



Book of Abstracts

The Emerging Scholars Program

Spring 2023

Supported by

New York City College of Technology

CityTech Foundation

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Black Male Initiative (BMI)

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Polyethylene Glycol Diacrylate Degradation Rate Studies

Aaryan Nair, Freddy Ortega, Ian Simpson, Naeem Kotadia
Prof. Ozlem Yasar

In the field of tissue engineering, the scaffold is the foundation structure that provides the desired mechanical support for the tissue being engineered, the surface for cells to attach and spread, and access for nutrient transport crucial for cell viability. The scaffolds are 3D building blocks that are designed and fabricated precisely prior to their implantation to the host tissue. When scaffolds with the desired shape and size are fabricated, they can be seeded with cells and appropriate growth factors. After cells show healthy growth within the scaffold, they are implanted into the body with the scaffold to allow full-scale tissue regeneration.

In this research, photolithography is adapted as a fabrication method to generate PEGDA-based structures. In this method, ultra-violet (UV) light is reflected on PEGDA and as a result of the interaction between UV light and precursor solution, PEGDA turns into solid form.

Despite the potential of PEGDA in scaffold applications, the mechanical properties have not been studied to a great extent. Therefore, in this project, the mechanical characterization of PEGDA was conducted for various polymer concentrations. Specimens with 20%, 40%, 60%, 80% and 100% PEGDA to water ratio were prepared for compression tests. Our preliminary experimental data results show that mechanical properties of PEGDA can be controlled by changing the PEGDA to water ratio. Stronger and stiffer structures can be obtained with high PEGDA concentrations while softer structures can be fabricated with reduced PEGDA concentrations.

Identity Only Politics as Technologies of Power: Latinx Population in the United States and the fight for Electoral Sway

Aayiana Marrero, Emily Bieber, Sahar Nasim
Prof. Xavier Moyssén Álvarez, Arturo Humberto Enamorado III

This research aims to understand the ways in which the Latine identity electoral strategies are being used as a technology of power to reinforce the white-supremacist system in American politics. Through critiquing identity politics pertaining to sexuality, the Muslim diaspora, and the Black feminist identity, we define a shift of identity politics, to something we refer to as the *identity-only* politics. As such, this discourse has been co-opted as a tool utilized by politicians that aids in maintaining a white-dominant society. It is important to note that the concept of identity politics is not necessarily problematic in nature, our issue is explicitly *identity-only* politics: both the democratic and republican party use the Latinx identity as a selling point for electoral purposes. Furthermore, after analysis of the states with a high Latinx population, it is evident that a vast majority of political candidates, who used a Latino-based platform, have swayed the Latinx vote towards the right-wing. This has detrimental effects towards the LatinX community as the conservative party has little to no support for this minority group – immigration restrictions, lack of healthcare, deportation, and low income job opportunities. Finally, utilizing Critical Race Theory as it relates to race-based laws, displays the method in which identity politics is manipulated by the white-supremacist system. Through our research, we have concluded that despite having some representation in American politics, the LatinX community still remains misrepresented in the sense that the large diversity within this population has been disregarded and has been grouped into one category, flattening the national, racial, and ethnic diversity that exists

within the group. The LatinX population is the second largest ethnic group in the United States; however, their misrepresentation in identity politics has led to further ethnic prejudice and maintains their status as a marginalized group in American society.

3D Printing With Lunar Geopolymer

Adrian Mckinnon, Charudatta Mhasde, John Anthony, Maria Hashmi, Brian Rosendo
Prof. Akm Rahman

The way of using concrete to build structure's is the past and the future is using geopolymer made with lunar material . But not just using lunar material . but contrasting with state of the art methods like 3d printing . In order to move a step in the right direction my team and I have two challenges , that being creating a lunar based geopolymer that is not only strong but resilient and modifying a 3d print to withstand the chemical properties of our geopolymer when printing . The first half were tasked with creating a geopolymer sample with two lunar based stimulants along with other chemicals that are able to endure several tests such as compression and tensile tests . Our second task was taking a already existing clay 3d print and modifying it in order to print this new geopolymer . While we are in the walking stages of our endeavor I believe that it could open the gate ways to visions of lunar based structures on the moon or even military application.

Enhancing UI/UX Design and Compliance Regulations with Artificial Intelligence

Ahjahla Murphy, Denitsa Dineva, Malak Alammari
Prof. Patrick Slattery

Artificial Intelligence (AI) is an evolving field that focuses on developing computer systems capable of performing tasks typically requiring human intelligence, such as language translation, decision-making, and speech recognition. AI technologies, including augmented reality, virtual assistants, and robots, have the potential to significantly improve creativity in user experience (UX) and user interface (UI) design. These design aspects play a critical role in the successful development and implementation of AI products and should be considered throughout the AI life cycle.

This research aims to explore the relationship between AI and UI/UX design and its implementations in compliance regulations. It will address the following questions: (1) How can AI be employed to enhance UI and UX design in various industries? (2) What role does AI play in algorithmic compliance regulations, particularly in financial institutions?

To answer these questions, the researcher will investigate existing AI technologies and their applications in UI and UX design. They will also analyze how AI systems can contribute to more efficient and effective compliance processes in industries such as finance. By reducing regulatory breaches and human errors, AI and automation can improve compliance management and risk mitigation.

Through this study, the researcher aims to provide valuable insights into the potential of AI in transforming UI/UX design and improving compliance regulations. The findings will contribute to a better understanding of AI's role in these domains and pave the way for future research and innovation.

Beyond the Egyptian Pharaohs

Aia Mahmoud

Prof. Jieun Yang

The project is designing a museum to showcase the history and culture of Egyptian Pharaohs. Ancient Egyptians showed creativity with their unique colors, patterns, language, makeup, fashion, architecture, and beliefs. Their language, Hieroglyphics, was a form of art that was inspired by nature. Kings and queens are buried in their own sarcophagus, a coffin designed to resemble the person with the hands placed on the chest. The museum includes a main exhibit (“Pharaoh craft”, showcasing sculptures and architecture), two large exhibits (food and origins of Egypt), three small exhibits (hieroglyphics, religion, clothing), and an outdoor exhibit (natural world).

The architecture and design process are inspired by layered patterns and spaces of the ancient Egyptian temples. The architectural plans showcase the hierarchy of different exhibits and public spaces, and the angled geometry helps the reading of the layered spaces. The concrete exterior reflects the massiveness of the Egyptian temples, and glass gaps let light layer through interior spaces.

Mapping the Campus

Alyssa Duran, Wilna Michel, Leslie Munoz

Prof. Anne Leonhardt, Maria Hitchings

The making of maps has been with us since early on in human existence, showing their crucial importance to people’s lives. Some of the oldest known artifacts involve maps that were etched into stone or clay tablets that communicate the location of places of local interest. These early maps focus on local features and descriptions that could help people easily find their way. One of these important and necessary maps is a campus map. A campus map helps the students attending classes reach the necessary classrooms and offices. With the map, the students can maneuver the many buildings and areas to reach where they need to go. For this project, we are going to use maps and data to create a campus map for the New York City

College Of Technology. With the maps, we are going to create a map of the general overall campus and then one for the Voorhees building. With the use of the programs Rhino 7, Illustrator, and ArcGIS Online we can create maps that will be beneficial to the students. For the general maps, we will create one that shows the whole campus, the entrances for every building, parking, transportation, and Accessible entrances. Then we are going to create a larger map showing the important and necessary icons that students will need. For example the Financial, Bursar, and Admissions offices. All the offices that freshmen students might need for everyday college life. For the Voorhees map, we will have a 3D rendering of the Voorhees building and show the floor-by-floor layout of the building. We started by laying out the ideas we had for the map in ArcGIS Online, which is an online mapping software. When we had an idea of what we wanted each map to look like and the information we wanted, we extracted the 2D map lines from Rhino. After that, we added the colors and created the icons in Illustrator.

ARCscholars

Amal Toaimah, Catherine Valenzuela, Erickson Diaz, Kaylynn Daoud, Kevin Valencia, Vincent Zheng, Sofia Bilbao
Prof. Naomi Langer-Voss

ARCscholars is a diverse group who shares a common interest in solving urban challenges through studying and proposing improvements to the built environment. From professors at CUNY City Tech to NYCHA Design & Implementation specialists and NYCHA residents, we encompass a group of scholars united by this common purpose.

We developed an architectural and urban proposal that will enhance the overall quality and design of our case study development: the NYCHA Marcy Houses, located Bedford–Stuyvesant Brooklyn NY. Our research included a comprehensive site investigation, multiple informative discussions with the Resident Leaders at the development, an understanding of planning issues, and weekly design workshops at the City tech Campus.

Our design is focused on three main categories of development: *Roof Design*, *MActive*; *overall site strategy*, and *Placemaking*.

Can We Correct Diffusion MRI Data for Alzheimer’s Using Magnetic Susceptibility of Geriatric Brain Iron?

Anam Riaz, Anjalee Rabbani, Jennifer Padilla
Prof. Subhendra Sarkar; Duke Shereen

Alzheimer’s disease (AD) is a chronic neurodegenerative disease characterized by the presence of the two neuropathological metal protein makers: amyloid beta (A β) & intracellular neurofibrillary tangles primarily in the gray matter regions of the brain leading to cognitive dysfunction. Exposure to high metal ions such as iron effects leads to protein aggregation and oxidative stress levels, leading to neuronal loss in the AD brain. It is established that abnormally raised brain iron levels contribute to AD in which iron accumulation results in iron death or cell death and leads to cognitive deficits. Magnetic resonance image techniques have shown a consistent correlation between cognitive dysfunction and iron deposition mostly in the hippocampus, cortical areas and basal ganglia. Diffusion MRI data and magnetic susceptibility measurements provide complementary information and composition, and both can be affected in AD. Changes in brain iron levels can affect magnetic susceptibility measurements and diffusion MRI data. Magnetic susceptibility is a measure of how a material responds to a magnetic field, and it can be influenced by the concentration and distribution of iron in the brain. MRI can also detect abnormal iron accumulation in the regions of the brain which can be associated with various neurodegenerative disorders such as Parkinson's Disease, Alzheimer’s disease and Multiple Sclerosis. Accumulation of iron is a hallmark of aging and neurodegenerative diseases.

Employment Restrictions and Psychosocial Distress Among Immigrant Women in the US

Annique Matthews
Prof. Smita Dewan

The focal point of this project is to explore the relationship between employability

restrictions including the type of employment restriction, the length of the type of time of unemployment, and the participation in voluntary activities in the aspect of the psychosocial well-being of immigrant women. This research aims to highlight the mental health of immigrant women who are qualified to be in the workforce but are diminished in their domestic roles.

All mental health requires more concern as it has the ability to halt work performance, and the responsibilities in one's life and can bring about sickness if it is allowed to be in a poor state. This is able to be conducted through an extensive review of findings that reflect the experience of immigrant women after they have relocated to the United States. The different ethnic origin of immigrant women is a variable that was frequently looked upon as the United States has become a largely diversified nation. The findings will focus on mental health outcomes for women who are unable to work due to employment restrictions. Through the use of organized research, we can begin to go beyond the raised questions and start taking action on the necessary change in the employment industry sector. The presented findings will signify why the redirection of the mental health of immigrant women is a prominent problem in the U.S. concerning the inability to assimilate into the workforce as well as the prior and after challenges.

National Heroism

Antonio Forbes

Prof. Elizabeth Parks

I was born on a small famous island, Jamaica. A country that's known for many things: agriculture, language, fashion, music, and more. What the glossy advertisements don't show you is how hard it was for Jamaica to become this place of tourist attraction. The amazing things that bring people there also cause hardships. These hardships were spearheaded by our founding fathers and mothers of the land, people who fought, bled, and died for the prosperity of this small island. We regard them as Jamaica's National Heroes and Heroines. I want to shed some light on some of these heroes and heroines, those I find significantly important to the culture of Jamaica, and also those who represent black leadership and black power. There are four people specifically that I believe to be the best example of black leadership

and power. First is Jamaica's only National Heroine, Nanny of the Maroons. During the beginning of the war in Jamaica, Nanny was a woman who was no slave but was a respected and outstanding leader as well as the known spiritual leader of the "Windward Maroons" in the 1740s, they were a group of female warriors. She was also known as the queen of a forest, as she was unbeaten in them. She was known as a symbol of unity and strength to the people of Jamaica. Second is Samuel Sharpe, a slave named after his master. Known as Sam Sharpe of Montego Bay, he led the slave rebellion in St James, which led to the abolition of slavery in the 1830s. Third was Sir Alexander Bustamante, a man who went abroad to learn about the world we live in. After his travels, Bustamante returned to Jamaica and could see that the country was

too unstable and unorganized. He took it upon himself to incite change and form one true government. He started the political party Jamaica Labor party (JLP) and later became the first Prime Minister of Jamaica in 1962. Fourth is Norman Manley. Manley was active during the same time as Alexander Bustamante, as they were two edges of the same sword. Norman Manley started the People's National Party (PNP) and ran in the election against Sir Alexander Bustamante. While he didn't become Prime minister, he moved Jamaica towards internal self-government in 1959 and then later Jamaica became an independent country in 1962.

All of these powerful black heroes and heroines created different narratives for the

prosperity of Jamaica. Each of them showed outstanding leadership that went beyond them, putting the country first and allowing it to flourish for further generations. I believe it is important for us to study and research these black, powerful, and once influential people because there is so much we can take away from their history. By studying them, we may be able solve current world problems such as, proper leadership.

Instead of focusing on the negatives, let's pay more attention to their positives, they stepped up and faced the horrors ahead with fierce leadership. By not dwelling on the struggle, we fully acknowledge the brilliance of these people, not letting the negative define their success is what it means to be black excellence.

Education AutoEthnography

Asset Mballo, Edgar Castillo

Prof. Mery Diaz

This research highlights the overall impact of COVID-19 on college education on first-year students at CUNY specifically those who come from abroad. COVID made a lot of people feel isolated and with so many other options at that time, it made some students lose hope in education which caused a significant amount of dropout or failing semester.

For this research project, I will examine the impact of the COVID-19 pandemic on the experience of starting college. I think it's important as there have been a lot of changes that came with the pandemic. One of those is typical college experiences and the value of going to higher education. The reason I am interested in these research questions is because I believe I have experienced the impact of studying during the pandemic and I am interested in analyzing myself to see what the outcome is and how it changed my perspective as well as what will be a possible solution to this. I will be using autoethnography to help answer this question as I am able to use my own experience to offer insight into the problem and also analyze the impact and effect from a personal point of view. Autoethnography is a form of research that consists of analyzing yourself. As a researcher and student, I believe this is the most effective method to study my experience and find the impact and what solution I want to obtain from it.

Compton or Inelastic X ray Scattering in the Presence of Iodinated and Gadolinium Contrast Media May Image Surface States or Texture in Bulk Animal Protein Matrix

Ayesha Arooj, Derby Desir, Robert O'Brien

Prof. Subhendra Sarkar

The use of X-ray imaging in medical diagnostics and research has significantly advanced in recent years yet challenges still exist in accurately detecting and characterizing certain biological tissues, particularly those containing minerals such as iron and copper. In this study, we explored the potential of copper and iron nitrate filters to modify X-ray images by inducing multi-energy broadening of incident X-ray beams in the 20-36 keV range. Our research has the potential to expand the use of Fe and Cu nitrate filters in medical imaging, particularly in studying the rough surfaces of cancer cells. By using highly scattered X-ray beams in low-energy CT and mammography machines, we can more accurately capture the unique features of these surfaces, which can be indicative of cancer growth and progression. By introducing heterogeneity and texture of bulk medium, we hope to explore the surface effects of the filters and improve the detection of abnormal texture or minerals present in cancer cells, leading to more accurate diagnoses and better treatment options. Our hypothesis was that biological tissues containing Fe and Cu complexes as biominerals may absorb X-rays differently if the beam has

various energies matching the energy levels in Fe and Cu-rich areas. Through our experiments using Fe and Cu nitrate salts intermixed with alkali halides as filters, we observed energy broadening of incident X-ray beams. In addition to introducing heterogeneity, we are extending atomic Compton scattering to molecular crystals. Since human tissue works with Cu and Fe complexes, we have selected nitrate salts for in vitro experiments. They both have many valence electrons in the molecular orbitals. Fe(NO₃)₃ has one more NO₃ group than Cu(NO₃)₂ and perhaps why showing more anisotropic Compton scatter. This will be explored further since brain tissue uses anisotropic communication based on electromagnetic waves in well-designed balance of Cu and Fe homeostasis for which our results may be applicable. Our findings could contribute to the development of new contrast materials and imaging methods for use in diagnostic and exploratory procedures in medicine.

Enrollment trends in Radiologic Technology Program at City Tech for X-ray vs Others Imaging Modalities

Bich Pham

Prof. Lillian Amann

Last semester, we conducted a survey to better understand the incoming student body from the Radiologic Technology and Medical Imaging Program at New York City College of Technology - their interest before they completed the first semester in the program, and if they consider the Radiologic Technology and Medical Imaging Program as a stepping stone to other radiologic modalities. This semester, we continue our research by following the same group of students through their first clinical rotation and learning if-and-how this experience affected their future career plans. In the first semester of the program's clinical rotation, the students are only introduced to the X-ray department for hands-on experience with real patients. After working in the hospital, did it increased their desire to stay remain an X-ray technologist, or did it steer them towards other imaging modalities?

Data was collected from the remaining students in the Radiologic Technology and Medical Imaging Program. This survey gathers basic demographic information from the students, including their age, gender, and ethnicity. We also asked the students about their clinical rotation experience and how it felt working with real patients. The research showed that the Program will produce approximately 20 radiographers who are willing to remain radiographers for their entire career. The other students will move on down their career path and will likely consider the bachelor programs available at New York City College of Technology.

The Deception of Social Media

Bryant Ariza

Prof. Elizabeth Parks

The purpose of this research is to focus on how social media can be manipulated to alter an individual's opinion towards a certain topic or issue. An estimated sixty percent of the population use their social media applications for more than two hours each day. It is important to identify what is being displayed and spread across our screens. There will always be bias in the media. However the ability to know the full or both sides to the story can affect what we can consider as an appropriate response. Because anyone can post on their social media profiles the vulnerable are more exposed to receive inaccurate information. Large companies capture their audience, through displaying the news or their interpretation of their side of an issue. The way we think and feel have a great impact on how we perceive and favor a side. Dr. Michael Worksman, an associate professor of tech management, has researched the topic and discovered that when searching for something

new of a specific subject, there is a higher tendency of swaying one's opinion. On the other hand, when a person follows their own principles they tend to stick with their information and only look for data that will back up their case. There are many websites that evaluate information based on how reliable and accurate it is. There are other sites that address the left and right sides of current topics. Through my research I expect to be able to make a more reasonable and fair-minded decision when expressing my perspective towards a topic. The tools I gain can be shared with others, allowing them the ability to express their opinion based on accurate data. As a society we must acknowledge the amount of information revolving around us. The ability to separate facts from fiction can help open our minds to alternative interpretations.

Exactly Solvable Two-Body Problem in Two-Dimensional Quantum Mechanics

Claudio Malvino, Jianning Luo
Prof. Roman Kezerashvili

There are a multitude of solutions that are known for three-dimensional two-body problems for various potentials, such as Coulomb and harmonic oscillator potentials, in quantum mechanics. This is not the case for two-body problems in two-dimensional quantum mechanical systems. With the advent of two-dimensional materials, such as graphene and monolayer transition metal dichalcogenides, the need for solutions of non-relativistic two-dimensional quantum mechanical systems increases. We will be showing how to make the transformation from a three-dimensional configuration non-relativistic Schrodinger equation to a two-dimensional configuration in the case of two particle systems. We will also be achieving an exactly solvable solution by utilizing the Nikiforov-Uvarov method and transforming the two-dimensional second order differential equation into an equation of the hypergeometric type. With this method, we will be able to extract exactly solvable solutions to two-dimensional quantum mechanical systems as the solution to an equation of hypergeometric type is exactly solvable and known. We will also compare the difference in the energy and probability density between a three-dimensional system and its two-dimensional counterpart. Specifically, we will be considering the following potentials: Infinite Circular Well, Two-Dimensional Harmonic Oscillator, and the Hulthen Potential. With our methods we have concluded that by selecting the appropriate substitution, while operating within the framework of the Nikiforov-Uvarov method, we are able to transform the two-dimensional Schrodinger equation, which is a second order differential equation, into an equation of the hypergeometric form for the case of the infinite circular well. At the time of submission of our abstract, we have not yet achieved a result for the Hulthen potential but are currently working on it. With the results of our research, we will be able to expand on the known solutions of two-dimensional quantum mechanical systems with central symmetries consisting of two interacting and non-interacting particles. These results can be useful with research performed in other fields of scientific interest such as condensed matter physics. Furthermore, with further solutions to two-dimensional quantum systems available, they can be used for pedagogical purposes that are beneficial to the undergraduate quantum mechanics curriculum. It will allow for students to interact with the special functions of mathematical physics (hypergeometric function, Bessel function, and orthogonal polynomials) and can function as an incremental steppingstone between one dimensional quantum systems and the three-dimensional hydrogen atom.

Country Tech: The Rebirthing of a Windswept Dairy Barn in the Catskill Mountains

Dahrel Cadore, Felix Alvarado, Rokhaya Ndiaye
Prof. Kenneth Conzelmann

This real-world project centers on the birth, life, abandonment, destruction, and rebirth of a ca. 1911 dairy barn in the Catskill Mountains. The barn sits in the north-east corner of a 20-acre parcel of land which was purchased by its current owners in 2020. The owners joyfully took to the barn, with their own hands restoring and securing it for structural stability and future reuse. Then, in the late winter of 2022, a windstorm pulled the barn from its foundation and left the building teetering in the landscape.

This project scope aims to repurpose the remains of the barn as part of a new Environmental Study Center. Designed by City Tech students and faculty, this center will be managed and operated by the owners to establish outreach to benefit, educate, and inspire children and adults within the region and beyond. Design concepts for the site include the application of progressive building technologies, renewable energy solutions, and advanced agricultural practices. This fully off-grid compound will preserve and feature the ruins of the fallen barn as an historical, interactive, and architectural place-based learning experience.

While performing research with the CSTEP Program in June 2022, our team's visit to the barn offered a firsthand experience and interaction with the landscape, its topography, vegetation, and sun/wind dynamics. We performed on-site documentation using traditional methods and then in the studio utilized 3D digital software and printing technologies to generate diagrams and models of design scheme iterations for our discussion and debate. Our design integrates the remains of the barn ruins which features an elevator lift that takes visitors either to the top of the structure to overlook the field and sky above, or to an earthen tunnel that allows visitors to experience the cool and fragrant underground world. The site will also offer a new semi-submerged Hub Building for research and exhibitions, and a Farm Hub for agricultural activities. Wind turbines, solar panels, guest lodging cabins and tree houses will also be distributed across the site.

ESP, the Emerging Scholars Program, has again offered an opportunity for the team to continue and develop our initial visions and ideas begun with the CSTEP program. Our current focus is on the residential component for the site. Passive House principles, green environmentally friendly building materials, and sustainable construction practices will be explored and implemented. The owners envision this as a Home Center Retreat - a fully off-grid structure - a place for them and members of their family and friends to gather and commune, to engage deeply with nature, and to live off the land, with appreciation.

Potential Application of Alkali Halide Filters for Imaging of Key Minerals in Fresh Porous Fruits

Daler Djuraev, Katie Tam, Angela Moore
Prof. Subhendra Sarkar, Zoya Vinokur, Lillian Amann

There is a significant interest in quality control of fruits by CT imaging and electrical resistance measurements. While it is accepted that dry fruits maintain the nutrient content our prior works show a dynamic readjustment in mineral distribution with heat shocks and drying of fruits. We hypothesize that Fe, Cu and Mn distribution depend on surface charges and surface areas available and is responsible for biomineral distribution at cortex and cores of fruits. A drawback of current characterization tools is the lack of knowledge about oxidation or charge states of nutrients and minerals during ripening and drying of fruits. The role of moisture in tissue is hard to understand but seems to control internal tissue geometry. This work plans to demonstrate if spectrally multi-energetic X-ray beams produced by alkali halide filters can characterize the porosity changes

between fresh and dried states in model fruits. A potential application would be the tissue structure changes in radiation resistant tumors and during wound healing where tissue fluid affects imaging results. Current radiological tools with X-rays or MRI do not address such internal tissue texture changes. This work focuses on the role of moisture or tissue fluid on X-ray scatter compared to dry tissue.

Machine Learning in Finance

Elma Kastrat

Prof. Satyanand Singh

In our study, we work on an optimization of an appropriate stock portfolio based on available information. Our work takes into consideration the average return and any associated risk. We produce an investment strategy that predictively allows a portfolio to grow with high yields. We look at the stocks relatively stable over the period.

Our goal here is not to show you how to win at the stock market, but rather to show how, with stock quotes and some statistics, you can figure out the average rate of return on investment and the risk of investing. We will use Lagrange multipliers to construct an optimal investment portfolio based on these estimates.

Ethical and Social Issues in Information Systems

Fahima Zannat

Prof. Patrick Slattery

The digital age has brought significant advancements in the realm of intellectual property (IP) and information systems, but it has also introduced numerous ethical challenges and privacy concerns. This undergraduate research project aims to provide a comprehensive overview of these issues, focusing on copyright infringement, patent trolls, open-source software, user privacy, and security, while seeking to answer the following questions: How can ethical challenges in IP protection be effectively addressed? How can user privacy and security be ensured in online transactions and social media platforms?

Design and Implementation of a Restaurant Website Using HTML, CSS, and JavaScript

Fahmeda Khanom, Touheda Khanom

Prof. Farrukh Zia

This project aims to develop a restaurant website using HTML, CSS, and Javascript. The website will be designed to showcase the restaurant's menu, location, contact information, and other essential details. The primary goal of the website is to attract potential customers and provide them with a user-friendly interface that is easy to navigate. To achieve this goal, we will use HTML to create the website's structure, CSS to style the website and make it visually appealing, and Javascript to add interactive features such as dropdown menus, image galleries, and a reservation system. The website will be fully responsive and optimized for desktop and mobile devices. Our project team will work together to develop the website's design and functionality, utilizing our individual strengths and skills. We will conduct regular team meetings to ensure that our progress is on track and to collaborate on any challenges we may encounter.

In conclusion, the restaurant website developed using HTML, CSS, and Javascript will provide customers with an engaging and informative experience that will encourage them to visit the restaurant. We hope that this project will serve as a valuable learning experience for our team and provide a useful tool for the restaurant's marketing efforts.

Language Bias on Campus

Israt Korno, Sumiya Jahan

Prof. Lubie Alatraste

This research aims to answer the following main question: What is language bias? We will look at the set of sub-questions too: a) How can bias be detected? b) What causes language bias? and c) What are possible solutions to language bias. Language bias refers to the tendency of individuals to hold prejudiced attitudes and beliefs about others based on their language use, accent, or origin (<https://resources.unbabel.com/blog>). This bias can be manifested in many forms, such as discrimination, and stereotyping, and can have significant negative impacts on individuals' social, psychological, and economic well-being (<https://microsoft.com/en-us/microsoft365-life-hacks>). Language bias is a common issue in society that often goes unrecognized. Sociolinguistic research helps uncover bias and raise awareness about such prejudice with the goal to minimize it. Many researchers documented instances of language bias. When meeting a new person, individuals may consciously or unconsciously focus on their language, accent, or origin, which can lead to negative thoughts and attitudes toward them (<https://www.bbc.com/worklife>). This is because some accents are considered more prestigious, such as the British accent within English language varieties. Standard language versions are also favored by some social groups. These types of preconceived notions create social barriers for those members of the society who speak other less favored versions. Bias, just as all forms of discrimination, can have negative consequences on someone's life and existence. The literature review reveals many examples of language bias. One is when doing a job interview because the interviewers can judge the value of the person by the accents instead of the qualities that they have on their resumes. Society should come together to accept different accents and focus on human talent and shared values instead of using accent and dialect to negatively judge others or exclude them. Raising linguistic awareness is one approach to solving the problem of language bias.

Number Theoretic Arithmetic Functions and Dirichlet Series

Ivan Morozov

Prof. Satyanand Singh

Number theory involves quite a few arithmetic functions, and a major class of such functions can be expressed as an infinite Dirichlet series. Though these series may initially seem convoluted, we may study its convolutions in greater depth to uncover beautiful properties of and relations between divisors, most notably primes. Applications of Dirichlet series span many mathematical fields from generating functions to differential equations and complex analysis. This work will explore the derivations of some of their most fundamental and elegant properties, as well as their extension into the complex plane and some of their properties on it.

Military Invasion of Ukraine and World's Perspective

Jean Lucas

Prof. Elizabeth Parks

The military invasion by the Russian government is a significant event that became public over a year ago. This brought many furies from many people around the world towards Russia. And much support from many countries in Ukraine. The United States and the United Kingdom are key countries to provide them with military aid and support. This military invasion has resulted in many countries retracting and ending any relationship they have had with Russia. Many people from different countries who are watching this through the media and news sources have stated through interviews that they want a solution fast and that they want this invasion to end as soon as possible. This has now become a situation that has killed many innocent Ukrainian people as well as the eviction of people to go to other countries. The Russian military is known to have powerful weapons making the Ukrainian military struggle against them.

My purpose in this Research project is to interview people from the United States that are from different countries as well that are from different ages to see if the difference in age brings a different response perspective. I will ask them how they feel about the ongoing invasion as well as research online for different reliable news sources about this invasion.

Delusional Types in Forensic Psychiatric Patients

Alyssa Ramsawak, Johns-sely Felix, Margarita Aleshka

Prof. Daniel Capruso

Aim: The project was to determine if there is delusional content that is characteristic of forensic psychiatric patients.

Subjects: Patient were male (n=9) and female (n=1) psychiatric patients involuntarily committed to Kirby Forensic Psychiatric Center (Wards Island, NY) under NYS CPL § 330.20 as having a “dangerous mental disorder.”

Method: Brief case histories of the instant offense drawn from the medical record of each patient were reviewed.

Results: Frequencies of delusional types in this sample were as follows: 40% had delusions of external control, 40% had religious delusions concerned with God, the Devil, or sin; and 30% had delusions with sexual content. In addition, 40% of the patients were described as experiencing auditory hallucinations at the time of the instant offense, with half having command hallucinations, and the other half having hallucinations with persecutory content.

Discussion: Exploring the delusional types in forensic psychiatric patients who commit homicides, assaults, and sex crimes may help in determining which type of disturbed beliefs may signal an urgent need to prevent violent acts. This study contains no control group of delusional patients who have *not* engaged in violence, so a statistical analysis could not be performed that might have had predictive or discriminative value. As a first step, the results provide preliminary indication that delusions of external control or with religious content may warrant urgent intervention to determine if an increased risk of violent behavior is present.

Control the VEX Robot With Image Processing

Justin Bartholomew

Prof. Lili Ma

Why would we control a VEX robot using Raspberry PI? By doing so, we are able to integrate a camera (the PI camera) on top of the VEX mobile base. Using the OpenCV libraries, image sequences captured by the PI camera can be processed onboard. The extracted information from the image plane is used to control the motion of the robot, realizing vision-based control tasks such as visual serving/tracking and vision-based localization.

We have successfully integrated VEX mobile base, Raspberry PI plus its camera module, and OpenCV, by controlling the robot to follow a color target. Motors' rotating directions and speeds are adjusted based on the visual clues. The robot's functionalities are significantly improved by being able to tackle real-work problems. This project produces a prototype of a smart device that uses visual information to make decisions and actions.

Grenada Mental Restorative Space

Kada Clyne

Prof. Phillip Anzalone

The mind is an intricately powerful tool, however, sustainability of its health and development is often trivialized, especially within smaller developing countries, like Grenada. A holistic-care approach is necessary to deal with underlying causative agents of mental health challenges. The objective of this project is to highlight how architecture can act as a restorative tool within nature, to enhance the mental wellbeing of individuals within a community. In tandem with the revision of scholastic case studies, architectural precedents of mental health facilities were also analyzed. The research conducted helped determine the state and contributory factors of mental health systems of the Caribbean, particularly Grenada. The International Journal of Mental Health Systems' analysis produced [insight] on the prevalence of mental health stigmas in Small Island Developing States (SIDS) and the effects of addictive disorders to disease burden, which was used to further analyze data from the 2018 PAHO report on Grenada. The report revealed that Mental, Neurological, Substance use disorders and Suicide (MNSS) accounted for the largest burden of all disease groups highlighting its predominant effect on the community. Furthermore, there remains a need for additional research on mental health, and the influence of underlying stressors, lack of resources and the need for more under qualified/under-quantified professionals. In this context, I propose architecturally altering an expansive site, catering to spaces of mental health and development through symptomatic treatment and facilitating societal adjustments, within the natural landscape of Grenada.

Augmented Reality With Membit

Daniel Greene, Katherine Alas

Prof. Jenna Spevack

Augmented Reality (AR) is an emerging medium that superimposes digital content over a user's view of the real world. In our research we explore the user experience, focusing on how AR interactions can connect people through collaboration and community building. Utilizing the AR application Membit™, "a geolocative augmented reality (AR) storytelling platform," developed

and co-founded by Jay Van Buren, we are helping to identify interface and usability issues, providing outreach support, and developing a collaborative AR exhibit to showcase the creative work of COMD students and alumni, also creating a eventual egg venture for the student to participate in using the Membed event features.

Types of Cyber Attacks and Incident Responses

Kaung Myat Thu

Prof. Patrick Slattery

Cyber-attacks are increasingly prevalent in today's digital age, and their impact can be severe for individuals, organizations, and governments. To effectively protect against these threats, it is essential to understand the different types of attacks and have an incident response plan in place to minimize damage and restore normal operations quickly.

This research aims to contribute to the field by addressing the following questions: What are the main types of cyber-attacks, and how can organizations effectively respond to these incidents? How can the incident response process be improved through post-incident activities?

The study examines various cyber-attack types, including malware, phishing, ransomware, DDoS attacks, and social engineering, and explains the incident response process, which consists of several steps, including Preparation, Identification, Detection and Analysis, Containment, Eradication and Recovery, and Post-Incident Activity. The research highlights the importance of effective incident response and the role of post-incident activities in ensuring continued preparedness and improvement for future incidents.

The study concludes that having a comprehensive incident response plan and understanding various cyber-attack types are vital for organizations to protect against threats and minimize their impact. The research recommends updating policies, training staff, conducting tabletop exercises, and maintaining incident response capability to enhance incident response processes.

Social Media Impact on Young Minds: The Impact of Trends and Legislation

Keelyany Gomzales

Prof. Patrick Slattery

This research project aims to investigate the effects of major social media platform techniques on the development of young minds (under 18 years of age), specifically focusing on critical thinking and other brain function development. Social media has become an integral part of a teenager's life, affecting every aspect such as their behavior, emotions, self-esteem, and mental health. The study will address the following research questions: (1) Do major social media platforms negatively impact the development of critical thinking and other brain functions in young minds? (2) Are industry trends addressing potential concerns related to these impacts? (3) Is existing or proposed legislation addressing potential concerns related to the influence of social media on young minds?

To answer these questions, the researcher will engage in various research activities, including discovering prior research and concerns raised in the public domain, investigating recent developments and public discussions on the subject, and gathering information on existing and draft legislation related to the matter. The researcher will analyze the findings to determine key

points of discussion and identify contentious aspects of trends and proposed legislation. By examining the social and lifelong impacts of social media platforms on young minds, this research aims to contribute to a better understanding of the potential risks and challenges associated with the pervasive use of social media among young people. The study will also shed light on the effectiveness of industry trends and legislation in addressing these concerns, ultimately informing future policies and interventions to protect and promote the healthy development of young minds in the digital age.

Artificial Turf and Health Hazards

Le Van La

Prof. Vishwas Joshi

Artificial turf, also known as synthetic, man-made grass, has been used and produced with the purpose of landscape decorations and in various forms in athletics and playing fields, business areas, and homes. The main goal of the research is to determine if the use and production of artificial turf pose any possible health hazards to human health. By finding the health risk factors, we can take precautionary health hazards into account before using and exposing artificial turfs in public places.

Several studies have demonstrated that the chemicals in crumb rubbers which used to produce artificial turfs, such as phthalates, per- and polyfluoroalkyl substances (PFAS), and polycyclic aromatic hydrocarbons (PAHs), are known to be mutagens, endocrine disruptors, carcinogens, and neurotoxicants (Murphy et al., 2022). Some studies have also specifically examined the effects of exposure to these chemicals in the setting of artificial turf on human health (Murphy et al., 2022). The project is conducted online by using, summarizing, analyzing, and organizing relevant literature, articles, and data that are available via open sources, and the world wide web. As a result of this project, we look forward to finding what chemical components in artificial turf can cause health problems, and from that suggest a safer substitute option for the production of artificial turf to reduce exposure harm in the future.

Opportunities in Sustainable Architecture

Ludje Henry

Prof. Elizabeth Parks

Sustainability was first defined as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainability is important to maintaining our quality of life. It is the practice that can improve water and air quality, reduce landfills, and increase renewable energy. An understanding of how to re-use materials and how to choose more sustainable products will guarantee cleaner and healthier living conditions for all people, especially those in lower income communities.

The objective driving this study is how can we as inspired Architects, Builders, and Engineers start designing more sustainable buildings to contribute to the changes of our living conditions. In this study I will research alternative materials that can be used to replace the ones that are less sustainable. I will search for strategies that provide better opportunities in sustainable architecture. To find these alternative options I will read about sustainable architecture in books and online using the library research page. I will interview Architecture professors and experts on sustainability. There are some ways that I found that can improve sustainability in architecture; 1-

Use low impact buildings Materials. 2- Add cool roofs to minimize air conditioner energy use. 3- Install renewable energy systems.

In conclusion sustainable building will be a huge help to a sustainable environment and it will benefit everyone. That it why it is not just one group's problem but everyone's problem. This research will reform architects' thinking on how to build, considering not just the design but ways in which the design can contribute to a healthy lifestyle.

Investigating the Taste Quality of Hydroponic Vegetables in Culinary Applications for Year-Round Availability

Madelyn Kelly

Prof. Tracy Zimmermann

This study aims to investigate the taste quality of hydroponic vegetables in comparison with conventionally grown vegetables produced in peak season. The guiding research question for this study is whether hydroponic growing can create vegetables that taste just as good as conventionally grown vegetables that have been grown in peak season; thus, eliminating the need for seasonality. The significance of this research lies in its potential to inform the development of sustainable and efficient methods of vegetable production that can reduce the impact of seasonal limitations on the supply chain. This study could be of relevance in urban areas where space for traditional farming is limited, and consumers are increasingly concerned about the taste and quality of their food. The findings of this study could also raise awareness in the culinary and restaurant industries of ethical environmental stewardship and how it can provide them with a superior product in the off season, as well as a reduced carbon footprint.

Our research focuses on two varieties of tomato plants: the Tiny Tim and Dwarf Red Robin varieties. Both have been chosen specifically for their viability in our hydroponic system. We are currently in phase one of our research, where we germinated the seeds, and are monitoring the growth of the tomato plants. The data collected will be statistically analyzed to determine the optimal nutrient, pH levels, and time for harvest in the hydroponic atmosphere and draw conclusions on the viability of hydroponic vegetable farming for year-round availability. In phase two of our research, we will employ a comparative sensory analysis approach to evaluate the taste quality of hydroponic and conventionally grown vegetables. The vegetables will be assessed by a trained panel of assessors based on their appearance, aroma, texture, and taste.

Do Cosmic Filaments Protect Galaxies from Gas Stripping in Observed Clusters?

Lianys Feliciano, Daniel Gallego, Ena Chia

Prof. Charlotte Welker

In the vast universe, galaxies and stars are the most visible objects. Less visibly is the cosmic gas that is all around in our universe. Gas, however, is directly responsible for the formation of stars and galaxies. Stars can only be formed when provided with enough cold gas. When gas condenses and cools it can form stars, which can congregate into galaxies containing billions of stars. This gas can vary in density and form different structures within our universe, voids that have the least dense matter, walls which are slightly denser, filaments that are even denser, and nodes that have the highest density. Filaments particularly are cooler gaseous regions

that branch into galaxy clusters. Filaments are also referred to as “cosmic highways” because they channel galaxies into large clusters that contain up to thousands of galaxies in a bath of hot, dense gas. In this project, observational data from observed galaxies are analyzed to better understand the relationship between filaments and galaxies. In particular, by using the SAMI galaxy Survey and the Horizon-AGN simulation, our research group investigates whether galaxies become less distorted if they stay near cool filaments when moving toward clusters. By analyzing different parameters of these galaxies including stellar mass and age we have been able to understand these relationships as they relate to the distance of filament. In doing so, we will be able to confirm or deny that galaxies remain star forming when close to filaments.

Information Systems/Technology OER Textbook Enrichment: Understanding Data Mining and Its Relation to Information Systems

Malak Alammari
Prof. Patrick Slattery

This research project aims to enrich an Open Educational Resource (OER) textbook on Introduction to Information Systems/Technology with a focus on data mining and its relation to hardware and software components of information systems. The study will address the following research questions: (1) What is data mining? and (2) How does data relate to the hardware and software components of information systems?

To answer these questions, the researcher will conduct research to ascertain the current state of data mining and its relevance in the field of information systems/technology. The results of the research will be incorporated into an existing OER textbook, modernizing or updating its content. The researcher will collaborate with the project team to develop a plan for incorporating new content into the OER textbook and communicate findings and progress to ensure the project's overall success.

The research will analyze various data mining algorithms, such as K-Nearest Neighbor, Neural Networks, and Association Rules, to understand their applications in transforming large datasets into useful information. The study will also examine the advantages and disadvantages of data mining for corporations, highlighting its applications in product development, manufacturing, and customer relations, as well as potential concerns regarding data privacy and inaccuracies.

By investigating data mining and its relation to information systems, this project will contribute to a more comprehensive understanding of the topic for students and educators using the OER textbook. The enriched content will enable learners to better comprehend the importance of data mining and its applications within the broader context of information systems and technology.

New Gender Identity in the Fashion Global Workforce

Malik Lee
Prof. Alyssa Dana Adomaitis

The purpose of this paper was to examine how employers in the fashion industry perceive gender diversity. There is an estimation of at least 40% of employees do not identify as either male or female but rather transgender meaning non-binary, not identify as either male or female (Inclusion, 2023). While there is some acceptance of non-binary employees in the workplace, there are still challenges these individuals face from other LGBTQ employees. Previous literature has primarily examined biases from the perspective of LGBTQIA+ employees. This was examined related to

diffusion theory. In this study, employers in the U.S. fashion industry were interviewed using open-ended questions on gender diversity in the workplace. Qualitative analysis of the results from 25 employers are being analyzed for themes which will be discussed.

Exploring Methods for Recycling Filament Waste in 3D Printing

Max Rios Carballo

Prof. Angran Xiao

The goal of the current study is to investigate cutting-edge techniques for recycling filament waste from 3D printing procedures. Appropriate waste management techniques are required to reduce this trash's harmful environmental consequences. The goal of the project is to look at new methods for recycling filament waste in order to minimize disposal and encourage reuse. To acquire data from pertinent papers and research, a thorough literature review methodology was used. The findings show that this issue may be resolved utilizing a variety of recycling techniques, including shredding, melting, and re-extrusion. The type of filament waste and the intended goal will determine which approach is best to use. Overall, the study promotes sustainable behaviors, reduces the environmental impact of filament waste, and helps create appropriate waste management solutions for 3D printing.

A Deep Learning Approach to Diagnostic Classification of Prostrate Cancer Using MR Images

Mehnaz Hoque, Charlene Chung

Prof. Pegah khosravi

Background

Advances in our knowledge of the significance of magnetic resonance imaging (MRI) in the identification of prostate cancer have permitted its incorporation into clinical procedures. Many techniques based on MRI “using various machine learning methods” have been employed for prostate cancer diagnosis and categorization. The most prevalent approach for identifying prostate cancer is a pathologist's microscopic examination of stained biopsies and the Gleason score of histopathological digital images. Recently deep learning-based artificial intelligence algorithms have shown promising results in this field. An automated classification algorithm for detecting high risk prostate cancer from low risk was proposed by combining a number of deep learning approaches.

Objectives

In this study, we integrate magnetic resonance imaging (MRI) data with pathology assessments of 679 patients **extracted from the TCIA database** with probable prostate cancer in order to construct an artificial intelligence (AI)-based model for early detection of prostate cancer. The MR images were labeled with prostate biopsy and an algorithm will be created to differentiate high-risk tumors from low-risk tumors.

Materials and methods

In this method, MR images which is the most common method for differential diagnostics of tumor type in prostate cancer are input into a convolutional neural network (CNN) model. “The pre-treatment MR images have been labeled by post surgery pathology or pre-surgery biopsy results”. Then, the trained CNN model using 127 images of patients will be validated and tested using 112 cases and the performance of the model will be measured by accuracy as well as the area under the ROC curve (AUC).

Results and discussions

We develop a multilayer CNN architecture which is a subset of the DL algorithms to support running the training operation of the network on Central Processing Units (CPUs) as the traditional computer microprocessors to automate the diagnosis of tumors through neuroradiology images. Our primary result showed that our model can automatically detect high-risk and low-risk of prostate cancer with AUC of 0.75 for the test set.

Conclusions

We hypothesize that we can develop an automated model that provides a data-driven and reproducible way to assess cancer risk from MR images and a personalized strategy to potentially reduce the number of unnecessary biopsies.

Keywords

PI-RADS, Prostate Cancer, Deep learning, Convolutional Neural Network, Machine learning.

Driving Forces Behind Choosing Radiological Technology as a Career

Mikhail Kun, Peber De Jesus, Tatiana Ryzhakova

Prof. Zoya Vinokur

Healthcare covers a wide range of services. One aspect is medical imaging and all its various modalities, such as radiographic technology, ultrasound, CT/MRI, and mammography. We would like to explore the reasoning behind how people choose radiographic technology as a career. Was it a first choice or a career change? The perfect career is hard to choose. Many people change their careers in mid-age life. Radiology technology is a unique career that

has many pathways after completing school and passing the licensing exam. It allows for cross-training into other modalities and administration. The pros and cons will be described on making a career choice where people tend to come from different jobs and degrees to start all over again to apply for a medical imaging modality.

Fabrication of Monolayered TMX Materials for Quantum Connectors

Pedro Sotomayor

Prof. Vitaliy Dorogan

Quantum computers are the next big thing. They use information stored as qubits to perform exceedingly complex calculations that normal computers can't, in a fraction of the time. They use the principle of quantum mechanics to model a superposition of states, going even further than a traditional 0 and 1.

However, even with their edge over normal computers, they still face similar drawbacks. They are still limited by the size of the information they can process. With normal computers, you can compensate by making a super-computer. But unlike with conventional computers, you can't just hook quantum computers together to make a quantum super-computer. Different quantum computers use different physical principles to function. One could use low-temperature superconductors, while another could use optics. The usage of different principles renders the computers incompatible with each other and presents a hurdle for upscaling and tackling more advanced computations.

In response to this, we propose to make a quantum connector, capable of receiving electrical input from one quantum computer and subsequently converting it to an optical signal that can be read by another quantum computer.

The device will use TMX semiconductors, specifically the materials WS_2 and $MoSe_2$. After exfoliating each of the materials in a careful process using special scotch tape, we will deposit them onto a silicon chip and subsequently fabricate contacts to the flakes using electron-beam lithography. We will be using TMX materials specifically for their ability not only to operate at low temperatures but up to room temperature as well.

Brain Tumor Detection and Classification from MRI Images Using a Convolutional Neural Network Model

Raecine Greaves

Prof. Pegah khosravi

The classification of brain tumors is performed by biopsy, which is not usually conducted before definitive brain surgery (Badža & Barjaktarović, 2020). The improvement of artificial intelligence (AI) techniques can help neuroradiologists in tumor diagnostics without invasive measures. AI leverages software to digitally simulate the problem-solving and decision-making competencies of human intelligence, minimize subjective interference, and potentially outperform human vision in determining the solution to specific problems. We present a new convolution neural network model (CNN) architecture for brain tumor detection. The developed model is simpler than already-existing pre-trained models, and it will be trained and tested on magnetic resonance images (MRI). The goal of this project is to create a neural network that will classify brain tumor images; non-tumor vs brain tumor. By creating a CNN, the model will classify if the patient has a tumor or not based on the MRI images. First, images will be applied to the CNN, then we will use a training set to train the model on the features that are needed to identify the differences in the normal versus brain tumor images. The model that was created was a three layer 2-d convolutional network; this will solve the issues of overfitting and it has a pooling layer which will help improve the speed of the neural network. When creating the model, there were a total of 963 images used (test set: 53 images, validation set: 63 images, training set: 841 images). Throughout this process, my primary result for my CNN network produced a 0.68 probability curve. Improving the hyperparameters will improve my AUC results. At the end of this project, the goal is to train a model that will produce an accuracy of over 90% based on the steps it will take to normalize and get a predicted accuracy score.

Machine Learning Galaxy Morphology

Rene Coronel

Prof. Ari Maller

The light profiles of galaxies can be largely fit by an exponential disk and an exponential to the 4th power bulge (galaxies can be 100% one or the other). However, the computational cost of performing such a fit is rather expensive, which has led many scientists to instead perform a single component fit to galaxy light profiles. With a single component fit the exponential is raised to a free parameter. We study the distributions of these fitting parameters and their relationships. We then use machine learning to try and predict the bulge-to-total ratio from the other properties.

Valence Electron Grazing- Compton Filters to Achieve Hyperspectral X-ray Imaging without Sample Overheating

Sabina Rakhmatova, Zuoni Ke, Somdat Kissoon
Prof. Subhendra Sarkar, and Eric Lobel

This work extends the inelastic x-ray scattering by Compton effect from individual atoms to simple molecules with electrons available in molecular valence orbitals. We started with the theory of Compton type angular scattering by individual alkali and halogen atoms and observed anomalous scattering results from alkali halide salts with molecules arranged in regular halide lattices. We are modeling the results in terms of two novel concepts, that may be named “Compton Harmonic Generation” and “Compton Steal” and are presented in this work.

Doorfront.org: Using NYC Open Data to Improve Accessibility for People with Mobility Impairments in New York City

Said Naqwe
Prof. Patrick Slattery

Approximately one-fifth to one-quarter of American families have a family member with a mobility impairment, which poses challenges for many local communities, particularly in New York City Boroughs. To address this issue, Doorfront.org aims to make sidewalks and facilities, such as residential buildings and restaurants, more accessible to disabled residents of New York City.

As a research assistant for Doorfront.org, I used NYC Open Data to accumulate data on inaccessible facilities, such as the NYC sidewalk polygons, building footprints, city hydrants, bus shelters, parking meters, street trees, pedestrian ramps, litter baskets, city benches, and newsstands. I downloaded a non-geospatial CSV file of all boroughs of New York from the NYC Open Data portal and researched to become familiar with the dataset's basic latitude and longitude information.

Using QGIS and GeoPandas, I organized the data to enable developers to improve the Doorfront.org website. The website allows anyone to report areas that are not accessible to people with disabilities while also collecting data that can be used to fix them. The "Change Street view location" feature of the website enables users to jump to different locations without specifying information.

In conclusion, Doorfront.org is a collaborative effort to improve accessibility for people with mobility impairments in New York City. The project utilizes NYC Open Data to accumulate data on inaccessible facilities, which is then used to improve the website and create a more inclusive community.

Open Educational Resource (OER) Textbook Update Process and Tools

Shaquan Larose
Prof. Patrick Slattery

This research project aims to explore the potential of ChatGPT in enhancing and updating existing textbook chapters, with the goal of making learning more engaging and accessible to students in the digital age. The study will address the following questions: (1) How can ChatGPT be utilized to modernize and improve textbook content? (2) What impact does the updated content have on

student engagement and understanding of the material? (3) How can the integration of ChatGPT-generated content into textbooks contribute to a more effective learning environment?

To answer these questions, the research will involve identifying key topics and themes within existing textbook chapters that require modernization or updating. The researcher will then conduct research to gather additional information and sources to enhance the textbook content. Next, the project will involve developing a plan for incorporating ChatGPT-generated text into the textbook and evaluating the effectiveness of the ChatGPT-generated content using critical thinking skills, adjusting as necessary.

By revitalizing education with modernized textbook chapters using ChatGPT, the research aims to create a more effective learning environment that caters to the needs of students in the digital age. The study will contribute valuable insights into the potential benefits of incorporating AI-generated content into educational materials, ultimately fostering more engaging and thought-provoking learning experiences for students.

The Golden Ratio in Architecture

Sofia Bilbao

Prof. Ariane Masuda

Two positive numbers a and b are in golden ratio when the ratio of their sum to the larger of the numbers is approximately 1.618. The golden ratio appears in many architectural constructions as well as in the nature. It is also known as the divine proportion since it provides a symmetry that is aesthetically harmonious. We explore some applications by identifying their mathematical dimensions of the golden ratio and analyzing their geometric shapes. We also discuss a relationship with the Fibonacci numbers, and exhibit a golden rectangle produced on Scratch, which is a high-level block-based visual programming language.

Classification of Normal Versus Pneumonia From Chest X-ray Using an AI Model

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Background

Pneumonia is considered one of the diseases that causes a major death all over the world ([IEEE Staff 2020](#)). Pneumonia is an inflammatory condition of the lung affecting primarily the small air sacs known as alveoli (Zhang et al. 2023). Pneumonia is usually caused by infection with viruses or bacteria and less commonly by other microorganisms, certain medications, or conditions such as autoimmune diseases (Kermany *et al.*, 2018). Therefore, detecting pneumonia from an x-ray requires a lot of experience because some diseases like congestive heart failure and lung cancer screening can imitate pneumonia ([IEEE Staff 2020](#)). Deep learning algorithms has become the most widespread approach to machine learning and determining the aggressiveness prostate cancer using magnetic resonance images (MRI) (Khosravi et al. 2021). One of the most popular deep neural networks (DNNs) algorithms is convolutional neural networks (CNNs). Using CNN is useful in organizing and selecting images for huge data without time consuming. Previous work to improve pneumonia detection using CNNs models that are available and pre-trained like AlexNet, SqueezeNet ResNet18, and DenseNe201 that did a great job in image classification and

with good outcomes([Kermamy et al. 2018](#)) . CNNs model may ultimately aid in expediting the diagnosis and referral of these treatable conditions, thereby facilitating earlier treatment, and resulting in improved clinical outcomes. Using conventional neural networks for disease diagnosis will be advantageous to low-income nations, because it won't be extremely expensive and will provide everyone an opportunity to have an early lung disease test.

Materials and Methods

In this study, we developed three layers: convolutional layer ,pooling layer and fully connected layers (FC) we developed with (CNN) to automatically classify a cohort of 5862 patients with available X-Ray images from Kaggle (Kermamy *et al.*, 2018) for normal vs. pneumonia cases. The dataset is categorized into 3 groups randomly as training, validation and test sets with a ratio (80%/10%/10%), respectively. Each category contains subgroups for each image category (Pneumonia/Normal). We used PyTorch and Google Collab tools which have become synonymous with deep learning as they provide people with an easy and affordable way to quickly get started building their own neural networks and training models.

Results and Discussion

In this method, X-Ray images which are the most common method for diagnostics of pneumonia from normal are input into a CNN model. Then, the trained CNN model using 4000 images of patients will be validated and tested using 1862 cases and the performance of the model was measured by accuracy as well as the area under the ROC curve (AUC). Our primary analysis showed that our model is able to classify pneumonia and normal cases with AUC and accuracy of 0.9 and 90% for the test set, respectively.

The Impact of Artificial Intelligence on Business Operations

Valon Dellovci

Prof. Patrick Slattery

The integration of Artificial Intelligence in business operations has significant implications across various industries and functional areas. This research project aims to investigate the following research questions: First, how are businesses using AI to automate and optimize their operations, and what are the benefits and challenges of implementing AI solutions in different industries and functional areas? Second, what are the ethical and social implications of AI adoption in business settings, and how do businesses ensure transparency, fairness, and accountability in their AI systems and algorithms? Third, what skills and knowledge are required for employees to effectively work with AI systems? Fourth, how are educational and training programs adapting to prepare the workforce for the increasing role of AI in the workplace?

The research outcomes will provide valuable insights into the transformative role of AI in business operations, highlighting the potential advantages and challenges that organizations must navigate. The findings will emphasize the importance of ethical considerations in AI adoption and emphasize the need for businesses to ensure responsible and transparent AI integration. Furthermore, the research will shed light on the skills and knowledge required for employees to effectively work alongside AI systems and explore the role of educational and training programs in preparing the workforce for a future shaped by AI. By understanding the all-around impact of AI on business operations, organizations can be better equipped to make use of the potential of AI, while mitigating risks and ensuring ethical and sustainable integration of this technology.

An Alternative Approach to Urban Renewal

Yanfang Liang

Prof. Michael Duddy

The history of Robert Moses, New York's famous Power Broker, is well known. He held many positions in the New York City and State governments and is famous for building highways, bridges, and parks. One of the positions he held was the chairman of the Committee on Slum Clearance which was controlled the federal money distributed to New York under Title I of the Fair Housing Act of 1949. Under his direction, several blocks of Brooklyn Heights facing Cadman Plaza were cleared to make room for a Title I project which eventually became two.

This study will research the history of the original project and investigate how redlining and eminent domain doomed the blocks needed for the project. The original proposal will be discussed and evaluated as urban renewal. The two complexes that were finally built will be documented. Both of these projects reflected a new approach to urban renewal that combined high-rise residential towers with townhouses. Thought at the time to be a breakthrough in modern urban design, the history and precedent for this kind of architecture will be documented.

In conclusion, this study will evaluate the impact of these buildings on Brooklyn Heights, explore whether they are beneficial, and make suggestions on improvements.

Augmented and Virtual Reality: Advancement of Technology and its Impacts on Medicine, Education, and Other Industries

Yassine Chahid

Prof. Patrick Slattery

Augmented and virtual reality are both developing technologies. This means that their drawbacks, implementations, and sophistication have changed as they develop. The main points to be addressed include three points related to this development cycle. Firstly, how capable was this technology during its infancy years? By understanding the capabilities of older AR/VR technology, there can be a gauge set to help measure the rate at which the technology's capabilities are advancing. Secondly, what is the current state of AR and VR technology? In order to juxtapose the progression during this technology's lifespan, comparisons can be made to its contemporary applications and capabilities. Additionally, this helps with establishing the ways in which AR/VR are currently relevant within different industries and general life. Lastly, and arguably most importantly, in what ways can this technology shape certain aspects of future life? As seen with the jump from Web 1.0 to 2.0, digital services exploded in popularity. A prime example of this is e-commerce giants such as amazon or ebay, which have had vast impacts on the way we consume goods and services. Similarly, the project will explore the possible impacts VR/AR will have as time progresses. In order to answer these questions, it is important to first study the many proposed ideas regarding AR/VR. After this, it is important to see how these ideas have come to fruition with time. And finally, how this progress can facilitate drastic changes in which industries in the future may operate.

Analyzing a Winning Strategy in Sperner's Game

Yitao Li

Prof. Ariane Masuda

We consider a game in honor to a German mathematician named Sperner. The game involves two players, say, A and B. Suppose n is an integer greater than or equal to 2. On each turn, both players place their letter in one of the n positions, placed next to each other, without a letter. We say that a collision occurs when there is a letter change from left to right. If all positions are filled, player A wins if the number of collisions is odd; otherwise, player B wins. It turns out that there is a winning strategy for player A regardless of player B's movements. To prove that this winning strategy always works, we use a mathematical technique called proof by strong induction. This is the one-dimensional case of a famous result named Sperner's lemma. We also present the two-dimensional case, also known as Sperner coloring.

Image Recognition Android App

Zhenghua Li

Prof. Marcos Pinto

The TensorFlow Lite models provide a pre-trained model for developers, which is a cost saver and time saver. To train an image recognition require a lot of time, and pricey, especially when it requires a good graphic card to run the model. Even there are so many great image recognition models out there, but a great image recognition model that is capable of recognizing more image, it requires more resources for the model to calculate in order to increase the accuracy. Unlike the others, TensorFlow Lite is suitable for mobile, since it can recognize 1000 different objects, it means that it has smaller size, and cost less resources for calculation, and this is why we choose TensorFlow Lite as our image recognition models.