Kellogg Honors College Convocation

Spring 2020

www.cpp.edu/honorscollege
2020 Convocation Participants

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<td>Taylor Doole*</td>
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<td>Sydney Ghazarian</td>
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<td>Katrina Gumushian</td>
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<td>Steve Issakhanian*</td>
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<td>Tristan Sherman*</td>
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*Graduating Spring 2021
The Kellogg Honors College gratefully acknowledges the Capstone project mentors:

Jill Adler-Moore*  
Mohamed Aly*  
Alison Baker  
Scott Boskovich  
Cord Brundage  
John Caffrey*  
Neilan Chaturvedi*  
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Payam Parsa  
Vilupanur Ravi*  
Bohdan Schatschneider  
Jamie Snyder  
Zahra Sotoudeh  
Don St. Hilaire  
Adam summerville*  
Nolan Tsuchiya  
Jason Turcotte  
Dorothy Wills

*Mentored multiple projects

About the Capstone Project

The Honors Capstone Project is the culminating academic experience for students in the Kellogg Honors College. Honors students, under the supervision of faculty mentors, complete an in-depth project which demonstrates research, scholarship, and creativity in a topic of their choosing. Capstone projects are formally presented in a poster session at the Kellogg Honors College Convocation every spring semester. Convocation for Spring 2020 was cancelled after Cal Poly Pomona transitioned to remote learning as a result of COVID-19. In lieu of an in-person poster session, students submitted video presentations of their research projects. The following pages contain project abstracts with links to posters and video presentations. A video message from Kellogg Honors College staff to students is available here.
2020 Capstone Project Abstracts
In alphabetical order by students’ last name. Click the project title to view the research poster (PDF). Click students’ names to view their research presentation video (Youtube).

**Shock Dyno Control System**
**Scott Addams**, Mechanical Engineering
Mentor: Nolan Tsuchiya

This project is part of a larger senior project in which the goal is to test various rear bike shock absorbers and collect their performance data. This data can then be used to help customers make well informed decisions on which shock absorber they would like to buy. The mechanical engineering objective this project is to create a control structure that compresses each shock at a constant velocity to give them all fair and similar tests for comparison. The focus of this project is to design and code the control and data analyzation structure used to run the tests on the shocks. The control structure is a feedback loop that takes in position data and controls the force outputs in order for the system to control the rate of compression of each shock. The data analyzation structure will take the data recorded and convert it into a form in which people can easily understand. The control and data analyzation structure are to be coded within Labview’s graphical interface system.

**Current Accounting Students’ Curricula and Accounting Professionals’ Expectations: An Exploratory Study**
**Kirsten Bayona**, Accounting
Mentor: Mary Im

Four-year colleges are continuously striving to satisfy accounting professionals’ expectations for recent graduates by constantly developing their accounting curricula. Previous studies show that expectations on accounting graduates’ performance in the workforce greatly influence the curricula constructed in business schools. However, events such as the creation of the Sarbanes-Oxley Act of 2002, the changes made from various tax reforms, and the advancements made in business technology make it difficult for colleges to keep their curricula updated with current accounting policies. This research will analyze how accounting curricula in California business schools currently reflect what skills employers believe accounting graduates should possess. The results reveal that colleges offer a sufficient number of courses which ultimately cover fundamental conceptual business and accounting knowledge. Also, there is a rising emphasis for curricula to focus on business technology and ‘real world’ experiences; areas of knowledge accounting professionals believe that graduates are lacking. The purpose of this research is to understand employers’ expectations of accounting graduates and how it relates to the content included in accounting curricula. Analyzing the curricula’s strengths and weaknesses will better prepare accounting students who are entering the workforce.

**DIY Electric Skateboard - Remote Controls and Electronics**
**Kurt Bennett**, Mechanical Engineering
Mentor: John Caffrey

Electric skateboards have become a popular mode of travel among today's youth, especially in urban cities and college campuses. While anyone can purchase an electric skateboard from a variety of manufacturers; the price of a reliable board can be very high, and the consumer passes up a valuable opportunity to learn from the construction of his or her own board. This project provides the opportunity for aspiring engineers or any tinkerer to design and build their own electric skateboard, and in the process learn more about: design, CAD, manufacturing, and various electronic components including motors, remote controls, and electronic speed controllers. This project was created in collaboration with Adrian Cardona, with my focus being on the electrical components including the motor, batteries, electronic speed controller,
and remote control. The instructional documentation provided with this kit will provide all of the information necessary to design, manufacture, and assemble all of the parts required to create a functional, affordable, and safe electric skateboard.

**ESG Investing – More Important Now...More Important in the Future**  
*Sarah Bibb*, Accounting  
**Mentor:** Don St. Hilaire

Within the last thirty years, the United States has experienced tremendous growth in the world of technology; giving individuals access to an unlimited amount of data at the tips of their fingers. With this new access to information, came the opportunity for individuals to become more informed on matters and transform the way that they viewed the world around them. One area of growth that has occurred, is the consumer’s increased desire to support brands and businesses that engage in corporate social responsibility (also known as ESG Investing). This poster aims to showcase the growing importance of ESG Investing by delving into the history of its existence and its three main components; Environment, Social, and Government. The future of ESG Investing and its forecasts of increased usage are also presented. Last, but not least, using the Standard Industrial Classification (SIC) system, this poster compares ESG ratings for selected eating places (5812) to hotels and motels (7011).

**Acute Skeletal Muscle Hemodynamic Response to a Single Percussive Therapy Application**  
*Damar Blanchet*, Kinesiology  
**Mentor:** Edward Jo

Myofascial release techniques have been utilized as part of a pre-exercise warm up routine due to their purported benefits in optimizing subsequent muscular performance. Percussive Therapy is a recently popularized technique that involves percussive massage through a mechanical device. In practice, users often apply percussive therapy as part of a pre-exercise warm up routine. The purpose of a warm-up is in part to increase arterial blood flow and therefore, oxygen supply to the muscles involved in the subsequent exercise bout. However, to our knowledge, there is no evidence that demonstrates the effects of a percussive therapy treatment on muscle hemodynamic and oxygenation. Thus, the purpose of this study will be to examine the acute effects of a single percussive therapy treatment on lower body muscle hemodynamics and oxygenation as measured by near infrared spectroscopy (NIRS). Participants will receive one single percussive therapy application on the quadriceps of their dominant leg. Total muscle hemoglobin, oxy-hemoglobin and deoxy-hemoglobin will be measured pre- and post-percussive therapy treatment using NIRS-based muscle oximeters. Continual measurements on the contralateral quadriceps before, during, and after the treatment will be used as a control.

**Mechanics of a DIY Electric Skateboard**  
*Adrian Cardona*, Mechanical Engineering  
**Mentor:** John Caffrey

The objective of this project is to design and construct an electric skateboard kit that acts as a “do it yourself” package where young, aspiring, mechanical engineers may follow step by step instructions to build our custom electric skateboard as well as learn about some of the most basic engineering principles involving motors, gears, fasteners, computer aided design software, and safety. The secondary objective is to make this product at a cheaper cost than similar products on the market. The systems that I will be focusing on are the drive gear mechanisms, machining of the mount for the gear system, and lastly all the engineering drafting of the gears and the covers. All of these components will be designed to the best of my engineering knowledge and judgment in order to create the most cost efficient, and power efficient model that
will give eager and passionate engineers hands on experience with topics professional mechanical engineers use every day. This project was done in collaboration with Kurt Bennett with his work focusing on all the electrical systems.

**Corrosion Behavior of 304L Stainless Steel Produced by Laser Powder Bed Fusion**

**Ho Lun Chan**, Chemical Engineering  
Mentor: Vilupanur Ravi

Austenitic 304L Stainless Steel (UNS S30403) is a favorable candidate for additive manufacturing (AM) because of its excellent weldability and is used in many industries including but not limited to chemical processing, medical, commercial and domestic applications. In this research, the microstructure and corrosion behavior of AM 304L Stainless Steel (SS) and its wrought counterpart were studied under three conditions: as-fabricated, heat treated at 700°C for 250 hours and heat treated at 800°C for 250 hours. Test coupons were electrochemically characterized in accordance with ASTM G59 and ASTM G61 protocols in a 3.5 wt% NaCl solution. Microstructural characterization was performed using optical & scanning electron microscopy and energy dispersive spectroscopy (EDS). The results of the electrochemical and microstructural characterization will be presented and discussed.

**Business Improvement Districts in Southern California: Constructive or Counterproductive?**

**Jackeline Cortez**, Political Science  
Mentor: Neilan Chaturvedi

The purpose of this study is to analyze the business improvement districts that have been adopted by many communities to improve the conditions in the city. Though BIDs may have been created with good intentions, it is important to analyze the effects they have had to determine whether they are effective or egregious. This study focuses on business improvement districts within Southern California. To analyze the effects of BIDs on surrounding communities this study takes into account qualitative data. This includes case studies on cities with and without business improvement districts that have taken initiatives to deter crime. Based on the qualitative analysis, this research comes to several conclusions. The crime rates in the cities and areas surrounding the cities dropped incrementally. However, the homelessness rates increased in the surrounding areas. Based on these findings, the relationship between these factors and the effects of the business improvement district is inconclusive. Future research should be made into outside factors. This research is essential to the development of cities not only in Southern California but cities across America. As a nation that is constantly striving to improve, it is important to analyze models like BIDs for their true effectiveness.

**Utilizing the Systems Engineering Design Process to Imagineer a Themed Backyard Ride**

**Kenneth Culver**, Mechanical Engineering  
Mentor: Steve Dobbs

Theme park rides offer a level of storytelling and immersion that provides the guest an entertainment value far richer than the purely physical thrills of amusement park rides. Different types of motion generated by the ride system architecture, coupled with themed elements tied to a compelling story, fully immerses the guest into that story. With this in mind, the goal of this project was to design a fun and safe “flying”-themed ride that would be the newest attraction in Dobbsland, the Disney-inspired backyard theme park. The ride’s target demographic was aimed at young children and teenagers, but could be rideable by anyone under 200 lb. This demographic influenced the attraction’s overall fun factor, which serves as the core purpose behind this project. The physical thrill induced by the track profile was designed using human acceleration limits. The emotionally thrilling aspect of the ride resulted from incorporating scenic and interactive elements reflecting the chosen theme of Quidditch, the flying broomstick ball game from the Harry Potter franchise. To design such an attraction from an engineering standpoint, the systems engineering design process was utilized to identify key design
requirements, develop architecture candidates that could satisfy these requirements, and then select the optimal candidate. A critical emphasis on safety warranted dynamic structural and fatigue analyses, and a failure mode and effects analysis (FMEA).

**Redesign of Solar Automatic License Plate Reader Trailer**

Madison Darr, Mechanical Engineering  
Mentor: Mehrdad Haghi

Throughout the nation, one tool that our law enforcement agencies use is the automatic license plate reader (LPR). These readers are responsible for scanning license plates of vehicles on roadways or traffic stops and running these plates against databases of vehicles with known violations. License plate readers can be statically mounted on infrastructure, mounted on patrol vehicles, or can be relocated with ease on deployable mobile trailers. The goal of this project is to redesign the mobile LPR trailer by replacing a gas-powered generator system with self-sufficient solar power. This project encompassed the procurement of a trailer, design of mounting structures, selection of back-up power, design of a thermal control system, and the generation of plans for construction and assembly of consequential trailers in mass production.

**Data Analysis Application Towards the Effect of Angle of Attack Indicator in General Aviation**

Zhixuan Ding, Industrial Engineering  
Mentor: Shokoufeh Mirzaei

In-flight loss of control (I-LOC) is one of the major causes of accidents in general aviation (GA). Based on recent data, “I-LOC accounted for 1,1194 fatalities from 2008 to 2014, close to 54 percent of fatal fixed-wing GA accidents in the United States”. Within these I-LOC fatalities, exceeding the critical angle of attack (AOA) in landing or take-off process is one of the major reasons leading to the I-LOC fatalities. In this research, we are testing whether using an angle of attack indicator is effective in assisting with GA pilots making better decisions in order to reduce the I-LOC fatalities.

**Formula SAE Strain Gauge Amplifier Design**

Ernesto Esparza, Electrical Engineering  
Mentor: Phyllis Nelson

Designing a formula student racecar is almost impossible without any data to support the design decisions. The car contains numerous supportive steel (and titanium) rods which are validated in simulations to have a factor of safety of 2+, but we need to verify if these simulations accurately reflect real life. Therefore, I am focusing on creating a low-cost, small form factor and low noise strain gage amplifier circuit for our car. This circuit would give us the ability to read the magnitude of forces applied to the cars various members. For this design I will be utilizing a popular amplifier with a built-in Analog to Digital converter to receive data from the strain gauges. An ARM based microcontroller will be reading the data from the amplifier, scaling it and outputting the data to the cars CAN Bus. This entire circuit will be on a custom designed PCB, along with supporting power regulation and protection circuitry.

**Effective Board Governance: An Analysis of the CSU Board of Trustees**

Juan Garcia, Political Science  
Mentor: Jill Hargis

Large organizations often rely on a governing board to provide leadership, structure, and guidance. Organizations can differ in almost every aspect, however, the boards under which they are governed are historically similar in structure,
purpose, and procedural rules. Despite the apparent similarities, not all boards perform equally; some organizations enjoy the leadership of a particularly effective board, while others seem to be hindered by a less effective one. This study will focus on finding the characteristics that enhance the effectiveness of a governing board as opposed to those that inhibit it. After identifying such factors, the findings will then be applied to the CSU Board of Trustees, the governing board of the California State University, to analyze the effectiveness of the board in its leadership of the nation’s largest four-year university system.

**Site-Directed Mutagenesis of B345: Effects on Host ESCRT Recruitment by STIV**

*Sydney Ghazarian*, Microbiology  
Mentor: Jamie Snyder

Although Sulfolobus turreted icosahedral virus (STIV) has emerged as a model archaeal virus, its replication cycle has not been fully characterized. We have found that STIV exploits the Endosomal Sorting Complex Required for Transport (ESCRT) machinery of S. solfataricus in a similar fashion to the enveloped eukaryotic viruses, HIV and HCV, suggesting an evolutionary link between archaeal and eukaryotic viruses. Previous studies have shown that the Major Capsid Protein (MCP) of STIV (B345) interacts with an ESCRT-III homolog (SS00619) in the Sulfolobus genome. Deletion of the C-terminal 22 amino acids of B345 eliminated this interaction. We hypothesize that B345 interacts with ESCRT-III (SS00619), such that it recruits the ESCRT-III protein to vesicles that will eventually become the internal membrane of the assembled virion. Our goal is to determine the specific amino acids in the C-terminus of B345 that are required for the interaction with ESCRT-III. V332D mutation has been created within the C-terminal tail of B345 gene. The construct will be tested in the context of virus replication, B345 alone (in the absence of other viral proteins) in S. solfataricus cultures, and in co-immunoprecipitation assays.

**Maximizing Storage Density of Steel Pipes: Optimization Modeling**

*Katrina Gumushian*, Industrial Engineering  
Mentors: Ellips Masehian & Payam Parsa

With increased development, expansion and urbanization in recent decades, the steel pipe industry is growing rapidly and is projected to increase its market value within the coming years. As companies increase their production, pipe storage has become a pain point in accommodating the production increase. This project presents a Mixed Integer Programming (MIP) model for maximizing the storage density of steel pipes. The solution to the model maximizes the number of pallets stored, assigns them to bands of specified width within a storage yard, and consequently minimizes the space occupied. The effectiveness of the solution will be evaluated against the current state with the percentage of space utilization as the key performance metric.

**Surface Characterization of Metals to Understand Corrosion Behavior**

*Kevin Guo*, Chemical Engineering  
Mentor: Vilupanur Ravi

Typical corrosion testing methods produce data that are often difficult to reproduce because of human errors or material inconsistencies. Minor variations in the testing environment or the sample microstructure can create large errors. In addition, the surface of test samples are altered or destroyed in most corrosion tests. Samples cannot be retested for statistical analysis unless the surface is re-ground. In this project, a technique was employed to map the surface potentials without altering or destroying the sample. Insights into the influence of surface finish on alloy nobility was also obtained. The surface potentials of different materials, i.e., type 304 stainless steel, a titanium alloy (Ti-6 Al-4 V) and a heat-treated aluminum alloy were evaluated under different surface conditions.
The Effects of a Single Percussive Therapy Application on Passive Lower Body Range of Motion

**Stephanie Guzman**, Kinesiology

Mentor: Eddie Jo

Myofascial release techniques have been widely utilized for a variety of purposes such as mitigating myofascial pain and muscle tightness as well as improving range of motion (ROM). Percussive Therapy is a recently popularized technique that involves percussive massage through a mechanical device. In practice, users often apply percussive therapy to acutely improve ROM. However, these potential benefits are largely supported by anecdotes, and to our knowledge, no empirical evidence currently exists. Thus, the purpose of this study will be to examine the immediate effects of a single percussive therapy treatment on passive lower body ROM. Participants will receive one single percussive therapy application on the quadriceps and another on the hamstrings of their dominant leg. The percussive therapy application will be done using the Theragun G3PRO. Knee ROM will be assessed utilizing 2D motion capture before and after treatment for both the quadriceps and the hamstrings. On the contralateral limb, ROM will be assessed before and after 5 minutes of rest and will serve as the control condition.

Harvest Moon 2.0

**Kendall Haworth**, Computer Science

Mentor: Adam Summerville

Harvest Moon 2.0 is an open-source farming and exploration video game developed in Godot. It is directly inspired by Innocent Life: A Futuristic Harvest Moon, a PSP video game. The purpose of this capstone project was to further my own skills in software engineering and game development. Godot uses GDScript, a Python-lite backend programming language, and focuses development around nodes arranged in a tree-like fashion. Harvest Moon 2.0 features a full game loop, 1,613 lines of code, and was developed over the course of 10 months. Plant, water, and harvest crops. Visit the town to sell your crops and buy seeds and tools. Sleep in bed to progress the day. The player will become tired and forced to sleep if it grows too late in the day. Logs, weeds, and stones clog your fields over time and must be cleared. Work requires energy shown in an energy bar, and you must sleep to regain energy. Weather changes between sunny and rainy. A custom inventory system is used for equipping tools and organizing items. A save game system allows you pick up your progress right where you left off.

Encryption Design and Lightweight Development

**Robert Herndon**, Computer Engineering

Mentor: Mohamed Aly

Encryption is used in everyday life, but it has not been optimized for small area and low power devices. The project I am working on is attempting to create a lightweight encryption that will eventually be placed on drones in order to communicate across a mesh of drones, allowing a full synchronized but secure action. This means that other people, unless they are able to crack the encryption, will be unable to send appropriate signals to the drones, and the mesh will be safe from outside attacks. This process is done in a team, but encryption is little taught within our curriculum and I had some background with some prior experience. I plan to show that encryption at its most basic state is easy to explain and understand when properly introduced. Our complex approach will modify how industry secures small networks and how the encryption can be implemented on any device.

Making a Community-Based Farmers Market: The Role of Critical Food Systems Activism and Education
Calista Ho, Liberal Studies
Mentor: Teresa Lloro
The Pomona Valley Certified Farmers Market addresses and examines food access in the city of Pomona and how this research site works within and against traditional food systems. While working closely with community partners at the farmers market, the research goal and objective is to increase food access among the residents of Pomona and how it contributes to the development of socio-ecological community in the city. Through extensive hands-on participation, creating a developed relationship with community members as activist ethnographers provides a safe atmosphere at the farmers market. This project primarily focuses on creating a space for knowledge sharing that emphasizes health, nutrition, and well-being, and food preparation, as well as uplifting the values of tradition and culture. By implementing a recipe sharing center at the site, the main objective is to be able to incorporate both community voices and food knowledge by building unity around healthy interaction in a reliable, safe space. This project demonstrates the intention that knowledge sharing does not just have to be partial, and that community members can also be involved in this process of learning so that everyone is passing and gaining their information mutually.

Robots in Hotels: Are They Worth the Investment?
Hayley Ho, Hospitality Management
Mentor: Kelly Min
With technology advances growing exponentially, society continues to integrate robots into all avenues of life. This study investigates whether the hotel industry should invest, integrate, or continue, day to day operations with the assistance of hospitality robots. Using a mix of news articles and previous literature, this work shows various types of robots, as well as different functions in technology. Further, through a survey distributed to current and potential customers, respective price-points and their effect in creating firm performance are suggested.

Low Cost Embedded Device for Animatronic Control
Dominic Holloman, Computer Engineering
Mentor: Mohamed Aly
Animatronics are an integral part of many amusement park rides, museums, and children’s toys. The animatronics in amusement parks are large, complex devices costing anywhere from thousands to millions of dollars. The sacrifices made for mass produced children’s toys are often seen in the animatronic’s features and behaviors. The goal of this project is to create a low cost, entertaining children’s animatronic toy capable of responding to the user’s emotions. Using commercial off-the-shelf parts (COTS), this project’s design allows for visual, physical, and auditory feedback based on the user’s emotions. The toy takes the form of a sunflower in a pot, with the bulb of the sunflower being an LED dot matrix display. The embedded system contains a Raspberry Pi Zero for facial recognition, as well as an 8-bit PIC microcontroller for peripheral interfacing. These microcontrollers receive data from a USB camera and microphone. Once an emotional state is determined, animations are displayed on the LED-dot matrix, a grid of RGB LEDs attached to the petals change to an appropriate color sequence, the stem moves in a specific pattern, and sound effects are played from a speaker hidden within the flower pot.

Electric Double Layers: Adsorption of Yukawa-ions Near a Charged Wall-A Density Functional Study
Steve Issakhanian, Chemical Engineering
Mentor: Lloyd Lee
This project is a study of lithium ion batteries and the electric double layers formed on the surface of each electrode. This double layer is the stacking of charged molecules due to their opposite charges. We examine the adsorption of the ionic mixtures modeled in terms of Debye potentials on a charged surface. Adsorption is the physical process which attracts one type of material to the surface of another material. This study consists of theoretical calculations run through Fortran, which is the base software language for MATLAB. We use the Yukawa-ion model over the coulomb model in order to reduce the amount of iterations needed during calculations. An Ornstein-Zernike relation is used to model the statistical states of the molecules within the electrolyte fluid solution. Using these models, we are able to mimic electrical double layers as seen in an electrochemistry point of view. Our goal is to increase the charge density and lifetime of a lithium ion battery by tweaking the material used in the electrolyte solution. Since it is difficult and expensive to run physical testing on each type of material, we use software to mimic the same conditions in a theoretical standpoint.

Disney World Resort: A Data Visualization and Analysis of Attraction Wait Times
Kevin Lee, Computer Information Systems, Technology & Operations Management
Mentor: Rita Kumar

As the availability of data from an expanding array of data streams grows exponentially, organizations and analysts are now increasingly reliant on data analytics techniques to generate insights for informed decision-making and to spearhead process improvements and innovations. The amusement park industry is no different: timely data analysis can be indicative of current conditions, influencing the daily operations and allocation of resources within Disney World and its selection of attractions and rides. Indeed, previous research applications of data analysis have led to mobile apps such as Lines, which utilize information such as historical wait times and live location data from app users to predict wait times with astonishing accuracy. The implications of such tools are extensive. To start, tourists can more easily plan trips by strategically minimizing wait times; Disney itself can utilize this data to manage demand and proactively plan services. In this study, we analyze a dataset of wait times and various other conditions from 2012-2019. Specifically, we employ data visualization and several analytic techniques to understand the overall trend and the various factors impacting Disney World’s wait times. In addition, we combine these factors with time series forecasting techniques to predict wait times at a daily level.

Spanish Heritage Language Processing: Using Rosetta Stone to Impact Heritage Spanish
Julissa Loza Mendez, Psychology
Mentor: Amalia Llombart

Throughout America’s history, millions of individuals migrated to North America, bringing along their native language. When Heritage Spanish Speakers are born, they are typically exposed to the minority family’s language and the majority country’s language. In the academic 21 system of North America, minority languages are treated as “foreign” with a negative connotation. As a result, many heritage speakers do not continue learning their heritage language and become more dominant in the majority language, English. The goal of this study is to start investigating if and to what extent engaging in furthering Spanish through a computerized program (i.e., Rosetta Stone) will affect proficiency levels for Heritage Spanish Speakers (HSS). Moreover, in line with recent findings that show that short, intensive exposure to a new language modulates cognitive performance, we will test whether the process of engaging in relearning the heritage language leads to similar effects. The study will be a pre-post between-group design. We plan to test and compare performance between the participants who further their Spanish skills through Rosetta Stone.

Rediscovering Counterpoint: An Introduction to Polyphonic Composition
David Magluyan, Electrical Engineering  
Mentor: Steve Lacoste

For this project, I composed three musical pieces using a technique called polyphony. Polyphony (also referred to as counterpoint) is a term used to describe music that is formed by several different melodic lines, that when played together, form a harmonic progression. By contrast, most music heard today consists of a single melodic line that sits on top of a harmony (homophony). Polyphony was the favored style of the Baroque musical period, and the most famous composer of this era is Johann Sebastian Bach. My inspiration for this project was Bach’s The Art of Fugue, in which he writes eighteen original polyphonic compositions all based off a single melodic phrase, called a subject. Similarly, the pieces I composed for this project are also based off a single subject. The first piece is a chorale prelude - a piece meant to serve as brief introduction to a sung church hymn. The second piece is a canon, which means that one melodic line is a copy of the other. The final piece is a fugue. Fugues have three or more melodic lines that begin with the subject and develop it in a way that is related to but distinct from the other melodies.

Effect of Delivery Route on the Efficacy of a Liposomal Aspergillus Protein Vaccine Against Pulmonary Aspergillosis in Dexamethasone Treated Chickens  
Jordan Markson, Animal Science  
Mentors: Jill Adler-Moore & Cord Brundage

Pulmonary aspergillosis (PA) is an airway infection in poultry with limited treatment options. The efficacy of a liposomal Aspergillus protein vaccine (VesiVax®, Molecular Express Inc) was tested with a dexamethasone sodium phosphate (Dex SP) immunosuppressed PA model. SPF eggs were incubated for 21 days, hatched and moved to BSL2 rated cages. Birds were vaccinated (n = 8/group) on day 4 (d4) subcutaneously (sq) or mucosally (mu) and again d10 mu and d17 mu. Control birds received phosphate buffered saline. Animals were immunosuppressed intramuscularly with 8mg/kg Dex SP twice daily on d19-d24 and challenged mucosally d20 with Aspergillus fumigatus conidia. Lungs and tracheas were collected on d24 for fungal burden. Blood was also collected on d24 for an anti-spore agglutinating antibody assay. The vaccinated chickens were better protected against infection compared to non-vaccinated fungal challenged birds (327 vs 546 CFU/g lungs, P=0.005 with the sq, mu, mu regimen; 357 vs 546 CFU/g lungs, P=0.07 with the mu, mu, mu regimen). Tracheas of the vaccinated chickens showed better efficacy for birds given the mu, mu, mu regimen versus birds given the sq, mu, mu regimen (P = 0.037).

Process Improvement and Cost Reduction in Wire Manufacturing Industry  
Ivan Marroquin, Industrial Engineering  
Mentor: Ellips Masehian

In order for companies to remain competitive they must find ways to improve their processes, reduce waste, and decrease costs. This capstone consists of working at a wire manufacturing company’s facility in order to propose a plan to improve their products while at the same time reducing costs. More specifically, focus was directed to analyzing their galvanizing of wire department. A plan was proposed to implement a preventive maintenance system of the bearings that were being used in order to improve the overall quality of their products. Not only would this plan improve quality but also lower cost by reducing the amount of scrap, rejects, and rework that is being produced in the department. Different alterations and alternatives were considered in order to formulate a plan that would be most beneficial to the company.

An Exploration of the Uses of Technology for Second Language Acquisition  
Audrey Murray, Anthropology
Mentor: Dorothy Wills
The twenty-first century has seen an unprecedented amount of rapid technological growth. While many forms of technology exist and are being developed for language learners, most schools and teachers are not equipped to use these technologies in the classroom. In this project, I explored how technology is affecting second language acquisition among adult language learners. For this project I conducted one interview with an English as a Second Language (ESL) instructor at Mt. San Antonio College, and one participant observation session in an ESL classroom. My results and research show that using technology in the classroom provides benefits such as more motivation to learn, individualized and independent learning, transferability of skills to other areas of life, and access to more authentic materials. Unfortunately, the cost of implementing technology and of properly training teachers to use it are the biggest deterrents of using technology in the classroom. However, using technology in the language classroom will overall improve the quality of education and will give students and teachers access to real language used by real people in real places.

Perception and Judgment
Christopher Muzquiz, Mathematics
Mentor: Alex Madva
Cognitive science is the intersection of biology, psychology, philosophy, linguistics, artificial intelligence, and computer science that focuses on the study of mental phenomena and its classifications. The nature of the mind has piqued the interest of scientists and philosophers for centuries, but we struggle to understand it because of inherent limitations of phenomenology (i.e., the inability to accurately and informatively self-report cognitive activity). Hence, studying consciousness is a black box problem because we cannot directly study cognition due to its elusive nature. In particular, one familiar cognitive product is perception, which refers to information that has registered in the mind and intangible qualia that manifest within the subjective experience. Judgment, on the other hand, is the subsequent metacognitive construction that consists of the linguistic report of epistemological concepts as a result of perception. Current vernaculars suggest that perception and judgment are interchangeable, however we should make clear distinctions when studying the mind in scientific contexts to make further refinements in cognitive classifications. All in all, cognitive science in the forms of psychological studies, computer modeling, and epistemological literature will have important implications in understanding artificial intelligence and ourselves.

Big Data Analytics for 5G Self-Healing
Ibrahim Naffaa, Electrical Engineering
Mentor: Tamer Omar
In modern times, various types of structured and unstructured data are produced and collected in massive quantities due to the increased connectivity of our society. With such a large amount of data being collected, it is both beneficial and necessary to create infrastructure to analyze “Big Data” and finding meaningful results. In the case of a 5G self-healing simulator developed by Cal Poly Pomona’s Wireless Network Security Lab (WNSL), data about the simulated 5G networks are generated in the order of gigabytes with the potential to rapidly increase over time. Since it is essential to analyze the data produced by the 5G simulator, Amazon Web Services (AWS) is utilized to rapidly create a big data system where big data analytics can be performed. Due to the complexity of 5G, various parameters can affect the performance of the network including data rates, antenna sectors, and transceiver angles, which results in massive data sets, but not all data is necessary for our analytics. For this project, an algorithm was developed with Amazon Athena to reduce our data set for analysis using other tools on AWS.

Implementation of UAVs with SDRs to Restore Wireless Connectivity After Disaster
Omar Naffaa, Computer Engineering
Mentor: Tamer Omar
In the event of a natural disaster, victims are often times left without a means of communicating for aid due to cellular towers degrading or failing. A proposed solution to this issue is to utilize unmanned air vehicles (UAVs) with radio capabilities in order to relay the connection of a working cellular tower from a distant area away from the disaster. The purpose of this project is to establish a connection between two Universal Software Radio Peripherals (USRPs), with the eventual goal of integrating these devices on UAVs. During this project, I worked to implement a program using the LabView software application that would utilize Phase Shift Keying (PSK) as a means to modulate a signal that would be transmitted between two USRPs. Once the transmitter and receiver software were created, different versions of PSK were tested and compared with the ultimate goal being to determine the most effective modulation technique while also proving that a remote radio connection can be created between the devices. From this project, I gained hands-on experience working with multiple communication protocols as well as exposure to LabView as a software development platform.

Determining Speaker Distinction in English Derivational Morphology: The Use of -(i)fy and -ize
Rebekah Paerels, English
Mentor: Olga Griswold
The current study investigates the linguistic aspects which influence the distinction between the derivational suffixes -(i)fy and -ize by fluent speakers of English. Two procedures were used in the study. First, the researcher conducted phonetic analyses of existing English verbs containing the two suffixes: 30 with the suffix -(i)fy and 30 with the suffix -ize. Based on the findings, a survey was conducted, in which 173 adults who self-identified as proficient in English were provided with a list of English stems (real and nonce). Participants were asked to make judgements and select a suffix to create novel verbs. Preliminary results show that the distinction between the usage of -(i)fy and -ize is determined by the variable phonemic stress patterns of English. For a stem to take the suffix -ize, it must (1) be multisyllabic, (2) end in an unstressed syllable, and (3) end in a consonant. In other environments, stems take the alternate suffix -(i)fy; however, there exist some exceptions which require further research. These findings provide insight into a previously unstudied distinction within English's derivational morpheme system relative to lexical stress and a speaker’s tacit knowledge of language productivity.

Social Media’s Role in Major League Baseball
Sarah Pascual, Communication
Mentor: Jason Turcotte
This study seeks to understand how social media plays a role in fandom or trust, and how it affects fan enthusiasm about the organization. Specifically, this study analyzes the Los Angeles Dodgers and how their social media strategy affects both fans and non-fans of the organization. The Los Angeles Dodgers social media consists of their Facebook page, Instagram, Twitter, and YouTube page. There has not been a lot of research on what specific type of social media post is successful for the Los Angeles Dodgers, and I decided to test this. Included in the study are four videos (two philanthropy and two promotional) and I am testing which approach is more successful for both fans and non-fans.

Comparing Stress Behaviors Observed in a Flock of Sheep When Housed in Pens and After Separation and Placement in Pasture
Jenelle Pawluk, Animal Science
Mentor: Ondieki Gekara
Sheep are a prey species and are flock animals as a result. When sheep are prevented from fleeing from perceived threats, such as physical barriers like fencing, they can become agitated. Agitation is generally noted as increased vocalization, continual trotting or galloping, pacing, stamping, and head-butting. In this study, 5 sheep were selected out of a flock of approximately 90 and their behaviors, including those indicating stress, were observed for 30 minutes morning, afternoon, and evening. The observations were taken for 10 days and aggregated. Then, 36 sheep from the flock of 90 were placed into 18 different pens holding 2 sheep each. The behaviors of the sheep were observed, as well as any signs of agitation or stress, during the same intervals for 6 days. The first day that the sheep were placed into the pens in pasture, there was increased vocalization and pacing. The remaining days of observation, there was no significant display of stress behaviors with the exception of one sheep. One sheep forcibly escaped its pen and forcibly entered a different pen on three occasions. The remaining sheep did not display behaviors that indicated agitation or stress after being placed in pasture.

Cost Effective Methods to Estimate the Electronic and Physical Properties of Homo-Halogenated Benzenes
Kylie Pearce, Biochemistry
Mentor: Bohdan Schatschneider
The increasing costs of inorganic semiconducting components in electronic devices have driven the search for cheaper substitutes. Organic molecular crystals are one group of inexpensive materials which have the potential to replace inorganic semiconductors. One important property to consider when investigating potential organic semiconductor candidates is charge carrier mobility (μmob). Since this property is difficult to calculate using conventional computational chemistry approaches, properties which are correlated to μmob are calculated instead. Such properties include the intermolecular orbital overlap integral (Hab), valence and conduction band dispersion, crystalline polarizability, and the intermolecular crystal energy framework. In this study, the relationship between the crystal packing of all homo-halogenated benzene crystals found in the Cambridge Crystal Structure Database (CSD) and the above electronic properties was examined as halogen bonding is known to perturb the electronic properties of organic materials. It was found that molecules with packing arrangements containing the most π∙∙∙π interactions between the benzene rings had some of the highest band dispersion and crystalline energy framework values. Generally, it was found that symmetrical species had smaller band gap values compared to asymmetrical species. In addition, it was found that symmetrical species with larger halogens typically had higher energy framework values.

Spenserian Poetics: Analysis and Application in Research-Based Creative Writing
Katelyn Porter, English
Mentor: Alison Baker
Edmund Spenser’s epic poem, The Faerie Queene, is a widely recognized allegorical piece of literature that has been studied and referenced throughout modern English literature. At his death, the poem was left half-finished. Though many have studied his poetry and context, none have attempted to complete his work. In my research, I attempted to understand Spenserian poetics to the degree of replication. The methods for this included the explication of Book I of The Faerie Queene. In this, I analyzed and researched Spenser’s poetic structure, devices, style, history, allusions, and the purpose for each in creating his unique story. This analytical research addressed writing and outlining a Book of the Faerie Queene in Spenser’s style. After an analysis of Spenser’s approach, these findings were then synthesized into a story of my own invention. Continuing the artistic work of Spenser, I outlined Book VII in the style of Spenser to continue his legacy. After outlining, I wrote the climax canto (chapter) of my story, Book VII: The Legende of the Princesse Aida, or of Kindness to give flesh to that which has passed as my protagonist Aida does in confronting the murderous Invidious with “No armes, no sword, not one thing...”.
The Reformation of Educational Policy in California: An Analysis of Executive Order 1110 and its Effects on Minority Students

Inside the California State University System

Alexis Ramirez Ruiz, Political Science
Mentor: Neilan Chaturvedi

As the largest system of public higher education in the country, the California State University system has served for decades as a testing ground for some of the most relevant developments in higher educational policy around the country. Recent developments within this public system however has led to a multitude of speculations surrounding its actual objectives. The purpose of this study is to examine the question of how and to what extent has the implementation of Executive Order 1110 impacted the success levels of minority students within the California State University system. In order to approach this question, the different factors conforming the concept of student success in higher education are first analyzed and defined. Following the establishment of this central concept, the research of this study utilizes statistical analysis on recently reported data by the CSU system. The study also attempts to gain a more meticulous and precise understanding on the effects of this policy, by conducting a sample survey at one of the largest and most diverse campuses within the CSU system. Prima facie results from both of these data-based analyses indicate a various effects on the levels of college success among minority students. Effects that according to the same data, can potentially expand as more students from these specified groups as they continue to experience the effects of this policy. As a national leader for the advancement of minority communities within the State.

Encrypted Convolutional Neural Network

Christopher Sasso, Computer Science
Mentor: Tingting Chen

Machine learning models, especially deep learning models, have been widely applied on various types of data, and will further transform many aspects of our daily lives. However, these popular machine learning algorithms typically were developed without a thorough consideration of data security and privacy issues. In terms of big data with its high volume, variety and velocity, existing data security solutions fall short in efficiency, flexibility, and scalability. These security and privacy challenges either cause some critical technology to malfunction (e.g., self-driving cars could misclassify a stop sign as a yield sign with the computer vision learning model under adversarial attack) or undermine the promising future that big data and machine learning can bring us (e.g., with unsolved privacy issues, human genome-based personalized medicine and medical practice will be delayed and risky).

Determining the Lower Limit of Detection of HSV-2 in Homogenized Tissues Using a Plaque Forming Unit Assay

Khadija Shafiq, Biotechnology
Mentor: Jill Adler-Moore

Herpes Simplex Virus Type 2 (HSV-2) causes nearly 60% of genital Herpes infections in people ages 14 to 49 in the United States. Animal models are used to test the efficacy of antiviral treatments. Previous studies have demonstrated that HSV-2 vaginal infection of outbred Swiss Webster (SW) mice can be detected in spinal cords and brains post-infection. The Plaque Forming Unit (PFU) Assay has been used to detect HSV-2 viral burden in these tissues. In this study, we added known amounts of HSV-2 to homogenates of uninfected spinal cords and brains of SW mice, incubated samples with Vero cells for 23h in 96-well flat bottom plates, then stained cells with crystal violet. The plates were evaluated to determine if the virus could be diluted in the tissue samples and still produce PFU. The assays were done on alternate days to determine its reproducibility and sensitivity. Similar PFU results were obtained from one day to the next, and the lowest amount of
virus that could be detected was 2.0 PFU in the spinal cord and 1.0 PFU in the brain. This data validates the PFU assay as a valuable method to measure viral infection in animal tissue.

Optimization of Formulation of Gluten-Free Pasta Enriched With Protein Using Pulse Protein Isolates

_Viral Shukla_, Food Science & Technology
Mentor: Gabriel Davidov-Pardo

Much of pasta’s properties come from gluten; however, those with Celiac disease have an adverse reaction to its consumption. Pulse proteins have the possibility of mimicking the gluten network. The objective of this work was to use pulse protein isolates to create an enriched protein, gluten-free pasta product. A mixture design of experiments (MDOE) using isolated protein from pea (PPI) and fava (FPI) in varying percents (100:0, 75:25, 50:50, 25:75, 0:100 PPI:FPI) was added into a base consisting of rice flour, tapioca starch, and xanthan gum to create lasagna pasta. All formulations were tested for extrusion feasibility, optimal cooking time, cooking loss, swelling index, color, water activity and hardness. The MDOE was evaluated using Minitab software to create optimal formulations of 30:70 and 43:57 PPI:FPI using semolina based pasta as the standard. Optimal formulations were tested for physicochemical and cooking properties, and a Hedonic sensory evaluation was conducted along with semolina and whole wheat pastas. This study shows that pulse proteins may be used as a novel protein source for gluten-free pastas, and that the formula may be optimized through the use of mixture design of experiments.

CH-STR (Chess Strategy) Bot

_Alex Thia_, Mechanical Engineering
Mentor: John Caffrey

Chess is a simple, yet complex, game based around maneuvering chess pieces strategically around the chess board in order to put the opposing player’s “king” in checkmate. It is typically played in one of two settings: with a physical board between two players facing each other or a digital board between two players far from each other. The purpose of this project is to meld both the physical and digital board in order to form a hybrid type of play. As the player and programmed AI plays chess with a digital board on the computer, signals are sent to control the stepper motors and electromagnet which move the chess pieces from beneath the physical chess board to reflect the movements made on the digital board. In doing so leads to an entertaining chess experience in seeing the chess pieces move without the user having to do anything.

The Effects of Concussions regarding Memory Retention

_Danielle Tostado_, Kinesiology
Mentor: Kinga Matusik

In the field of Kinesiology, physical injuries pertaining to movement are often at the forefront of discussion. However, concussions are usually not discussed as often, despite their potentially damaging effects that can have a significant neurological impact. This study aims to show the aftereffects of concussions as related to memory retention. In order to determine the neurological impact of concussions on one’s memory, I chose to collect data from California State Polytechnic University, Pomona athletes through an online survey that included several memory assessments. This project pieces together responses and data gathered from student athletes to show the lasting effects of this type of injury, as well as acknowledging the perceptions and notions felt by the participants surrounding the topic of concussions. By further examining the issues associated with concussions, I want to change people’s mindsets in regard to this particular brain injury and for them to ultimately gain more knowledge surrounding this subject matter. My goal is for this project is to
ensure that this type of brain injury is taken seriously. I anticipate this spurring further discussion, so that more can be done to help those affected by concussions.

**Prospective PLG 82-18 Use in Anterior Cruciate Ligament Reconstruction**

*Ingrid Ulrichsen*, Mechanical Engineering  
Mentor: Mehrdad Haghi

There are 200,000 anterior cruciate ligament (ACL) injuries in the United States each year with 94% of them requiring reconstruction. ACL reconstruction currently involves removing the torn ligament and replacing it with a piece of tendon from either another part of the knee or from a donor. The purpose of the graft is to provide a scaffold for the new ligament tissue to grow on. Scaffolds made from bioabsorbable polymers break down over time into compounds that can be absorbed by the body, leading to an implant that dissolves as new ligament grows so that at the end of healing there is only the new ligament with no need for another surgery to remove the scaffold. The goal of this study is to test a currently available bioabsorbable polymer, poly(lactic-co-glycolic acid) or PLG 82/18, that has similar mechanical properties to the ACL to be used as a scaffold in place of a grafted tendon. These tests involve measuring the mechanical properties of PLG 82/18 such as stiffness, tensile strength, and percent elongation initially and as it degrades to determine its viability as a scaffold during the healing process.

**Analysis of Methane in Shallow Aquifers Overlying Oil and Gas Production in Pennsylvania and Colorado**

*Rebecca Warner*, Geology  
Mentor: Stephen Osborn

High concentrations of shallow aquifer methane overlying deep oil and gas reservoirs has garnered public concern in recent years as hydraulic fracturing and horizontal drilling technologies have proliferated. There is still uncertainty as to the sources of methane. Studies (Osborn et al., 2011 and Jackson et al., 2013) of groundwater wells in Pennsylvania and New York concluded that there was a correlation between the proximity to oil/gas-wells and methane content in some shallow aquifer wells. Other subsequent studies claim a combination of shallow flow paths and local topography are the cause. This study seeks to use publicly available shallow aquifer methane data from the Colorado Oil and Gas Conservation Commission and data collected by Osborn from areas of oil/gas production in Pennsylvania and Colorado to assess methane concentrations against proximity and topography. ArcGIS was used with data from the United States Geological Survey to find the highest and lowest elevation points for various radii around the wells to compare the differences of local topography with methane content. The elevations of these points were gathered and compared to the well’s elevation to determine its relative topography as a ratio between the high and low locations and then compared to methane levels.

**Environmental and Cellular Responses to Aging**

*Brandy Weathers*, Animal Science  
Mentor: Hyungchul Han

Aging is a biological construct that dictates our place in society and can have implications on our quality of life. Over time, lifestyle choices, hormonal changes, and stressors of daily life can alter the natural function of cellular processes and accelerate the process of aging. Stressors of everyday life can accumulate to chronic stress, which can cause a gradual resistance to insulin and stimulation of fat buildup in the abdominal region. Stress inducing hormone imbalance of cortisol, catecholamines, and hypothalamic pituitary adrenal axis. In addition, depression negatively impacts aging by inducing diseases, mood disorders, dysfunction of the immune system, cardiovascular morbidity, etc. that can cause physical illness and a decrease in cellular longevity. Lack of sleep can be a contributor or side effect of age-related diseases and depression. Hormone and mood disorders can shorten telomere length, which impacts the lifespan of the cell. Nutritional
choices such as a high fat and sugar diet causes oxidative stress in the body contributing to the cause of altered transcriptional and cellular targets and damage to DNA. Methods to improve nutrition such as antioxidants, physical exercise, and a balanced sleep schedule act as preventative methods to slow the process of aging.

The Link Between the Opposition of Flag Desecration and National Anthem Kneeling

Hannah Wimer, Political Science
Mentor: Neilan Chaturvedi

As most Americans are aware, controversy has shrouded professional athletes in recent years, most notably Colin Kaepernick, who have made the decision to kneel while the playing of the national anthem occurred during professional sporting events. The people that oppose this movement refer to it as unpatriotic, and disrespectful to the United States military and veterans. These opposing attitudes to the athletes’ protests reflect a similar movement rooted in the patriotic defense of American symbols, the movement to criminalize flag desecration. This movement gathered momentum a few decades ago after the Supreme Court ruled in favor of protecting flag desecration as a form of symbolic speech in the 1989 landmark decision of Texas v Johnson. The patriotic outcry against this decision was massive, with many even calling for a constitutional amendment to prohibit flag desecration. With my thesis, I will examine the extent the movement to criminalize flag desecration is tied with the attitudes opposing professional athletes kneeling during the national anthem. This study is important because this is a link that has not previously been heavily examined, and will yield useful information about people’s attitudes toward patriotism, and indicate the strength of Constitutional protections toward unpopular political minorities.

Understanding Boss Battles: A Case Study of Cuphead

Andrew Wood, Computer Science
Mentor: Adam Summerville

“Bosses” – powerful, difficult enemies – have been a part of video games for the majority of their existence. Despite their integral role in many games, they have rarely been the focus of study. Cuphead is a run-and-gun style 2D action game with a large pool of boss battles, making it an ideal game for comparing and contrasting bosses, to determine what makes a compelling (or frustrating) boss battle. In this case study, we developed an ontology of ‘shoot-em-up’-genre attacks and bosses. With this system for codifying a boss battle, we cluster the attacks using a Gaussian Mixture Model – which are then used to represent a boss as a “bag-of-attacks”. We then use multinomial regression to predict the player experience of a boss given the parameterized boss.

Facial Emotion Detection via Convolutional Neural Network for Embedded Platforms

Kevin Worsley, Computer Engineering
Mentor: Mohamed Aly

Computer vision and machine learning are powerful technologies, with a wide variety of applications in many industries. Facial detection is a popular field, and detection of emotions can be essential to certain applications concerned with facial data collection. Many devices which implement this technology are embedded, often constrained by less computing resources or inability to connect to outside systems over the internet. This project demonstrates the use of a closed system Convolutional Neural Network (CNN) on an embedded device, trained to detect a user’s emotion based on their facial expression, and signal an animatronic figure with the appropriate classification. The model was built from the ground up on the Tensorflow framework, using Keras as a top-level API to design the model’s structure. It was trained with a subset of the fer2013 dataset. The model is presented in a efficient FlatBuffer format, designed for optimizations and lower-latency operation within Tensorflow Lite. These optimizations permit a complex model to run on an embedded device,
the Raspberry Pi Zero, without needing to access other outside materials or machines, as well as decreasing inference time with minimal loss in accuracy.