



# **Book of Abstracts**

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## **Parametric Art**

Daanial Ahmad  
Shaun Pollard  
Prof. Satyanand Singh

Lissajous curves, named after Jules Antoine Lissajous (1822-1880) are generated by the parametric equations  $x=A\cos(at)$  and  $y=B\sin(bt)$  in its simplistic form. Others have studied these curves and their applications like Nathaniel Bowditch in 1815, and they are often referred to as Bowditch curves as well. Lissajous curves are found in engineering, mathematics, graphic design, physics, and many other backgrounds. In this project entitled “Parametric Art” this project will focus on analyzing these types of equations and manipulating them to create art. We will be investigating these curves by answering a series of questions that elucidate their purpose. Using Maple, which is a software for mathematics we can graph these curves and analyze them to best give an overview of Lissajous curves.

## **A STEM-COMD Interdisciplinary Approach to Illustrating STEM Manuscript**

Edward Alston  
Prof. Sara Woolley  
Prof. Ivan L. Guzman

Many students, especially Civic Engineering students, find their textbooks unappealing. As design majors, my partner and I are tasked with figuring out how to make an Open Educational Resource (OER) manuscript on Civic Engineering, specifically, Soil Mechanics, more visually engaging for college students. We are approaching this issue through the use of designs and illustrations. Our approach to this is to summarize and condense the information of each chapter into a brief one or two-panel comic that introduces each chapter of the manuscript to the chapter’s particular topic. Each introduction comic will use animals that make soil their habitat (such as Beavers, Groundhogs, and Moles) as characters, explaining the chapter’s topic in a short and simple visual format. We believe this format can capture students’ attention easier, make the manuscript more engaging, and make the information easier to comprehend. We believe that this will help other manuscripts/textbook publishers think more critically about how to make their text more engaging and readable for college students.

## **What Entrepreneurial Start up Project Would You Open in the Current COVID-19 Environment?**

Yaneth Arevalo  
Prof. John DelloRusso

This research project is designed to investigate a new business opportunity to provide safe and personalized at home hair, makeup, and nail services. For many New Yorkers, going to the hairstylist or manicure salon has become very difficult and dangerous because they can contract COVID-19 at these public places. New York City salons are allowed to operate at 50% capacity, but even with that many New Yorkers feel it is still unsafe to take the risk of going to these public places. The motivation for this project comes from the need to provide an important service for peoples mental and emotional health. Getting a haircut, or nail treatment can improve a person’s

emotional state. We will be studying the problem by doing a targeted survey, we will ask participants several questions about their feelings towards going to the hair salon, how often they would like to go to the salon, and how they feel after going to a salon, we will also ask them if they would consider at home services. In conclusion, I found that people are going to the salon less frequently during the pandemic, people are afraid to get contracted with COVID-19 and also, they are concerned about being able to socially distance at the salon. New Yorkers in need of these services will pay to have a professional stylist come to their home to provide hairstyling, makeup, and nail services in a safe way and in this way the customer will avoid having to go to the salon. This business idea can have many implications, firstly, it will benefit both beauty stylists who want to work and customers who are afraid of contracting COVID-19 but need the services. Secondly, it can change the way that beauty services are provided, instead of having a salon, the business can be done by hiring stylists to do at home services. Lastly, this business will have a positive impact on the community by helping to lower the Covid-19 spread.

### **3D Bionic Arm**

Anny Baez Silfa  
Prof. Farrukh Zia

Previous work had been done on what was an adaptation of a robotic arm for Roboqueen, which is a persistent research project of the Department of Computer Engineering Technology. This robotic arm consisted of removing the cardboard hands from the Roboqueen and being replaced by 3D printed fingers and wrists to add functionality that did not exist before. Servo motors connected to Arduinos hidden in the forearm will be used to move the fingers and pick up and hold objects in the hand. Currently, the Finger Myoware is an update of the robotic arm in order to understand how prosthetic arms work. In this project the Myoware Muscle Sensor is implemented, which will be in charge of reading muscle activity. The servo motor will be connected to the arduino and will be used to open and close the finger.

### **MRI Signal Changes in Nanoparticle Infused Fruits: Role of Various Metal Ions**

Bleidis Buitrago  
Prof. Subhendra Sarkar

MRI is a useful electromagnetic imaging modality offering good structural definition as well as molecular properties in healthy and diseased tissues. We propose to measure and model the sample signal and noise changes in fruits infused with radiology contrast nanoparticles. Digital imaging contrast media like iodinated and Gadolinium contrast media provide long range energy correlation and seems to alter Proton relaxation times near the infusion areas in fruits. This will be compared with X-ray image noise on similar systems obtainable from collaborating X-ray research students (see Mousa and Sanchez et al, in this poster session).

## **Immunotherapy in Cancer Treatment: Synthetic Approaches and Mechanisms of Action**

Keyandra Bussey

Prof. Alberto Martinez

Prof. Diana Samaroo

Cancer immunotherapy is an effective method when it comes to the treatment of cancer. While immunotherapy is fairly new to the field of oncology, it shows very promising results and can be used in combinational treatments along with other traditional cancer treatments such as chemotherapy and radiotherapy. While the results are very promising, there is more research that needs to be done to correct the side effects that cause a burden for cancer patients. A study was done to see how effective immunotherapy drugs are when paired with traditional chemotherapy drugs. Introduction Immunotherapy, or biological therapy, is defined as the treatment of diseases by activating or suppressing the immune system. The field of immunotherapy is a very wide with five classes, each one showing different benefits and side effects. Immunotherapy allows the body to gain immunity to certain cancers due to specific immunotherapeutic drugs that allow memory B cells to create antigens to attack cancer-causing cells. While it is an expensive method, it is also very effective in treating cancers, providing most cancer patients with a 3-year survival rate of 43-77% for example, with pembrolizumab (Figure 1 vs 24-9% for standard chemotherapy [1]). In the United States, there are various traditional methods for treating cancer, such as surgery which requires a surgeon to remove cancer from the body, chemotherapy where doctors use drugs to attack and destroy the cancer cells, radiation therapy which uses high doses of radiation to kill cancer cells and shrink tumors, precision/target therapy where the cancer cells are identified and changes are made to stop them from replicating and growing, hormone therapy which stops specific hormones from being produced to slow down or stop the growth of cancers that use hormones to grow, and stem cell transplant which requires blood-forming stem cells and is used in many cancer patients who have had their stem cells destroyed from radiation [2]. Immunotherapy is thus an emerging strategy due to its promising results, although it is also a field that needs further development. In this work, we show some recent findings on clinical trials using combinations of chemotherapy and immunotherapy against lung cancer. In the U.S. alone, roughly 1.8 million Americans will be diagnosed with cancer, and out of 1.8 million Americans affected by cancer, over 606,520 of them will die from this disease [3]. The goal of this research experiment was to see how effective immunotherapy in combination with other cancer-treating drugs.

## **Mindcontrol of Mobile Robot**

Bingfang Chen

Prof. Farrukh Zia

Talk and Roll Bot is a mobile robot project which combines computer hardware, computer software, mechanical, electrical, data communication and networking subsystems to create a working prototype of a computer-controlled robot system. In the current phase of the research project, background research is done to learn to use the Electroencephalogram (EEG) measurements of brain waves to control the robot. A modified Mindflex game controller is connected to Arduino and brain activity data is passed on to Processing code running on a PC in order to track and record brain wave patterns. The electrical activity of the brain is used to

turn a DC motor on and off. In the future, it will be used to control speed and direction of the DC motors in Talk and Roll Bot.

### **Using Statistical Analysis to Examine Weather Variability in New York City**

Ryan Chen

Yuhang Wang

Prof. Jiehao Huang

As the overall temperature of Earth continues to warm, atmospheric hazards (e.g. heatwaves, cyclones) may be driving increases in climatological trends. This study examines the daily precipitation and temperature record of the greater New York City region during the 1979-2014 period. Daily station observations from three greater New York City airports: John F. Kennedy (JFK), LaGuardia (LGA) and Newark (EWR), are used in this study. Climatological & statistical analyses are performed for the weather variability of New York City metro area to understand the impacts of climate change. The temperature climatology reveals a distinct seasonal cycle, while the precipitation climatology exhibits greater day-to-day variability. Furthermore, annual mean of precipitation and temperature in New York City show increasing trends with temperature trend is significant. After that, this study compares to other research findings with a different region such as Amazon Basin to examine the climatological pattern of precipitation in both daily and annual climatological trend. Amazon Basin has different climate phenomena than New York City due to different geographical location. Daily Climatology of precipitation in Amazon basin shows the greatest intensity occurred in January to March, with minimum in July. The annual mean of precipitation match with our spatial result generated by GPCP for global precipitation mean in January and July.

### **Heat Transfer Effects in Animal Tissues by Mammography and Signal and Noise Comparison of Nanoparticle Modified Animal Tissues in MRI**

Daniela Costin

Prof. Subhendra Sarkar

The set of experiments designed in this project are focused on diffusion and movement of various radio-opaque Gadolinium and iodinated contrast nanoparticles within various layers of animal tissues for understanding of signal changes with time. Digital imaging, in particular Mammographic 2D and 3D methods seem to show high resolution, real time images demonstrating the degradation of proteins in fresh chicken egg yolks with time that may help understand protein structure breaking from “toxic” ionic interaction.

### **Object Recognition and Voice Assistant with Augmented Reality**

Juan Estrella

Prof. Aparicio Carranza

Our research project aims to provide a visually impaired person with a superimposed map that will guide the individual to the desired destination through a voice controlled virtual assistant application that integrates Augmented Reality (AR) with Artificial Intelligence (AI) Computer Vision and Natural Language Processing (subfields of AI) will be combined to identify the spatial

environment and then create a graphic enhancement that provides the most direct route to the specific destination. These technologies will be incorporated into the Microsoft HoloLens which will be controlled by the user.

### **The 1935 Hurricane Houses of Islamorada: A Case of Successful and Rapidly Deployed Post-Disaster Housing**

Gloria Garcia

Kendra Gibbs

Prof. Anne Marie Sowder

According to the UN, during the past 20 years, the number of recorded disasters has doubled from approximately 200 to more than 400 per year. Post-Disaster Recovery is a set of strategies to assist a community in rebuilding after a disaster occurs. Post-Disaster Rebuilding (PDR) is when after a disaster occurred anything that got destroyed will get repaired. My research concerns a PDR case study in the Upper Florida Keys where the Labor Day Hurricane destroyed people's lives, property, and cities. After this disaster, a new type of residential construction was introduced that was steel-reinforced cast-in-place concrete. Natural disasters are happening more often. This means more problems and challenges to overcome. The challenges that are faced after disasters include logistical issues, insufficient human resources, risk management issues, and community issues. The PDR literature discusses the challenges that are faced after disasters, which include challenges for economic and human resources. The most important economic issue for post-disaster rebuilding is getting enough funding to rebuild in a timely manner. Research also suggests that public rebuilding efforts are needed when private rebuilding efforts are not possible or because many are not able to afford insurance. Permanent residential rebuilding efforts by public relief agencies are rare and agencies may spend immoderate amount of money in emergency relief to build temporary shelters. This can lead to difficulties of funding in permanent reconstruction. In addition, the biggest human resource challenge is recruitment of construction experts and skilled laborers at times when they are hard to find or there are not enough of them. According to Bilau et al., reconstruction workers require more training and organizational support than conventional builders. My methodology consisted of conducting a review of literature on PDR and using historical research methods to analyze the case study. During the post-disaster rebuilding period after the Labor Day Hurricane, the US federal government completed the residential rebuilding effort as a New Deal work relief job. My findings suggest similarities between the case study and the themes identified in the literature review such as complications in obtaining funding and adequate labor for post-disaster rebuilding efforts.

### **Blast + Velocity: Animated Web**

Shisir Humagain

Prof. Marcos Pinto

The purpose of this research is to determine how Blast and Velocity works better than the traditional CSS (Cascade Style Sheet). This project delves in the intricacies of web animations using powerful techniques: Blast and Velocity. Animating an HTML elements is usually done using CSS or JavaScript, but we can only animate a full existing element. Blast.js is a jQuery plugin that allows us to animate individual characters, words, or sentences. Velocity is a JavaScript

framework used to animate elements of a Web pages with transform animation, looping, class animation, and scrolling.

### **Open Educational Resources: What do Students Want?**

Aneeza Hussain

Joyette Noel

Prof. Tatiana Voza

This project aims at identifying the needs and requests of students for Open Educational Resources (OERs) in order to develop rubrics for design, evaluation but also revisions of OERs. For this purpose literature searches on the matter were conducted to determine if information on students' perspective on OER content and expectations existed. Simultaneously, feedback from fellow City Tech students with experience using OERs has been collected. Our results provide insight on how City Tech students perceive OERs, in comparison with traditional resources. This also pinpoints the key pedagogical features that OERs should offer in order to attract, engage and better serve students. The data collected will also contribute to a more methodical approach for assessment and improvement of existing OER material.

### **Virtue at the Coffee House: Poetry and Community in Contemporary America**

Jessyca Jones

Prof. George Guida

Poetry has become a binding force in society. Poetry is a medium of raw emotion combined with craft, which has the ability to mold, shape, and help us build relationships in various walks of life. The essence of our study is to examine why such a medium resonates with diverse, demographic and psychographic groups. We have also examined how the spoken word creates and sustains communities that produce alternative and pervasive and powerful countercultures. The expansion of poetry spaces across the United States creates local, regional and national networks that lie at the center of participants' lives, no matter their race, gender, persuasion or affiliation.

### **Understanding of Aerosol Transmission of COVID 19 in Indoor Environment**

Jacob Lopez

Sherene Moore

Cathal O'otoole

Matthew Quinones

LiaLun Xiao

Adama Barro

Prof. Daeho Kang

Our reason for discussing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or 2019 novel coronavirus (Covid-19), is to understand its aerosol transmission characteristics in indoor spaces, and to mitigate further spread of this disease by designing a new HVAC system. The problem that we are tackling is the spread of covid-19 droplets through aerosol transmission, by looking at potential engineering solutions to the existing HVAC systems. The purpose is to eradicate the spread of the COVID-19, by testing indoor spaces, in an effort to understand the effectiveness of ventilation controls. We believe that scientists and engineers have not created an

environmental controls system to combat Covid-19 in the indoor environment. The goal is to answer this need and construct an innovative HVAC model with highly efficient filtration and ventilation. The methodology is to conduct an epidemiological investigation by researching case studies and scientific results of COVID-19 pathogen fluid dynamics in enclosed spaces, as well as its effect on pre-symptomatic, symptomatic, and asymptomatic individuals. This invention would be impactful because it would greatly improve commercial and residential air quality in buildings. The consequence of this HVAC ingenuity would prevent the concentration of coronavirus2 aerosol droplet dispersion. This study suggests that it is critical and very important to prevent overcrowding and provide ample ventilation and filtration of the circulating air in buildings. Our findings will help to identify solutions in improving aeration standards, and integrate newer technology to upgrade HVAC-R systems.

### **Image Compression with Principal Component Analysis**

Dung Mai

Prof. Nan Li

For this research project, principal component analysis (PCA) is used to compress images to smaller sizes without losing the significant patterns or information of the original images. The goals of PCA are to reduce irrelevant or less important variables and capture the most variability of the original data. Hence, we use this technique to the images to minimize the redundancy and allow more images to be stored in the memory spaces. This research project contains the descriptions and the examples of how to calculate the Principle Components (PCs) using the covariance matrix method and project the data on the PCA space that is obtained from the calculated PCs. Experiments in this research project are done in R-studio.

### **Principal Component Analysis for Predicting the party of the Legislators**

Afsana Mimi

Prof. Nan Li

The project's motivation is to compare with the project, "***Decision Tree Predicting the Party of Legislators***" and It showed how the decision tree could identify the party of legislators who frequently voted against their parties. We used the legislators' roll call votes, ***Office of Clerk U.S. House of Representatives Data Sets*** (Categorical values) collected in **2018** and **2019**. In this project, we build a model to predict legislators' parties based on their votes using **Principal Component Analysis** and **Logistic Regression** from **Data Mining**. We are able to show the models can predict the parties of the legislators, and both have similar accuracy as the decision tree. Since both data have categorical values, Excel has been used to assign the numerical values to categorical values. All other calculations and graphical presentations are performed using the **R software**.

## **Benefits of Pre-Construction Analysis: CET Senior Capstone Expands Understanding of an Urban Refuge at GallopNYC Sunrise Stables**

Aalaa Mohammed

Prof. Anne Marie Sowder

For any construction project, there exists a phase of planning known as “pre-construction.” This initial phase of the project provides a definition of the project, identification of potential issues, planning and scheduling, scope, cost estimation, and analysis of needs for the job. My research analyzes a pre-construction case study conducted for Gallop NYC’s Stable in Howard Beach, Queens. The findings suggest that the practice of construction planning is effective in order to avoid delays in construction itself and ensure successful project completion. Supporting literature examines the ways in which construction planning is actually done versus studies with the common approach of addressing only the tools and technology required for this process. Some of the best practices for pre-construction analysis include but are not limited to: timing and extent of the survey, identification of vulnerable areas that fall within close proximity of the adjacent structure, and substantial field notes that document the existing conditions prior to the start of demolition, excavation, and construction. This paper contributes to research on pre-construction analysis effectiveness through consideration of City Tech’s CET Capstone project developed with GallopNYC at Sunrise Stables in Queens, NY. Over a course of fifteen weeks, students were able to create a design concept, budget, and schedule based on site visits and interviews conducted with clients. With this data, they put together schematic design documents and linked design work to conceptual budgeting and scheduling. My methodology consisted of conducting a review of literature on pre-construction analysis effectiveness and analyzing the case study for common patterns. Dolhon emphasizes the importance of pre-construction surveying as it allows the project participants to be aware of the common types of damage that may occur due to adjacent construction and the various construction activities that may cause the damage. This will help to focus the scope of the pre-construction survey.

## **Use of sustainable Architecture in Nigeria in Relation to Electricity, Water, and Pollution**

Ololade Owolabi

Prof. Paul King

Paired with the exponential increase in the population of Nigeria over the past 30 years has been an increased demand for natural resources. According to UN data, in the last 30 years, the population has increased from 95,212,450 to 206,139,598 making Nigeria the seventh most populated country in the world. Nigeria located on the western coast of Africa, is a developing country that obtained its independence in 1960. Since that time a number of critical problems remain unresolved including the availability of clean water and a dependable source of electricity. The major focus of this study will be to identify sustainable architectural design strategies, to address these problems and mitigate negative impacts in Nigeria.

A current means of providing electricity is the use of small diesel-based generators to provide electricity and power pumps to provide clean water, which exacerbates negative impacts by the increase in air and noise pollution including a thick black smoke that is detrimental to the health of the people of Nigeria. Additionally, the residue from the smoke produces particles that contaminate local water sources.

Sustainable architecture focuses on the reduction of energy use and the negative impacts that buildings can create, by using recycled or renewable materials and having a thoughtful approach to the designing and planning of spaces. It is of great importance that Architecture and urban planning be applied in a sustainable manner to guarantee a better future.

The purpose of this research is to compile and educate both professionals and the general public on how sustainability and sustainable Architecture can affect climate change and can benefit the overall quality of life in Nigeria. Some of the questions to be answered are how the use of sustainable architecture in Nigeria can help produce a better city, improve the quality of life of the people and what is an effective means to educate the people so as to assure a healthy environment for future generations. This goal is of great importance as there is a limited awareness of sustainability in Nigeria and it is mainly practiced by those in the field of architecture or urban planning who are the people with the power to shape the country.

Research began with a literature search on the subject. Information in articles and other publications was sorted and compiled and combined with personal knowledge gained by direct experience from my visits to Nigeria. This review shows that while many existing sustainable practices could benefit Nigeria, there is a lack of exposure and awareness of these methods among practicing architects, professional organizations and the general population making education a key component of the proposed plan.

## **Diffusion Tensor MRI in Late Onset of Alzheimer's Disease: A Critical Assessment of ADNI Databases**

Jennifer Padilla

Prof. Subhendra Sarkar

The Alzheimer's Disease Neuroimaging Initiative (ADNI) databases consist of study data to define and understand the progression of Alzheimer's disease (AD) including MRI and PET images, genetics, cognitive tests and biomarkers as predictors of the disease as well as a rich collection of similar data from elderly controls. Understanding of late onset of AD (LOAD) is the major focus in this initiative. The work here aims to identify patterns of cellular diffusion abnormality (Diffusion Tensor Imaging, DTI) in cerebral white matter where key areas suffer from atrophy and poor white matter connectivity. With the use of the ADNI website, there will be three levels of access within their database. The goal is to observe the images within the database while collecting data and making comparisons of the Fractional Anisotropy Table ranging 200 to 300 anonymous patient database. The patterns will reveal useful biomarkers in Diffusion Tensor Imaging in neurodegeneration in the gray and white matter of the brain. However, we believe DTI requires a critical pattern analysis in AD brains due to equipment and operator variability as well as tissue composition differences among patients leading to significant difficulty in using DTI data to predict and monitor time course of AD progression.

*Keywords:* Alzheimer's Disease Neuroimaging Initiative (ADNI), MRI, PET, Diffusion Tensor Imaging (DTI), Fractional Anisotropy (FA)

## **The Energy Challenge: Moving from Fossil Fuels to Hydrogen**

Russybel Richiez

Prof. Ivana Jovanovic

To aid in the fight against climate change and find a new fuel source before the current sources become depleted many have turned to hydrogen. While burning fossil fuels creates CO<sub>2</sub>, using hydrogen as a fuel source would only result in one byproduct: water. But several aspects come into question when it comes to hydrogen-like production methods, storage, safety, and even its economical aspect. The purpose of this literature review project is to identify the possibility of a hydrogen-fueled future as well as its constraints. In this project we focus on exploring different methods for hydrogen production such as the industrial steam methane reformation as the cheapest production method, and renewable energy-based processes such as biomass, solar and wind sources as clean methods. We will also investigate bioproduction such as fermentative biohydrogen production, light-dependent and light-independent processes. Hydrogen is typically stored as a gas or as a cryogenic liquid, yet due to its high combustibility the temperature and pressure must be monitored. Storage is demanding because the tanks need to be regulated and have electronic security systems. The material for the tanks must also be precise to avoid chaos. Safety concerns involve hydrogen being an odorless, highly diffusive, and easy to leak chemical. If the cost of producing hydrogen along with storage and hydrogen-fueled machines were to become competitive with the cost of oil from fossil fuels, then it would be possible for hydrogen to replace fossil fuels. By finding new and low-cost ways to produce hydrogen, it can become the fuel of the future.

## **Improve the Prototype of Low-cost Near-Infrared Diffuse Optical Imaging System**

Mohammed Shakil

Prof. Chen Xu

Diffuse Optical Tomography (DOT) and Optical Spectroscopy using near-infrared (NIR) diffused light has demonstrated great potential for the initial diagnosis of tumors and in the assessment of tumor vasculature response to neoadjuvant chemotherapy. The aims of this project are 1) to test the different types of LEDs in the near-infrared range, and design the driving circuit, and test the modulation of LEDs at different frequencies; 2) to test the APDs as a detector, and build the receiver system and compare efficiency with pre-built systems. In this phase of our project, we are focusing on improving the prototype of a low-cost infrared transmission system for tumor and cancer diagnosis.

## **A Year of Encounter: The 1948 Photo Album of African American Soldiers Stationed in Gifu, Japan**

Manhoor Sheikh

Prof. Emilie Boone

I will be assisting my advisor in analyzing the contents of a photo album from the 20th century that portrays the domestic life of an African American family living in Japan. This album is significant for a myriad of reasons including, there are not many photographic accounts of the personal/ intimate lives of black individuals in Japan from this time, photos in the album suggests

that this family had a connection to the military, and this album has uniquely been curated by a black woman, possibly the matriarch of the family.

My role in this project will consist of cataloging details in the album, from the first and last names of recurring figures, military numbers, labels under the photographs, and dates. I will also navigate through databases, including using the Interlibrary Loan (ILL) system through City Tech along with World Cat to acquire resources/ proper citing sources that can provide insight into how to approach the album. These resources could range from how to analyze vernacular photography to historical accounts of black military families/ what life in Japan was like for black Americans in Japan during World War II. I will also be reaching out to reference librarians at institutions including the New York Public Library, WWII Museum library, and Library of Congress. The hope is to discover as much information about the people of the album and to learn about an otherwise unrecognized narrative of life for black Americans.

### **Worm Reduction Gearbox**

Alcha Soumailou

Prof. Zhou Zhang

The stoppers to prevent mal-operation are widely used in machines and many transmission mechanisms. The worm gear set has the advantage that it can only be operated in one direction if the worm gear set is designed properly. In this project, a speed reduction gear box based on a worm gear set is designed to prevent a radar system rotating by accident. The output of the gearbox is connected to the end of the shaft of the motor with a cylindrical rigid connector. The reducer can provide an extra method to rotate the radar in a manual way. The self-lock property of the worm gear set can make sure that the radar keeps safe when it is out of duty. The problems that should be solved during the design procedure include the analysis of the structure of the reducer, and the configuration of the parameters of the worm set since the radar is a huge system, and the inertia is extremely critical. Therefore, how to design a reasonable and safe mechanism is challengeable. In this project, all the challenges are solved by an innovative design of non-backlash worm gear set. In addition, the proposed worm gear set has the potential to be used in the applications that require high precision.

### **Customized Global Tip Calculator**

Tatyana Taylor

Prof. Marcos Pinto

The project will build an Android mobile application that calculates the amount of gratuity (tip) for services provided by a restaurant located anywhere around 100 different countries. It will account for currency exchange and most frequent tip percentage for any particular country. This application can also be ported as a Web application.

## **Brain Glioblastoma Morphologic Features in MRI: Predictive Models for Spread**

Ruth Zero

XiangFu Zhang

Prof. Subhendra Sarkar

Glioblastoma (GBM) a malignant type of brain cancer affects roughly 3.19 per 100,000 persons in the United States. It is the most invasive brain tumor, as only less than 5% of patients survive 5 years after diagnosis. For the last three decades, the usual treatment of radiation and chemotherapy has not been an adequate solution. If an earlier, more accurate prognosis of cancer could be assessed, it would be profoundly beneficial for combating this disease. Magnetic resonance imaging (MRI) is a useful modality to provide a good structural definition of such cancer at various growth and treatment stages. Studying morphological changes in patients with GBM who underwent radiation and chemotherapy were conducted retrospectively by analyzing MRI images and data obtained by our hospital collaborators. Our goal is to apply the statistical analysis of MRI signal at various growth stages in this population and predict cancer spread in healthy brain tissue, as well as identify markers that allow for the radio resistance and growth of GBM.

## **Data Analysis and Visualizations of Drosophila Behavioral Phases**

Xiaona Zhou

Prof. Boyan Kostadinov

We analyze drosophila behavioral data from the neuroscience labs of Prof. Maria de la Paz Fernandez, Barnard College of Columbia University, and Prof. Orié Shafer, Advanced Science Research Center, CUNY. The main objective of this project is to create algorithms for analyzing and visualizing the average activity of drosophila across a specified number of days and across all live flies, and use this analysis to calibrate a smoothing filter to be applied to the raw fly activity so that the drosophila behavioral phases can be computed and visualized. We also investigate how to compute and visualize the onset and offset of behavioral phases as well as the trendlines of mid-day fly activity.

## **A STEM-COMD Interdisciplinary Approach to Illustrating STEM Manuscript**

Jennie ZhuPan

Prof. Sara Gomez Wooley

The general perception of undergraduate students is that STEM textbooks are not very interesting, nor appealing. Additionally, the high cost of said textbooks creates an economic burden on student's already stressed budgets. Through collaboration between STEM and Communication Design students and professionals at City Tech, we can change this narrative by adding creative, visually engaging illustrations to an Open Education Resource (OER) soil mechanics engineering textbook. By following a creative process that includes researching the topic of the textbook, planning, brainstorming, character design sketching, and final illustrations, a series of visually engaging illustrations were created to be included in the textbook. During the process communication between the client (STEM textbook author), art director (COMD faculty), and teammate (COMD student) became essential for the efficient exchange of ideas and decision

making. Character design is going to play a major roll when tackling the issue of engagement. Through this process it was decided that comic panel sections would be placed along the text in each chapter's title page. The character design consists of animals that live underneath the soil or deal with soil on a daily basis to create their homes, their hiding spots, etc. For the final product the team produced a cover illustration, alongside 10 half page or full page illustrations (1 per chapter).