



Book of Abstracts

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The Role of Calpains in Tetrahymena Thermophila

Barakat Adigun

Prof. Ralph Alcendor

Tetrahymena Thermophila is a unicellular ciliated Protozoa found in freshwater lakes and ponds. T. Thermophila is an eukaryotic organism that possesses remarkable complexity making it an excellent model for investigating both intracellular and extracellular activities. T. Thermophila has been used to study many biological phenomena such as: telomerase structure and function, cilia biogenesis, and epigenetic inheritance. Calpains are proteins that belong to the family of intracellular calcium-dependent, no-lysosomal cysteine proteases. Calpains are found in a few eubacteria and almost all eukaryotes, but not found in archaeobacteria. Calpain inadequacy can cause a variety of adverse consequences in many different organisms, such as lethality, diabetes, gastropathy, and muscular dystrophies. Although, T. Thermophila genome has been sequenced, the role of T. Thermophila calpains has not been examined. The purpose of this project was to characterize a calpain of choice (TTHERM_00885870) from T. Thermophila using bioinformatics tools. BLAST (Basic local alignment search tool) was used to search for human homologs that may be similar to TTHERM_00885870. Multiple Sequence Alignment such as, MUSCLE (Multiple Sequence Comparison by Log- Expectation), T-Coffee (Tree-based Consistency Objective Function for Alignment Evaluation), and MAFFT (multiple alignment using fast Fourier transform) were also used to search for alignment and close matches. Preliminary results indicate that TTHERM_00885870 might be more closely related to human calpain 16 and 7. More analysis will be done to confirm this similarity and potential functions of this calpain in T. Thermophila

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.

CITY TECH NYCHA ARCHscholars

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Jordon Stennett
Tasfia Amir
Oliver Hadi
Farai Matangira
Josue Perez
Delma Palma
Vaidehi Mody
Tischelle George
Prof. Naomi Langer
Prof. Jason Montgomery

Who are we?

We are a diverse group of scholars ranging in age, gender and background from all over New York City with a common interest in solving the challenges of the built environment. From professors at CUNY CITY TECH to NYCHA Design & Implementation specialists, to NYCHA residents themselves, we encompass a group of scholars united by a common purpose.

What are we here to accomplish?

This team of ARCHscholars is working collaboratively, sharing lived experiences, creatively thinking & planning to apply our research discoveries to the proposed design interventions. We seek to address and combat critical issues in order to foster a measurable improvement in community health, understanding, and relationships through enhancing the community at large via housing equity and durability. On the surface, it may seem as though we are seeking to merely enhance a few NYCHA developments through capital improvements. While aiming to keep within a modest budget to implement our proposals, our endeavor is much bigger in scope and impact. Our team believes these improvements will have a direct, indirect, and long lasting positive effect on the community.

How are we doing it?

We have developed architectural and urban proposals that will improve the overall quality and design of our case study developments: Whitman and Ingersoll Houses in Downtown Brooklyn. We visited both with NYCHA experts to discuss, observe, and analyze their current condition in order to help us understand the changes that we seek to implement. We then met weekly as a team to curate ideas and discuss the process of developing specific proposals.

What have we found?

During our regular meeting sessions, we concluded that our approach to improving the quality of life within NYCHA developments requires us to address issues on different scales. From urban design/site plan (large scale) to urban agriculture/greenhouse installations (medium scale) to architectural/senior center improvements (small scale). These three contributions will provide a more holistic approach to the concept of “a unified community”.

Site Plan

The overall site plan takes into consideration our site analysis of existing conditions. We are most concerned with reinforcing and enhancing existing landmarks such as the senior center, library branch, and historic neighborhood church. The site plan proposals seek to solve existing

challenges impacting pedestrian safety, prioritizing pedestrian traffic flow across the developments. The design also calls for the implementation of several nodal points for areas of social interaction. The site plan seeks to enhance landscape spaces, add entrance plazas and control the flow of human/vehicular traffic. All of this works to reinforce the identity of the existing community while looking for opportunities to improve connectivity to the surrounding neighborhoods.

Green House

The Greenhouse proposal would entail addressing issues at a multi-dimensional level. One of the primary goals of the greenhouse would be to help the NYCHA community engage with urban farming to mitigate food insecurity and unemployment while providing educational and career development opportunities right at the community's doorstep. The location for the greenhouses would be targeted to fill the existing under-utilized spaces located between the edge of the buildings and the fenced walking/vehicle paths.

Senior Center

Our proposal for the renovation of the existing Whitman Senior Center will advocate for a new and elegant design for the building and its users. To achieve this we are introducing larger windows, which will allow for better natural lighting and ventilation. In an effort to make the building safer, we plan to replace the existing deteriorating skin with new materials. This will positively affect the health and wellbeing of the seniors and other visitors. Lastly, we are improving the resident connection from the interior of the building to the exterior by programming the space more appropriately to the residents and directly connecting the seniors to the ecological and physical benefits of gardens.

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.

Smart scheduling for Electric Vehicles' charging needs

Mamadou H. Balde
Prof. Yu Wen Chen

The surging development of Electrical Vehicles (EVs) and the spread of their use within the middle class creates a novel and unique demand for the electrical grid, because on one hand, the charging of EVs is time consuming, and on the other hand, the charging stations are in disequilibrium with the projected rising use of EVs in response to the necessity of transitioning to green energy. The charging need is assessed based on the EV owners request both in time and

location, the available charging stations and the transient charging time; all of those factors are inserted in the scheduling of EV's charging. Moreover, convenience and proximity of charging stations in crowded areas are additional contributors to this enigmatic task. In this work, an effective scheduling system is sought based on predictable consumer behavior and available consumer requirements. Moreover, the results of a simple simulated design in Matlab are presented to verify the feasibility of the charging schedule that this work delved into. The simulation results proved that smart scheduling is a must-have tool for efficient use of the available charging stations and for optimum consumer satisfaction specially in times of high demand.

AR-Emergency Virtual Service

Reshma Begum

Saira Nazar

Prof. Marcos Pinto

The purpose of this research is to understand how Augmented Reality (AR) which is a variant of Virtual Environments (VE), can help people in their daily lives. AR allows any person to experience real world embedded with virtual objects either superimposed on or composited with. This project delves in the perplexities of advanced computer vision algorithms. AR technology uses the synchronized localization and mapping SLAM: a computer image algorithm that contrasts visual features between camera structures to map and path the environment. Along with sensor data from the smartphone gyroscope and accelerometer, it is possible to accomplish very reliable tracking. The AR frameworks such as ARKit (iOS, Apple) and ARCore (Android, Google) implement the computer vision algorithms for tracking and mapping. AR can be generated with a marker or in some cases it does not need one. AR technology can be of assistance in numerous fields such as healthcare, media, industry, marketing, etc. For example, in the healthcare field AR can be used for staff training, patient treatment, medical marketing, and disease awareness. An AR app is included in the project for instantiating the AR experience.

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).

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

Games Of Strategy

Keven Cruz
Prof. Ariane Masuda

A game of strategy refers to a game in which two opposing players choose their own ideal strategies in order for players to reach their main objective. We do this by using concepts from linear algebra and statistics, such as matrix techniques and expected value. We can use this very same concept to find out the effectiveness of two vaccines on a disease with two viral strains that has spread throughout a population. We demonstrate how this is done in a simple scenario by using a theorem that provides the optimal strategies for a 2x2 matrix game.

Internet Search Engine

Allan Emmanuel
Prof. Ariane Masuda

Search engines are designed to carry out web searches from the world wide web. The first internet search engine software was created in 1990. Today, some of the most popular ones are Google search, Yahoo! Search, and Bing. They are some of the most visited websites on the internet and are useful at recommending links based on some of the keywords that a user type. This project will focus on using linear algebra to rank website from the most visited to the least visited.

Paint The City

Juan Estrella
Prof. Farrukh Zia

Paint the City lets you create, share, and discover street art in augmented reality. Imagine having a secret world hidden in your phone where you are free to express yourself and develop a community full of potential friends.

CREATE

Choose from a variety of colors and brush sizes to create your masterpiece, we give you the tools to be as detailed as possible!

SHARE

When you are done you can publish your work which will be shown to people passing by. You can also share it with your friends and create your own private art gallery. All of your work is owned by you so no one can steal your credit.

DISCOVER

The world is your newsfeed, find artwork or secrets that people have created in your area. Leave a like or comment to show appreciation and make new friends.

Characterizing the role of Calpains in *T.thermophila*

Tayna Gebhardt

Prof. Ralph Alcendor

Tetrahymena thermophila is a multi-nucleated, unicellular protozoan found in bodies of fresh water. Combined with its short life-cycle, the presence of two genomes within *T.thermophila* make it an ideal organism to study. There has been extensive work done on *T.thermophila* in areas of cell division, programmed nuclear death, and evolutionary phylogeny, all of which has broadened and enriched knowledge of more complex eukaryotes. Calpains are a type of calcium-dependent cytosolic protease expressed in all mammals. They are important in intracellular calcium-regulated mechanisms and play a role in apoptosis. One reason calpain activity is significant because of its role in the growth or degradation of muscle which can contribute to the development of certain diseases such as muscular dystrophy. The genomic information found in the macronucleus of *T.thermophila* is responsible for the organism's genotype and phenotype. And although this genome has been sequenced, more examination of the role of calpains is necessary. The objective of this research is to characterize a particular calpain in *T.thermophila* using bioinformatics computer software and to discover potential similarities. This research will focus on the THERM_00387030 protein. Characterization of this particular calpain will be done by utilizing various alignment software such as NCBI basic local alignment search tool (BLAST), molecular evolutionary genetics analysis (MEGA), and visual molecular dynamics (VMD). The initial findings indicate a close relation between THERM_00387030 and calpain-15 and calpain-14 found in humans.

Using Statistical Analysis to assess PM2.5 Pollution

Baohua Huang

Prof. Nan Li

Climate change and air pollution is a major issue worthy of attention at the moment. With the gradual development of industry in developing countries, the problem of industrial and air pollution has become more and more serious. The most common pollutant for air polluters is PM2.5, a kind of fine particulate matter, which floats in the air. It is easily inhaled by people and slowly accumulates in the human lungs, causing diseases. Most of the PM2.5 comes from the burning of coal, oil, and rubbish. However, the concentration of PM2.5 maybe influenced by various weather conditions. We analyze the PM2.5 readings and meteorological records of Beijing in China from 2010 to 2015. The PM2.5 pollution index of these cities can be analyzed through statistical methods. We construct and compare models using Lasso regression and Decision tree respectively to demonstrate the relation between the event and its causing factors.

Disinfection Station for Face Masks (Software Implementation)

Jennifer Islam

Prof. Farrukh Zia

As the world currently faces a global pandemic where anyone can get sick from COVID19, one way for people to stay safe from the general public is by wearing face masks. This project involves the design, construction, and testing of a disinfection station device for face masks where the user can clean and dry their face masks in order to make them safe to be used multiple times. The device consists of a temperature & humidity sensor (to measure the temperature of water), push button, potentiometer, servo motors, DC motor, and LEDs attached to an Arduino UNO. This device follows a finite state machine approach, where it uses a push button to move from one state to another. In the first state, it will turn the servo motors to move the tray of face masks down and back up to a box filled with water to wash the face masks. In the second state, it will turn the DC motor using a potentiometer to dry off the face masks. During the operation of the device, different LEDs will emit different colors to show different states of the program. Additionally, by using data communication with the PC Serial Monitor, the same actions can be performed as the push button, to go from one state to another, if the user chooses to not use the push button. This project will undergo troubleshooting by using sample codes to test the hardware components. By the end of this project, a complete documentation of the project will be recorded in a poster format. Due to the world having to face COVID-19, now is the time to show the importance of creating devices such as this to stay safe and healthy. This project was inspired by a similar device created by Jean Noel Lefebvre.

Impact of Sex in Luxury Fashion Advertisement on Brand Attractiveness And Identification

Jessyca Jones

Prof. Alyssa Dana Adomaitis

This study examined perceived brand attractiveness of and identification with fashion luxury brands given different levels of sexuality in advertisements. Sex in advertisements has become increasingly more common to generate attention and interest in fashion luxury products with limited research on its influence on the consumer. A sample of 1266 males and females completed a survey on brand attractiveness and identification after examining an advertisement of a luxury fashion product. Participants were assigned an advertisement that featured a same-gendered model at one of four levels of sexuality (fully clothed to nude). The results indicated less sexuality in luxury advertisements was better in generating attractiveness to and identification with the brand. These findings are important to scholars and marketers of luxury brands. The development of relationship marketing is formidable in this study as one questions the value of societal trends, what will increase shock value and the maneuvers luxury brands take to maintain longevity.

Body Movement Based Control

Angelika Kocab

Prof. Farrukh Zia

This research project involves design and implementation of a motion sensor based Assistive Technology device. The project will enable a person with a disability to interact with a device or

a child can use it to interact with a toy or a game. Computer hardware and software will be used in combination with motion and distance sensors with a micro-controller. This project will be completed in several phases including background research, hardware design, software implementation, testing and troubleshooting and complete documentation.

Understanding of Aerosol Transmission of COVID 19 in Indoor Environment

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 over-crowding 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.

The History and Impact of the BQE on the Williamsburg Neighborhood of Brooklyn

Tiffany Zhang

Pamela Lopez

Prof. Michael Duddy

The Brooklyn-Queens Expressway (Interstate 278), originally known as Brooklyn-Queens Connecting Highway, allows automobiles to travel between the Gowanus Parkway and the Triborough Bridge. Referring to a map of the boroughs of Brooklyn and Queens, the BQE highway runs along the shoreline until it reaches the Brooklyn Navy Yard where it cuts through the Williamsburg neighborhood. The research project objective is to determine why the Brooklyn-Queens Expressway follows this path through Williamsburg, and to investigate its long-term effects on the community. We begin the project by gathering newspaper archives and modern articles to understand the purpose of constructing the highway, the powers that made it happen, and its impact on the neighborhood. This project involves building an understanding of

the historical background surrounding the conditions both before and after the Brooklyn-Queens Expressway in the neighborhood. We conclude by imagining a principal aspect of New York's envisioned future – diversity, inclusion, and equity. Even though past and future generations benefit from the highway's construction in Williamsburg, it destroyed a once lively neighborhood. The findings will help aspiring architects become more aware of how their design implications can impact the surrounding community

Data-driven Indoor Localization in the Internet of Things

Shervorn Mathews

Prof. Li Geng

Indoor localization is difficult because of issues regarding the physics of signal propagation and multipath interference. Satellite-based technologies such as Global Positioning Systems (GPS) are unreliable indoors due to the signal attenuation during propagation and the multi-path interference. A data-driven process using the massive amounts of data available in smart devices may be the solution to this problem as they don't rely on sophisticated indoor propagation models like traditional methods. The emergence of methods in machine learning society can be used to fulfill this task. The objective is to estimate the location of a person in a room using Received Signal Strength Indicator (RSSI). A public dataset containing the location of 13 iBeacons and their RSSI at various locations was used to accomplish this; the dataset consisted of one labeled set and one unlabeled set. The labeled set is used to train a machine learning model and the unlabeled set is used to evaluate the performance of the trained model; training the program to read the dataset should eventually lead to it being able to tell where a person is in a room given a unique dataset. The first phase of this project is to explore the feasibility of using data-driven approaches by visualizing the data then finding the correlations between the locations and the RSSI values. This has many applications such as alibi confirmations, asset tracking and contact tracing illnesses like Covid-19.

The Role of Calpains in *T. thermophila*

Olorundamilola Okemeta

Prof. Ralph Alcendor

Tetrahymena thermophila is a model organism in biomedical research. *T. thermophila* belongs to a ciliated Protozoa, a major, ecologically successful monophyletic group of unicellular eukaryotes and freshwater organisms that inhabits streams, ponds, and can be found almost everywhere. Calpains are a family of ever-present expressed calcium-dependent, non-lysosomal cysteine proteases. Calpains are involved in apoptosis, cellular proliferation, and cell motility. The functional role of calpains was also found to be associated with myogenesis. Calpains are found in almost all eukaryotes and some bacteria, but not in archaeobacteria. While mostly calcium-dependent, calpains may also be activated through ERK-mediated phosphorylation.

Although the genome of *T. thermophila* has been sequenced, little is known about the function of calpains in *T. thermophila*. This project is involved in characterizing calpains found in *T. thermophila*. To select which calpain to work with, the human calpain I amino acid sequence was used to search for calpain genes in *T. thermophila* by searching the *Tetrahymena* genome

database found on ciliate.org. TTHERM_00259450 was selected and a Blastp search was done using NCBI BLAST to identify which human calpain TTHERM_00259450 was more similar too. A graphical summary of the BLAST protein sequence also helped see the top selection of proteins producing significant alignments (Homo sapiens) along with the protein-coding genes, TTHERM_00259450. Multiple sequence alignment tools such as [MUSCLE](#), [MAFFT](#), MEGA X, and [T-COFFEE](#) were used to further analyse the similarity between the selected protein, TTHERM_00259450, and the human calpains. Preliminary analysis suggests that TTHERM_00259450 may be more related to human calpain-1. It is, therefore, possible that TTHERM_00259450 may share some functions and structures that are alike to that of human calpain-1.

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

Jennifer Padilla

Prof. Subhendra Sarkar

Man made or naturally abundant ionic complexes from industrial or natural origin may have significant toxic effects on human health and on plants. This includes medical imaging agents that are creating toxin build up in our body as well as in ecosystem. This project involves MRI experiments designed at 3T which is considered to be a high field and were performed at Advanced Science Research Center/CUNY and at McLean Hospital, Boston involving three research 3T Siemens MR systems at comparable hardware and software configurations to distinguish the nature and distribution of such toxins in mineral rich fruits and vegetables as carbohydrate matrix and in poultry as the animal cell models. Interaction of disordered proteins and carbohydrates with electron rich and electron deficient ions (lanthanide and tri-iodo complex) are from MR images and from relaxation time measurements. The results indicate probable transmetallation (exchange of lanthanides with bulk metal ions in the samples) and chelation by the ligands in infused contrast nanomaterials. This is the first demonstration of transmetallation using magnetic resonance imaging in biologically unaltered fresh samples that demonstrates modification of biometal pathways due to toxic external molecular complexes.

Keywords: High-field MR, Lanthanide, Nanomaterials, Toxicity, ASRT

Computer Graphics

William Pollicino

Prof. Ariane Masuda

The objective of this project is to explore the critical elements of Linear Algebra that are used in Computer Graphics. Through the manipulation of algebraic matrices, three-dimensional images undergo the transformations of rotation, translation, and scaling to obtain new views of said image. An image or object is represented by an xyz-coordinate system, which is split into n number of straight-line segments with respective endpoints. When scaling an object along the x, y, and z directions, the coordinate system matrix of the image is multiplied by a diagonal matrix which includes the factors of scaling required. When translating an image, the matrix of the original position is added by the translation vector, which specifies the new coordinates of the

image. Rotating an image requires the use of the trigonometric functions sine and cosine, in which a rotation matrix including the functions along with angles of rotation is multiplied by the original coordinate matrix. In the project, these transformations are implemented using the GeoGebra software, which will provide a visual depiction of how these transformations are used to affect an image.

Using Interactive Math Applications to Model Concepts in Linear Algebra

Jake Postiglione

Prof. Ariane Masuda

We are uniquely situated in our mathematical virtuosity to analyze the juxtaposition between modern and ancient techniques in mathematics. Utilizing our modern tools, mathematicians have been able to solve complex problems that may have otherwise been impossible to solve for our ancestors. Using modern technology, we also have an advantage in constructing learning models that better convey the numerical relationships behind many modern methods. This research looks at the differences between the ancient and modern techniques of linear algebra, to learn about the influences in building the tools we use today, and how ancient techniques and concepts can be modeled using interactive software. Specifically, we look at a method that predates Gaussian elimination and was used to find the proportion or distribution of values of a linear system. In examination of the similarities and differences between the two methods, we look at the intuitions used in developing each of them and how understanding the development of each method may lead to a deeper understanding of how to apply these concepts

Research in Recent Trends in Fundamental and Applied Physics and Quantum Computing

Olga Privman

Prof. German Kolmakov

Quantum computing, artificial intelligence, machine learning – these are all highly engaging, though oft-mysterious fields. Graced with the mystique of quantum mechanics, its applied offspring – quantum computing – is often subject to the same scientific misinformation, with many articles on the internet providing a false and often intentionally misleading depiction of the science. This project focuses, then, primarily on research in recent trends in fundamental and applied physics, with a focus on quantum computing. The outcome is an electronic newsletter published on OpenLab by the end of the Spring 2021 semester, each issue of which will contain no less than seven accurate and reputable articles about quantum computing and related fields. The purpose of this newsletter is to provide reliable information to students, professors, and the general public about this innovative and often mysterious field. To make them more accessible, each article link contains an originally-written blurb to contextualize information. Information for the newsletter was found, researched, analyzed via scientific and academic articles on the internet, open-source journals, and journals accessible through the City Tech Library.

Markov Chains and the PageRank Algorithm

Pratima Roy

Prof. Nadia Benakli

Why is Google the most used search engine? The answer lies in the power of the PageRank algorithm which assigns a rank (a numerical value) to a webpage. This algorithm is used by Google to calculate the importance of a webpage based on incoming links, with the assumption that links from important pages should count more than those from less important pages. In this project, we will explore how concepts from linear algebra can be applied to acquire an understanding of the PageRank algorithm

Applications of Randomness in Finance Names

Daanial Ahmad

Jose Armando Sanchez Diaz

Prof. Satyanand Singh

We are going to discuss Brownian Motion which is also considered to be a Wiener process and can be thought of as a random walk. We will briefly discuss the fluctuations of financial indices and relate them to Brownian motion and the modeling of stock prices.

Disinfection Station for Face Masks (Hardware Implementation)

Lubna Sharmin

Prof. Farrukh Zia

As the world currently faces a global pandemic where anyone can get sick from COVID19, one way for people to stay safe from the general public is by wearing face masks. This project involves the design, construction, and testing of a disinfection station device for face masks where the user can clean and dry their face masks in order to make them safe to be used multiple times. The device consists of a temperature & humidity sensor (to measure the temperature of water), push button, potentiometer, servo motors, DC motor, and LEDs attached to an Arduino UNO. This device follows a finite state machine approach, where it uses a push button to move from one state to another. In the first state, it will turn the servo motors to move the tray of face masks down and back up to a box filled with water to wash the face masks. In the second state, it will turn the DC motor using a potentiometer to dry off the face masks. During the operation of the device, different LEDs will emit different colors to show different states of the program. Additionally, by using data communication with the PC Serial Monitor, the same actions can be performed as the push button, to go from one state to another, if the user chooses to not use the push button. This project will undergo troubleshooting by using sample codes to test the hardware components. By the end of this project, a complete documentation of the project will be recorded in a poster format. Due to the world having to face COVID-19, now is the time to show the importance of creating devices such as this to stay safe and healthy. This project was inspired by a similar device created by Jean Noel Lefebvre.

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.

Tracking the Queens Civic Center

Albert W. Vargas

Prof. Michael Duddy

The Queens Civic Center has been the subject of a long legal, and public battle dating back to 1930. The multitown dispute on which Queens's town should get the Civic Center, has caused a significant pause in the project's potential location but also the much-needed economic development for the community which is awarded the project. The Civic Center's advantages would effectively add value to both public space and much-needed courts into these neighborhoods which will provide thousands of jobs to the area chosen for this project.

This study traces the history of the Queens Civic Center, revealing several visions for locating elaborate civic designs in several neighborhoods of Queens. In the end, the Civic Center's eventual form was made because of the city's attempts to keep the project's building costs down while meeting the demands of the citizens within Queens. The intertwining of politics, power, and the needs of the community makes the Queens Civic Center a case study in the making of public architecture in the United States.

Use of Recycled Whole Textile Fabric for the Shear Strength Enhancement of Soil

Shaylin Venitelli

Prof. Ivan Guzman

Soil reinforcement is a practical and feasible means of soil stabilization. There are many applications and methods throughout the modern engineering industry. As of recently, the inclusion and utilization of recycled textile has been a focus of soil reinforcement practices. Both manmade and natural fibers have been tested in laboratory and real-world applications. Unfortunately, non-homogenous mixtures are often the result of in-situ application, resulting in industry wide deterrent from the potential practice. The study is attempting to determine the

improvements in soil strength parameters with the addition of whole recycled textile fabrics. Literature review will help stimulate and direct the physical testing in laboratories. Avenues of review will promote discussion on materials that can be tested in the laboratory as well as laboratory techniques employed.

Edge Detection and Convolutional Neural Networks

Xiaona Zhou

Prof. Boyan Kostadinov

We studied how edge detection could be done with convolutional operation. We rewrote the algorithm from scratch in R and compared edge images resulting from different filters, such as Sobel filter and Scharr filter. For a better edge detection outcome, we studied the five steps procedure in Canny Edge Detection in detail and rewrote the code from scratch in R again. We plan to learn about convolutional neural networks and implement some of its applications, such as car detection and face recognition.

A STEM-COMD Interdisciplinary Approach to Illustrating STEM Manuscript

Jennie ZhuPan

Jasmyn Cooper

Evelyn Ng

Prof. Sara J. Wolley

Prof. Ivan L. Guzman

The general perception of undergraduate students is that STEM textbooks are not appealing to those who are not in the field. Additionally, the high cost of said textbooks creates an economic burden on student's already stressed budgets. Through collaboration between STEM and Communication Design (COMD) students and professionals at City Tech, we can change this narrative by adding creative, visually and intellectually engaging illustrations to an Open Education Resource (OER) soil mechanics engineering textbook. During this two semester project, communication between the client (STEM textbook author), art director (COMD faculty), and teammates (COMD students) working process became essential for the efficient exchange of ideas, sharing of research, and decision making. To explain and add humor to this manuscript on soil mechanics, COMD Students have designed a cast of characters which are animals that live underneath the soil or deal with soil on a daily basis to create their homes. This semester the team is producing a final cover art, a title page illustration, alongside 10 half page or full page illustrations (1 per chapter).