mesh tires and to meet the requirements provided by NASA. The design process consisted of 3D CAD design, finite element analysis, refinement of design, and fabrication drawings in order to build and test a fully functional spring mesh tire.

39 A. **Youngstown State University EPA Campus Rainworks Challenge**
Daniel Bancroft, Blake Walker, Austin Snovak, Joseph Agati
Youngstown State University   *Joseph Sanson, Colleen McLean, Bob Korenic, Mentor*
Our research group outlined a rainwater management plan for a section of the Youngstown State University campus under the guidelines of the Environmental Protection Agency's Campus Rainworks Challenge. Overland flow calculations were performed to evaluate the site in its current state and the site after it would be remodeled to improve rainwater flow. Environmental sustainability was kept in mind, through incorporating permeable pavement, rain gardens, and bioswales. The final priority of the project was to make the area more appealing to the campus community.

40 B. **Stirred Tank Reactor Scaling**
Khailing Neoh, Gavin Wu, Maggie Wong, Enrique Luevano
Case Western Reserve University   *Heidi Martin, Mentor*
An industrial size non-ideal stirred reactor was modeled by experimental data from performing a tracer test on a lab scale reactor. By altering certain parameters, It was determined that a reactor with no baffles, lower flow rate, and lower mixing would lead to the highest mean residence time, which results in the highest percent yield. Although this trend is apparent, it should not be the only consideration when designing a reactor. Higher purity products take more time to make and would cost more. The purity specification should be discussed before final designs are made.

41 A. **Projection of Computation**

Sarah Alabsi, Caitlin Cole, Victor Ipinmoroti

Cleveland State University   *Pong Chu, Mentor*

Computation is a key aspect of our lives. Therefore, it is important to consider its evolution in the future and how it affects all of us as individuals. In this poster, we would look at the concept of computation and its progression. Additionally, we would compare two types of computers (classical and non-classical) based on how they work and their current state. We would discuss where they are likely to be in the future and how they would affect the lives of individuals. We plan to explain Moore's law; specifically capitalizing on the exponential growth he predicted in computational advancements, which has held true for over 50 years. However, we also plan to explain that there is evidence to prove that although Moore's law continues to hold true, it will indefinitely plateau at some point. The solution of this we believe lies in the realm of non-classical computers.

42 B. **Interior Ballistics: Flow of Hot Gases Into a Side Chamber**

Justin Stellmar, Carmen Marinucci, Matthew Hetzel

Youngstown State University   *Richard Goldthwait, Brian Vuksanovich, Mentor*

We modeled the flow of the hot combustion gases from the inside of a gun chamber into a small side chamber. We want to predict the time-varying pressure in the small side chamber as a function of the pressure inside the cartridge chamber of the gun. The side chamber represents a portion of the automatic reloading mechanism of an actual semi-automatic or fully automatic gun, and the ability to predict the pressure in this chamber is helpful in the reloader design.

43 A. **Cellulosic Ether Reactions in Low-Hydrogen Electrodes**

Dane Elliott, Aemilee Ziganti, Hannah Goldberg

Case Western Reserve University   *Joe Zalokar, Mentor*

The formula for a low-hydrogen electrode at a local welding company was having problems in manufacturing related to the slip agents in the coating not thickening as they should. This issue in the formula was either due to the basicity of hydroxides or the increased ionic presence of salts. The goal of the project was to determine what aspect of the new formula had caused the issues with the coating properties. This was done by testing the effect that increases in both basicity and ionicity had on the viscosity of the coating solutions; in either case, did the solution thicken as expected? The data found that hydroxides caused the slip agents to lose their thickening properties while salts did not inhibit this property.

44 B. **Animal Agriculture and The Environment: Why Cow Farts are No Laughing Matter**

Jennifer Frcho, Lisa Thomas, Mariangel Carrion

Cuyahoga Community College   *Cathleen Rossman, Vanitha Parameswaran, Mentor*

Climate Change has been understood to be man-made, yet there is a misconception of the exact causes. The burning of coal and petroleum products are thought to be the main cause of greenhouse gas emissions. While these do emit a considerable amount of carbon dioxide and carbon monoxide, it is not substantial enough to change a light bulb, drive a fuel efficient car, or use renewable energy for commercial power production. The raising of livestock for food consumption uses up lots of natural resources and cows produce a significant amount of methane that is emitted into the atmosphere. Much land has been cleared taking away oxygen producing trees for livestock. Switching to a plant based diet can help curb the impacts of Climate Change significantly.

45 A. **3D Printed Sand Casting of Low Density Gyroid Structure**

Alex Fitzgerald, Matthew Manna, Eric Haake, Kayla Theisler, Mackenzie Scrocco, Matthew Osinak
Youngstown State University   *Jason Walker, Brett Connor, Mentor*

The purpose of this project is to create a unique design that can replace basic structural components at a reduced volume without compromising overall strength. Using a mathematical model created in Matlab, the group produced a gyroidal structure that has many applications, 3D printing in particular. Due to the gyroid's complex geometry and size, directly 3D printing was not feasible. The group then turned to 3D sand casting, a method of manufacturing that enables aluminum cast gyroid structures to be produced in an easy and cost effective manner. Traditional casting methods limit the ability to create unique and complex internal geometries. Software's such as Magma and FEA were utilized to run computational simulation and analysis before finalizing designs.

46 B. **Patient Motion Detection Using KINECT**

Destinee Battle, Nia Simmpnds, Quin Breitfeller
Case Western Reserve University   *Jason Sohn, Mentor*

This project uses the Microsoft Kinect sensor to detect patient motion with an accuracy of 1 mm. The sensor is aimed at a target that is manually moved in the x and y directions. The depth of the object is measured as well. The data is collected by placing a rectangular and spherical target various distances from the sensor, moving the targets on grid paper in the x and y directions, and then recording the net displacements. The goal of this project is to determine whether the rectangular or spherical target results in the greatest accuracy and least amount of error. In the future, this research will provide a more affordable way for radiation technicians to detect patient movement and protect healthy tissue from radiation.

47 A. **Pile Driving Monitor: Measuring Foundation Displacement**

Barnabas Brennan, Carmaletta Hinson, Quinten Hutchinson, Katilin Newcombe, Sydney Tenaglia
Case Western Reserve University   *Brent Robinson, Mentor*

In many parts of the world, pile foundation displacement and settlement is measured with a piece of paper taped to a pile and someone holding out a pencil. The purpose of the Pile Driving Monitor (PDM) is to measure displacement at a safe distance from heavy machinery. This project aims to measure and compare real-time data to the industry standard Pile Driving Analyzer (PDA) to assess its viability as a market alternative.

48 B. **Development of Continuously Reinforced Filament for Fanufacturing Composite Materials Via Open Source 3D Printing**

Claire Dodrill, Robert Marsch
Youngstown State University   *Pedro Cortes, Mentor*

The approach of developing a continuously reinforced plastic composite via 3D printing is still in its initial stages. The Fused Deposition Modeling 3D printing process has proposed the ability to create materials with a continuous, stiff reinforcement. Materials able to support relative stresses and conditions are sought for high-performance applications in aerospace, military, or automotive fields. A thread has been coated with melted polymer through the use of a retrofitted filament extruder. Successful development of a continuously reinforced polymeric filament has lead to the subsequent printing of a structure in an open source 3D printer. The research performed may potentially serve as the preliminary stage for a full proposal with the Air Force Office of Scientific Research to incorporate sensing fibers into continuous printing systems.

49 A. **Transcutaneous Functional Electrical Stimulation of a Human Arm**

Kyra Rudy

Cleveland State University   *Eric Schearer, Mentor*

High spinal cord injuries often leave patients paralyzed and with little to no ability to perform everyday tasks on their own. One method of restoring motion to the arms of patients with high spinal cord injuries is functional electrical stimulation (FES). While implanted neuroprosthesis devices that deliver electrical stimulation to the arm show promise, they are highly invasive and patients with these devices are limited. In contrast, a fully external transcutaneous electrical stimulation device would allow for testing on a larger number of patients, including healthy individuals. The plausibility of using a transcutaneous electrical stimulation device to induce functional motion in the arm was investigated. These devices show promise for reducing the need for implanted devices during research and prove to be a potential alternative to invasive neuroprosthesis devices altogether.

50 B. **Autonomous Localization Utilizing Strobing Light Sources**

Jacob Boyd

Kent State University   *Darwin Boyd, Mentor*

In the NASA Robotic Mining Competition the goal is to design a robotic system that is capable of completing challenging simulations of tasks an autonomous Martian system would encounter. One of the largest obstacles when designing any autonomous robotic systems is localization and orientation. While many systems for localization have been designed and implemented such as GPS and ultrasonic ranging, the conditions of the Martian surface exclude many such systems and demand a minimalistic system. By utilizing strobing sheets of light and precise timing, it is possible to calculate the position of the robot as a function of time intervals in order to achieve high definition localization and accurate positioning, while being viable for use on the Martian surface.

51 A. **Reducing the Corrosion of a Potential Vehicular Structural Alloy**

Rana Abu-Hashim, Seth Egry, Ricky Ferry

Youngstown State University   *Holly Martin, Mentor*

Magnesium is of structural interest for its low density and high weight-to-strength ratio. However, magnesium is easily corroded and cannot currently be used in exposed areas within vehicles. Protecting magnesium with a hydrophobic polymer that is also resistant to aqueous solutions and hydrocarbons is vital for its use within vehicles. This research is studying the corrosion resistance and mechanical properties of an AE44 Magnesium alloy, which contains 4% aluminum and 4% rare earth elements, coated with polyetherimide. The ability of the magnesium to withstand exposure to 3.5 wt% saltwater and the ability of the coating to adhere to the magnesium surface are both vital first steps in creating strongly bonded PEI to a magnesium to prevent corrosion and increase the use of magnesium in vehicles.

52 B. **Predicting the Impact of Climate Change on Future Ice Jams in Waterways of the Midwest & Northwest Regions**

Jesse Saluga, Michael Craver, Kelly Kovacevich, Michael Kacir, Allison Rea

Youngstown State University   *Suresh Sharma, Mentor*

An ice jam is a dam on a river formed by blocks of fragmented ice. Knowledge of ice jams is important in the design of structures being built near waterways as these fragments of ice can cause significant damage if not properly accounted for. Being able to predict where ice jams are likely to occur can have a huge benefit on hydraulic and structural engineering. Because ice jams can only form under certain temperatures, our project used various spreadsheets and historical temperature databases to analyze past temperature data in two regions where ice jams are likely to occur, Billings MT and Bismark, ND. With the research that has been done we will be able to predict the likelihood of an ice jam. Adjustments can then be made for if and or when an ice jam will occur in these particular regions.

53 A. Aquatic Toxicity of Common Household Chemicals and Storm Water
Amanda Seidler and Lydia White
Youngstown State University   *Felicia Armstrong, Mentor*

Toxicity testing is a process by which environmental conditions can be evaluated. Daphnia magna, a standard test organism, were used because they are easily cultured in the lab and sensitive to a variety of contaminants. Common house hold chemicals were used in 24 hour acute toxicity tests. Daphnia were acclimated to moderately hard water following USEPA guidelines prior to testing. Using the same water, chemicals were added at multiple concentrations and replicated three times at each level including an uncontaminated control. Daphnia were exposed for 24 hours while being monitored. Counts were done every couple of hours for living Daphnia and dead Daphnia were removed. Water tests were done for dissolved oxygen, pH, conductivity, hardness and temperature to insure proper conditions. At the end of the test period, the percent mortality was determined and plotted against concentration.

54 B. Autonomous Vehicles in the Age of Information: Developing Technical Systems, Solving Ethical Dilemmas, & Enacting Legal Requirements
Jacob Meng, Lydia Fawzy, Rachael Bucey Leopold
Cleveland State University   *Michael Gallagher, Mentor*

From the early beginnings of the automobile, automation has been a dream. In 1945, the installation of the first cruise control on a production vehicle was the first step towards this goal. Today, the reality of a fully autonomous vehicle is on the horizon. Numerous manufacturers are developing the first production self-driving car. Level 4 automation consists of fully autonomous automobiles. These vehicles use GPS navigation, radar, and advanced cameras to guide their course. The vehicle's control system utilizes developmental architecture to maintain its location and avoid obstacles. Companies hope to release autonomous cars to the market within the next few years. However, with these technological advancements, new ethical concerns are identified. Also, potential cyber security threats are currently being investigated.

55 A. Computer Vision for Closed Loop Control of 3D Printing
Kayla Fisher, Emili Bonanno, Sara Cole, Adam DeMarco, Hannah Senediak
Youngstown State University   *Eric MacDonald, Mentor*

Process control in 3D printing (known as Additive Manufacturing) has largely been absent in production systems. Simultaneously, computer vision has become more accessible with open source libraries. Relatively high performance computation can be realized with a Linux board costing less than $40 USD and a USB camera costing $30 USD. 3D printing is particularly well suited to be enhanced by computer vision as the fabrication is layer wise and predictable, assuming correct operation. Structures are created with Computer Aided Design (CAD) that show potential risk of structural failure and delamination. Profiling of the structure in fabrication can easily identify occurrences of delamination of the structure. Information from detected delamination is then used to modify design and temperature of extrusion material to prevent future errors.

56 B. Maximizing Energy Capture in Low Wind Speed Environments
Amber Deming, Alexandra Eisenhart, Efrain Velez, Josh Westhead, Kevin Yacucci
Youngstown State University   *Hazel Marie, Mentor*

Using a 3D-printed model of a wind turbine shroud, we tested whether a shroud can increase the wind speed by acting as a standing airfoil to maximize the energy capture of low wind speed environments. An experiment was performed in a low speed wind-tunnel to measure the experimental increase in wind velocity. This data showed an increase in airspeed of up to 1.65 times that of the downstream airspeed. Energy data from a full-size, shrouded wind turbine was collected to determine the percentage of energy that can be captured compared to the actual wind speed. The data collected from the full-size, shrouded wind turbine was then compared to that of a similarly-sized, standard wind turbine.

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57 A. **Medtronic's Minimed 670G**

Nick Bryson, Taylor Catri-Eakes

Cleveland State University   *Thomas Slaven, Mentor*

According to the CDC National Diabetes Statistics Report in 2014, about 1.25 million Americans have type 1 diabetes. It is estimated that by 2050, that number will increase up to a total of 5 million people, and that is just in the U.S. alone. Having type 1 diabetes means constantly measuring glucose by finger pricks several times a day, and balancing insulin with multiple daily injections. This can be very redundant and life threatening. However, the FDA just approved Medtronic's new artificial pancreas, the Minimed 670G. The Minimed will automatically monitor both glucose and insulin levels, using an insulin pump, a glucose sensor, and a program that lets the two communicate to each other. This will dramatically decrease finger pricking, only 2-3 finger pricks are needed daily to calibrate the sensor. The device will eliminate insulin injections all together.

Mathematics, Statistics, and Computer Science

58 B. **Managing an Epidemic Through SIR and SIRS Models**

Ashley Boni

Kent State University   *Xiaoyu Zheng, Mentor*

An epidemic is defined as an outbreak of an infectious disease which affects a large portion of the population at a particular time. Our goal is to be able to use these models to help us learn how the epidemic evolves, and to learn how to keep it under control. For example, we may want to reduce the rate of contact between individuals who are contaminated and those who are susceptible. Also, we may want to vaccinate the population. Other methods of reduction may include quarantine, or cures (assume that recovery brings immunity). In this project, we will investigate the two models and how variation of their parameters affects aspects of the epidemic, such as duration, etc. Also, we will anticipate the fraction of the population that will acquire the disease before the end of the epidemic as well as the rate at which contact must be reduced in order to keep the epidemic manageable.

59 A. **The Limitations of Silicon and the Collapse of Moore's Law**

Andrew Leeseberg, Lindsey Shahan, EmilyAnn Moenich

Cleveland State University   *Jonathan Scott, Mentor*

In technology one of the greatest leaps in the past half-century was the invention of the silicon chip. Ever since their invention the chips have shrunk, the density of transistors has risen, and the cost of production has decreased. For the past 5 decades Moore's Law, that states every year the transistors per square inch would double, has been upheld. But in less than a decade this law could collapse as the limits of silicon chips become determined not by ingenuity, but the laws of quantum mechanics. With Intel planning to begin production of 7 nanometer chips in Q3 of 2017 we are fast approaching this limit. For when the distance between transistors drops below 5 nanometers the chances of quantum tunneling increases exponentially. We will explore exactly what the quantum tunneling phenomenon is and how it will become a limiting factor on current silicon chips in the coming decade.

60 B. Ceva's Theorem
Emily Herendeen, Nick Verbus
Kent State University *Donald White, Mentor*

Our project consists of Ceva's Theorem, its relations to other geometric occurences and the real world.

61 A. How to Beat the Dealer
Emily White, Josephine Sabatino, Drew Horn, Alexander Margetis, Sarah Cook
Kent State University *Mohammad Khan, Mentor*

The goal of our project is to describe the probability and underlying mathematics that go into card counting for the famous "Blackjack" casino card game. We describe strategies and techniques that are used to make bets given the probabilities of each possible outcome in order to beat the dealer on any given hand. Not only do we describe probabilities of each hand dealt, but we also explain how the dealer has the advantage and what is an "ideal" hand mathematically.

62 B. Data Speaks Out For Equal Opportunity
Jalen McKinne, Chase Petti, Alexa Roberts, Alex Thornton
Cleveland State University *Nigamanth Sridhar, Mentor*

This poster is an in depth look at how data visualization can be used to make the classroom a more accessible place. In this case specifically those with visual disabilities. We will be focusing on the use of sonification or data visualization through sound as a tool to help students understand complex ideas in a computer science context. Whether use is from a teacher's point of view as a tool in the classroom or from the students as a way to understand the concepts highlighted in the Big Ideas of the AP computer science curriculum, this tool simply makes the classroom a more accessible place while at the same time answering the "when is this gonna help me in life question".

63 A. A Study of the Reduction of Excessive Energy Generated by Strong Winds on Power Lines via a Velocity Damping Controller at the Transmission Tower
Donald Wayne Fincher
Kent State University *Mahmoud Najafi, Mentor*

In this research, we are pursuing the robustness of a self-excited vibrational system with negative damping. In practice, this is manifested as conductor galloping of overhead power lines, which is an oscillation of the lines caused by strong winds. Improved transmission tower designs are needed which are capable of combating excessive stresses exerted on the tower by the galloping power lines. Our model of this self-excited system shows that the oscillations can be controlled by adding a boundary velocity feedback controller at the transmission tower. Using a decomposition method, we show there is a closed form analytical solution which can predict the stabilizability of the system under certain conditions. Through this research, power transmission systems that are more reliable and resistant to galloping can be engineered.

64 B. Comparative Graph Model
Tim Zee
Kent State University *Mehdi Ghayoumi, Mentor*

Many facial recognition algorithms use template-based approaches to find features in facial images that can be used for authentication. This works by associating certain features with commonly known features of a human face. This can miss or inaccurately identify features. Comparative Graph Model does not use a template, but instead looks for closeness of features across images, along with how many times a feature is found, in order to decide what features accurately represent a person's face. This experiment uses Comparative Graph Model along with a neural network to create feature maps that are used for comparison to other images. Comparative Graph Model offers the advantage of versatility as it allows for features of any type of data, not just human faces.

65 A. **Deterministic Chaos: Understanding Random Number Generation**
 Evan Bause, Nick Pappas, Joshua Oberlin, Jared Anderson
 Kent State University

The very idea of a computer producing random results is paradoxical. One of the cornerstones of computer software design is that programming is deterministic; given the same set of inputs a machine that is working properly will always spit out the same output. However the creation of seemingly or truly random numbers has numerous applications and not all methods are useful in all situations.

66 B. **A Quantitative Analysis of Pokémon Go**
 Alex Johnson, Sho Tanaka, Jemima Ukwela, Josh Ryan
 Cleveland State University   *Barbara Margolius, Mentor*

Over the past year, Pokémon GO, a mobile Pokémon game has taken over the mobile gaming industry. The purpose of this study is to provide a quantitative analysis of the game, due to its popularity and many statistical aspects involved in game play. Using personally gathered data, we analyzed catch rate due to multiple variables, leveling up rates, Pokéstop item drop rates, and flee rate. We then compared our results to past studies.

67 A. **Was 2016 the Hottest year on record?**
 David Carlyn, Nick Crawford
 Kent State University   *Mikhail Nesterenko, Mentor*

Our goal is to recreate the recent experiments conducted by the National Oceanic and Atmospheric Administration regarding trends in global climate change. Their original experiment concluded that 2016 was the hottest year ever recorded. First, we begin by extracting existing data from reports provided by National Public Radio and the National Aeronautics and Space Administration. We will then use GNUPlot, a scientific graphing tool, to visualize the data. Finally we will present our results compared with the original experiments'.

68 B. **Mercator's Cylindrical Map Projection**
 Amanda Matson, Erin Davis
 Kent State University   *Donald White, Mentor*

Gerardus Mercator, a Flemish cartographer from the 16th century, presented what is now known as Mercator's Projection. Mercator represented the curved surface of the Earth on a flat surface. We are to analyze an essential characteristic of Mercator's cylindrical projection—conformality. This conformal property is defined by angle preservation and a point scale factor that is independent of direction. The meridians and parallels are orthogonal. Given this, Mercator's projection is commonly used for navigation especially near the equator. Due to the scaling factor increasing with latitude, the area of geographical regions increasingly distorts near the poles. We show these distortions using Nicolas Tissot's indicatrix.

69 A. **Persistent Homology**
 Daniel Squeri
 Kent State University   *Omar De la Cruz Cabrera, Mentor*

We first discuss simplicial homology, which forms the basis forpersistent homology. Simplicial homology analyzes a topological space, formalized as a simplicial complex, by finding the number of non-trivial cycles contained in the space. This allows us to find the number of "holes" of a given dimension in the space. We then describe the extension of this concept topersistent homology: Given a set of points ("data"), we use an increasingthreshold giving the maximum distance between points to be connected by simplices. As this threshold increases, holes form and disappear; these holes, and the duration for which they last, give us valuable information about thetopological space. Persistent homology shows significant promise in anew, burgeoning field called topological data analysis.

70 B. **Data Sorting Analyzer**
Arik Stewart
Case Western Reserve University   *Chris Fietkiewicz, Mentor*

In the field of Computer Science, there already exist numerous ways for programmers to efficiently sort data. Using the method that is most efficient is normally preferred, but each sorting method does have its own unique purpose. The goal of this expository project is to analyze and graph the runtimes of the most commonly used methods: Insertion, Merge, and Quick Sort. The methods are analyzed using preset and randomized arrays in addition to differing array sizes.

71 A. **Towards Mining Eye-Tracking Datasets for Expertise Prediction**
Jenna Wise
Youngstown State University   *Bonita Sharif, David Pollack, Mentor*

Eye-trackers are increasingly being used to study software developer behavior and program comprehension by providing insight into what a developer is looking at in source code. We analyzed an existing eye-tracking dataset on expert and novice developers performing debugging tasks. TraMineR was used to perform the analyses with sequential analysis techniques to determine eye gaze features and patterns inherent to expert and novice developers. Our results indicate that our approach effectively differentiates between novices and experts in certain debugging tasks. We discuss our study, analyses, findings, and implications of our results. This mining approach provides a useful means to quantify expertise that could be used to supplement the interviewing process.

72 B. **Eye Tracking: Determining Visual Recognition and Mapping Gaze Fixations**
Mitchell Franko, Anthony Hill, Kevin London, Firaus Odeh
Youngstown State University   *Alina Lazar, Mentor*

Eye tracking is a technology that monitors, and records eye movement as gaze fixations and saccades. The team has put together an eye-tracking study, which involves presenting test subjects with blurred images, and tracking eye movement as they answer a question about each image. The data of where subjects look will determine the limits of recognition. This data can be used to assess perceived image qualities. For the noisier images, the team hopes to see fewer but longer gaze fixations and shorter saccade distances.

73 A. **Black Jack Probability**
Karla McGinty, Garrett Anderson, Jeremy Sidoti, Christian Hartwick
Kent State University   *William John Hanlon, Mentor*

We preformed original research dealing with different Black Jack scenarios. Multiple variables were changed including how many players there were and what hand we were dealt.

74 B. **Battleship Strategies**
Zach Gazdacko, Chris Bertka, Miranda Etgen
Kent State University   *Matthew Alexander, Mentor*

For this project, we developed strategies of where to place ships, and where to guess when playing battleship with the hopes of winning the game the majority of the time one plays. This is a simple game using process of elimination, however we have found where a ship is likely to be placed. With this information, we have developed strategies that we believe will help reduce the number of guesses one must take before successfully beating their opponent. We have also found where one should strategically place their ships so that their opponent has a more difficult time finding them.

75 A. **Theoretical and Practical Significance of One-Time-Pad Cryptography**

Timothy Szeltner, Luka Komljenovic, Jonathan Wright

Cleveland State University *David Aloi, Mentor*

If two parties wish to exchange a coded message without an intrusion from a third party, the former have many cryptographic options. With regards to information security and absolute protection from decryption, the one–time-pad is unmatched. When the message is matched with an equally long plaintext encryption/decryption "pad" shared by the sending and receiving parties, which is discarded and replaced for each new message, the method is mathematically proven to be unbreakable by adversarial third parties. This has far reaching implications for military and security applications, including the transmission of coded messages in plain sight, without any risk of decryption.

76 B. **Probabilistic Programming**

Barton Yadlowski

Kent State University *Jenya Soprunova, Mentor*

An introduction to probabilistic programming and MCMC methods as helpful tools to have in a toolbox of anyone operating in domains where uncertainty is present.PyMC3 (https://github.com/pymc-devs/pymc3) and Python is used as an environment within which these ideas get explored and illustrated.Topics covered include defining Bayesian models, fitting the models, and posterior analysis.

77 A. **Bet On It**

Kory Slusser, Bryan Ritchie

Kent State University *Kyle Brown, Mentor*

Texas Hold'em is often thought of as a game of luck. While this is true to a degree, a smart player can use probability based stategy to improve his/her chances of winning. Using these tactics can help a player decide when it is in his/her best interest to call a bet, raise, or fold, depending on the situation.

78 B. **Operation STEM in the Classroom**

Marcus Lard, Madison Spahlinger

Cleveland State University *Susan Carver, Mentor*

Calculus can be a difficult concept to grasp, but with the help of peers who have done well previously, it is certainly less intimidating. Students who take the class without additional support are often limited to the practice problems found in a book or online. STEM peer teachers (SPTs) offer immediate feedback, problem solving skills, and concept analysis. The goal with this project was to see the tangible evidence of the progress made through Operation STEM along with student evaluations. Reviewing the statistics leads us to conclude that SPTs in the classroom provide valuable support that is vital for the success of students taking the course. This setup has been extended to pre-calculus courses and calculus II. With this information, it may be beneficial to explore this further in other mathematics courses.

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