



NEW YORK CITY COLLEGE OF TECHNOLOGY

CITY TECH

Book of Abstracts

Emerging Scholars Program

Fall 2025

Supported by:

New York City College of Technology

CUNY's Coordinated Undergraduate Education (CUE) Program

New York City College of Technology Transformation Funding

INDEX

| Student Researcher(s) | Faculty Mentor(s) | Department | Project Title | Page |
|---|-------------------------|--|--|------|
| Elizabeth Frias | Prof. David Smith | Entertainment Technology | Quantum Music Research | 1 |
| Samiya Shamsur | Prof. Charlotte Olsen | Physics | Illuminating the Connection Between Galaxy Morphology and Evolution with the Legacy Survey Of Space and Time | 2 |
| Christine Gratia | Prof. Lauren Park | Social Science | Place: Dwelling within the Built and Natural Environments | 3 |
| Angel Garcia, Lesly Guzman, Mohamed Ka | Prof. Muhammad Ali Ummy | Electrical & Telecommunications Engineering | The Redesign of a Lightbulb Testing Station | 4 |
| Milsy Peña | Prof. David Smith | Entertainment Technology | Collaborative AI in Healthcare | 5 |
| Yassine Chahid | Prof. Patrick Slattery | Computer Systems Technology | Advancement of Wearable Hardware & Possible Cross-Sector Applications | 6 |
| Nour Alkhadi | Prof. Sandra Cheng | Social Science | Competing Underground: How Public and Private Health Campaigns Shape Messages in NYC Subways | 7 |
| Jonathan Huerta, Roland Guevara, Edria Garganian, Eddie Hornedo | Prof. Ivan Guzman | Construction Management & Civil Engineering Technology | Re-purposed Whole Textile to Enhance Bearing Capacity of Pavement Soils | 8 |

| Student Researcher(s) | Faculty Mentor(s) | Department | Project Title | Page |
|--|--|---------------------------------|--|------|
| DiaaEldin Elabsy | Prof. Farrukh Zia | Computer Engineering Technology | Gesture Controlled Mobile Robot Using Inertial Sensing | 9 |
| Shiou Ching Chen | Prof. Farrukh Zia | Computer Engineering Technology | Control of Electro-Mechanical Systems with Assistive Technology Devices – Advancing From Proof-of-Concept to Integration | 10 |
| Zain Abidin, Savara Khan, Jade Acevedo, Lakpa Sherpa | Prof. Samuel Greenberg | Computer Systems Technology | OnycoScan | 11 |
| Aaron Soriano, Christopher Osorio | Prof. Seth Cottrell | Applied Mathematics | Applications of the Quantum Zeno Effect | 12 |
| Khaoula Dehhou, Alex Davis | Prof. Vitaliy Dorogan | Physics | Photoluminescence of Hybrid Quantum-Dot / Transition-Metal Dichalcogenide (TMD) Nanostructures | 13 |
| Alexander Abreu, Maria Hashmi, Zohaib Khan, Addree Barua | Prof. Abdou Bah, Prof. Hamid Norouzi, A.P. Blake | Physics | Monitoring Heat and Air Quality in Brooklyn Subway System | 14 |
| Angelo Demetroulakos, Mahir Mahdi, Gabriela Bernales, | Prof. Samsur Rahman | Mechanical Engineering | FDM 3D Printer Modification Process for Geopolymer Materials Application | 15 |
| Anooja Kavina Singh | Prof. Caner Koca | Mathematics | Improving Stock Price Predictions Using Lag Features and Hyperparameter Optimization | 16 |

| Student Researcher(s) | Faculty Mentor(s) | Department | Project Title | Page |
|---|---------------------------|--------------------------|--|------|
| Bryant Ariza, Diana Luna-Garcia, Elijah Walker, Bobbi Barker | Prof. Naomi Langer-Voss | Architectural Technology | Architectural Solutions for Ingersoll Houses; Focus on Building Design | 17 |
| Christopher Chow, Shiu Wong | Prof. Shang-Huan Chiu | Mathematics | Predicting Phosphorylation Sites Using LSTM-CNN Model | 18 |
| Cynthia Wen | Prof. Ralph Alcendor. | Biological Sciences | Characterization of Mannosidases in Tetrahymena thermophila Using Bioinformatics and Molecular Cell Techniques | 19 |
| Daisy Sosa | Prof. Khrystyna Vyprynyuk | Dental Hygiene | From Traditional to Innovation: The 2025 Shift in Lead Apron Use in Dental Radiography | 20 |
| Ali Algemsh, Jaskaran Singh, Al Emran, Feldy Liriano, Hailah Nagi, Daler Djuraev, Natalya Tomskikh, Hanna Baghdadi, Jennifer Balbuena, Zeenia Ahmed, Taro Suzuki, Halima Alazeb | Prof. Subhendra Sarkar | Radiologic Technology | Distinguishing Quantum Mottle from Information-Bearing Fluctuations (“Quantum Communication”) in X-ray Imaging | 21 |
| Daniela Guzman | Prof. Anne Chen | Architecture | Civic Thresholds at the Cooper Hewitt Smithsonian Design Museum Garden | 22 |

| Student Researcher(s) | Faculty Mentor(s) | Department | Project Title | Page |
|---|--|--|--|------|
| Fehaj Pabal | Prof. Elizabeth Milonas | Computer Engineering | What are the ethical concerns of relying on computer systems for financial decisions | 23 |
| Guadalupe Gonzalez | Prof. Jeremy Seto | Biomedical Informatics | Mitochondrial genome analysis of Eastern Blue Scoliid wasp | 24 |
| Heni Abid, Nour Mohsen, Nathaly Guaman, Kaijah Rodriguez | Prof. Jenna Spevack, Prof. Jody Rosen, Prof. Jonas Reitz | Communication Design | City Tech's OpenLab Internship | 25 |
| Imarcy Marmol | Prof. Jeremy Seto | Biomedical Informatics | Mitochondrial genome analysis of Eastern Yellowjacket | 26 |
| Iqra Nadir | Prof. Jeremy Seto | Biomedical Informatics | Working on the DNA extraction and amplification of Wolbachia infected insects to determine strain type via MLST amplicon sequencing and creating a bioinformatic pipeline to process these data. | 27 |
| Sally Chen, Amir Gamble, Isabella Ramos Guimaraes | Prof. Jenna Spevack | Communication Design | Campus WhispAR | 28 |
| Jonathan Huerta, Roland Guevara, Edria Garganian, Eddie Hornedo | Prof. Prof. Ivan L. Guzman | Construction Management & Civil Engineering Technology | Re-purposed Whole Textile to Enhance Bearing Capacity of Pavement Soils | 29 |

| Student Researcher(s) | Faculty Mentor(s) | Department | Project Title | Page |
|---|--|---|--|------|
| Julissa Mendez, Thomas Ely, Viviana Vladutescu, Yonghua Wu, Tianyi Zhao, Tahsinur Rahman, Thomas Legbandt, Fred Moshary | Prof. Viviana Vladutescu | Electrical & Telecommunications Engineering | Vertical Monitoring of Ozone Exceedances: Assessing NYC Air Quality with Differential Absorption LiDAR | 30 |
| Kazi Rahimu Islam, Kazi Tamim Nomany | Prof. Patrick Slattery | Computer Systems | Frameworks for Data Visualization Methods | 31 |
| Kevin Balbuena Montes & Kingston Ditsch | Prof. Abdou Bah, Prof. Hamid Norouzi, AP. Reginald Blake | Physics | Monitoring Heat and Air Quality in Manhattan Subway System | 32 |
| Kevin Balbuena Montes, Kristian Rice | Prof. Ahmed Hassebo | Electrical & Telecommunications Engineering | Evaluating 5G for Smart LED Streetlight Connectivity | 33 |
| Khalid Farhad | Prof. Suela Aalsberg | Social Science | How Pesticides Disrupt Ecosystems and Human Health | 34 |
| Kyshia Anderson | Prof. Alyssa Adomaitis | Business and Technology of Fashion Department | AI-Driven Sustainable Textile Waste Utilization in New York State | 35 |
| Anna Chan, Manal Eusha, Laura Then | Prof. Khrystyna Vyprynyuk | Dental Hygiene | Trauma, Dental Anxiety and PTSD: The role of the dental hygienist in providing trauma-informed care | 36 |

| Student Researcher(s) | Faculty Mentor(s) | Department | Project Title | Page |
|---|-----------------------------------|---|---|------|
| Mariam Selim, Brailyn Ventura, Anjum Ahmmed, Christopher Gabriel-Lopez, Jeremyah Herrera, Marti Tapia | Prof. Alexander Aptekar | Architecture | Sustainable Composite Masonry Design | 37 |
| Michael Ray Malonjao | Prof. Lia Dikigoropoulou | Architecture | inLAWN 2025: Collaborative Futures for Ukraine's Urban-Nature Landscapes | 38 |
| Mohammad Imad | Prof. Ahmed Hassebo | Electrical & Telecommunications Engineering | Arduino Assisted Pixy-camera Based Object | 39 |
| Nadia Contento | Prof. Ralph Alcendor | Biological Sciences | Cell survival and longevity factors, stress resistant mechanisms and cell signaling molecules | 40 |
| Nick Antoine | Prof. Alexander Aptekar | Architecture | Reinventing Haitian Vernacular with Bio-Based Design | 41 |
| Ousmane Diallo, Connor Kavleski, Devonte Allen, Twaambo Kabosha, Mohammad Sohail, Fnu Anchita, Taimoor Awan | Prof. Cyrus Meherji, Ahmet Yuksel | Computer Systems Technology | Career AI | 42 |
| Owen Murphy | Prof. Samaneh Gholitabar | Construction Engineering Technology | Planning a Health Impact Assessment Framework for Major Events in New York City | 43 |

| Student Researcher(s) | Faculty Mentor(s) | Department | Project Title | Page |
|-------------------------------|-------------------------|----------------------------------|---|------|
| Perla Reyes | Prof. Smitta Ekka D. | Human Services | “Enculturation” in Social Work Practice: A Scoping Review of Research and Practice Approaches | 44 |
| Rona Zhang | Prof. Charlotte Welker | Physics | Stars and Simulations: Classifying Filaments of the Cosmic Web | 45 |
| Ryan Mayleas | Prof. David Smith | Entertainment Technology | Shadows and Light | 46 |
| Saba Alkobadi, Amani Alkobadi | Prof. Mohammad Islam | Biological Sciences | AI Efficiency Compared to Humans | 47 |
| Shabik Sherchan | Prof. David Smith | Computer Systems | Metaphysics of Emergent | 48 |
| Shahd Abdalla | Prof. Dora-Ann Oddo | Dental Hygiene | Can autoimmune diseases affect the Oral Cavity? | 49 |
| Shaneece Prince | Prof. Steven Indelicato | Vision Care Technology | Through The Eyes of Time | 50 |
| Shayna Jung | Prof. Jeremy Seto | Biomedical Informatics | Endoparasite screening for Wolbachia | 51 |
| Suchi Chowdhury | Prof. Farrukh Zia | Computer Engineering Technology | Advanced Assistive Technology Facilitates Hands-on Service Learning | 52 |
| Sydni Ann Kolokoltsev | Prof. Vishwas Joshi | Chemistry | The anti-cancer goodness of grapes | 53 |
| Takoda Nestor | Prof. Daeho Kang | Environmental Control Technology | Mitigation of The Impact of Climate Change in Building Energy Consumption | 54 |
| Talisha Rahman | Prof. Elizabeth Milonas | Computer Engineering Technology | The Ethical Use of NoSQL Databases in AI-Driven Applications: Balancing Innovation and Data Privacy | 55 |

| Student Researcher(s) | Faculty Mentor(s) | Department | Project Title | Page |
|----------------------------------|--|-------------------------------------|---|------|
| Amna Saifi, Ugochukwu Emenawu | Prof. Farrukh Zia | Computer Engineering Technology | Assistive Technology Devices through 3d printing | 56 |
| Zihan Cao | Prof. Sean MacDonald | Data Analytics in Economics | Data Analytics for Sustainable Economic Development and Circular Economy | 57 |
| Abdoul Nana | Prof. Abdou Bah , Prof. Hamidreza Norouzi, A.P. Blake | Physics | Monitoring Heat in the Bronx Subway System | 58 |
| Aisha Ayub | Prof. Farrukh Zia | Computer Engineering Technology | Touching Emotions: Assistive Communication with 3D Emojis | 59 |
| Angie Navarro | Prof. Elizabeth Milonas | Computer Engineering Technology | The Ethical Uses of Non-Relational Databases | 60 |
| Harold Rojas | Prof. Samaneh Gholitabar | Construction Engineering Technology | Microgravity Simulation for Lunar In-Situ Build | 61 |
| Joseph Alonge | Prof. David Smith | Entertainment Technology | Mapping of Metadata Schematics | 62 |
| Kazi Tasin | Prof. Sara Moshtarizohrehnama | Computer Systems Technology | Exploring Common Software Vulnerabilities and Their Underlying Causes | 63 |
| Kevin Chen | Prof. Yousoon Baek | Radiologic Technology | Assessing plant health changes in a hydroponics system using computer vision models | 64 |
| Kevin Hernandez | Prof. Kenneth Conzelmann | Architecture | The Architecture of Water: From Forest to Village to City | 65 |

| Student Researcher(s) | Faculty Mentor(s) | Department | Project Title | Page |
|-----------------------|-----------------------|------------------------|---|------|
| Parviz Subkhankulov | Prof. Caner Koca | Mathematics | Research Project: In-Data Science About Machine Learning Models Predicting Stock Market Data | 66 |
| Sabahat Moughal | Prof. Sarah Price | Humanities | Navigating Legal Labyrinths: Health Communication and the Experiences of Immigrant Healthcare Professions in the U.S. Healthcare System | 67 |
| Marc Verma-Bonany | Prof. Satyanand Singh | Mathematics | Calculus Explorations of Symmetry | 68 |
| Stanley He | Prof. Jeremy Seto | Biomedical Informatics | Assessing local plant health with NDVI | 69 |

Quantum Music Research

Elizabeth Frias

Prof. David Smith

Quantum Music Research involves comprehension and application of quantum computing and coding for this new music genre named Quantum Music. We propose using quantum computing to analyze these subtle, high-dimensional patterns and generate new musical "improvisations" that inherently embody Mozart's style, based solely on the structural information derived from his compositions. We're confident and ready to test our theory that Quantum Music Genre is successful in copying and enhancing music notes without changing the integrity of the original note. It involves first applying the classical preprocessing step listed in our research. This includes delivering a music preprocessing pipeline and pseudocode for conversion. Once completed, we continue by using Quantum Mapping and Processing techniques and finalizing our project by using the Midi Reconstruction using IBM Quantum.

Illuminating the Connection Between Galaxy Morphology and Evolution with the Legacy Survey Of Space and Time

Samiya Shamsur

Prof. Charlotte Olsen

Galaxy morphology is the study of the structure and form of galaxies, including their shapes, sizes, and features like spiral arms, central bulges, or discs. Galaxies can be classified into various types such as spiral, elliptical, and irregular. The impressive diversity of morphological types in the galaxies has long been an area of investigation, and while we have an improved understanding of what factors contribute to a galaxy's appearance, our understanding is far from complete. This research aims to highlight the connection between galaxy morphology and evolution, with a focus on how environmental factors have influenced the structural characteristics of galaxies. Utilizing data from the Vera C. Rubin Observatory's Legacy Survey of Space and Time (LSST), this work involves analyzing state of the art simulated image data that accurately represents what we expect to see when the telescope begins taking observations in 2025. With an initial galaxy sample we start by classifying galaxies by eye. We then use positions and calculated distances to look for trends between galaxy location and morphology. This methodology allows us to uncover the correlations between the galaxy morphologies and their surrounding environments (i.e. groups, clusters, filaments, and voids, etc). We subsequently analyzed a subsample of the data, conducting a detailed inspection of each galaxy to enhance the clarity and visualization of our results. We anticipate our findings will provide deeper insights into the important question of what external environmental processes drive galaxy evolution.

Place: Dwelling within the Built and Natural Environments

Christine Gratia

Prof. Laureen Park

This study argues that “place” is not simply physical, it is actualized by the relationship between human beings and the environments they inhabit. This research will spotlight various philosophical theories that pertain to where humans do human activities, the ever evolving containers of socialization and how the external environment informs self-concept. This research narrows in on Edward Relph’s phenomenology of “place” and Martin Heidegger's concept of dwelling. Both concepts are defined as foundational structures of human existence which create an interdependent relationship between humans and the places we inhabit. From that relationship stems a responsibility of caretaking. Through a conceptual analysis of philosophical and interdisciplinary scholarship, the research connects the concepts of place and dwelling to care ethics arguing that relational forms of caretaking are essential for the mutual flourishing of living beings and the places they inhabit. The study concludes that place has inextricable connections to being and our very existence (Relph, 2012). It is through principled relational action that humans thrive. It is easy to dismiss met needs, healthy self-concept and singular human thriving as minutia in the grand theme of implication but this directly contributes to the entirety of public health and wellness. Following this research, future studies can focus on the traditions, virtues and actions of care ethics leaders in an attempt at organized action towards the repair of vulnerable or poisoned places and the cessation of mutually detrimental human involvement in the environmental crisis.

The Redesign of a Lightbulb Testing Station

Angel Garcia, Lesly Guzman, Mohamed Ka
Prof. Muhammad Ali Umyy

The intention of this research project is to develop a docking station for a lightbulb testing system; this system would be 3D printed and purely mechanical without the use of electronics to operate it. The purpose of this is to create a mechanism that is effective and simple to explain and demonstrate for students becoming introduced and acquainted with the engineering field. The core of this study would be to examine the functionality of non-powered mechanisms and functionality of designing softwares in order to plan out and create blueprints for such pieces to be 3D printed. It would be how effectively a station can be made and demonstrated to students to which, in theory, they would be able to replicate. It would involve heavy amounts of test runs and examinations, including discussions and problem solving techniques. We would need to investigate different links and mechanisms within kinematics and kinetics, as well as the distribution of forces within each link connected to the moving platform. In theory we want two links that fall along the sides when there is no pressure pushing downward on the platform in contrary to there being pressure the links will raise up and close onto the body of the lightbulb base in order to gain a negative connection, then the positive connection would be from contact of the tip of the base to the platform. This would all be designed using Fusion 360 and Autocad Inventor.

Collaborative AI in Healthcare

Milsy Peña

Prof. David Smith

With the rapid growth of Artificial Intelligence in healthcare, it is important for the U.S. to develop a clear framework that ensures its use is safe, ethical, and fair. This study utilizes a traditional literature based approach to look at how AI can be integrated into healthcare in a safe, ethical, and collaborative way. Earlier research showcases AI's potential in areas like diagnosis and drug discovery, but questions about governance, privacy and its exact relationship with healthcare providers are still unclear. By reviewing existing research, this study analyzes how AI could support, rather than replace clinical teamwork as well as explores the risks that come with its growing power. The studies examined show that AI can transform healthcare, but only if its use is guided by ethical frameworks. The findings complement previous work by emphasizing the need for strong oversight, transparency, and human involvement. This study also invites further exploration into how healthcare will need to adapt as AI becomes more powerful.

Advancement of Wearable Hardware & Possible Cross-Sector Applications

Yassine Chahid

Prof. Patrick Slattery

This study examines recent advances in wearable technologies including smart glasses, watches, rings, and related devices. It evaluates their applications across healthcare, manufacturing, education, and logistics. As real-time data collection, hands-free interaction, and continuous health monitoring become more prevalent, wearables are emerging as pivotal tools for both personal and professional contexts. The methodology combines a comparative analysis of current-generation devices, a review of technical specifications from manufacturer documentation, and case studies of specialized deployments, particularly in medical diagnostics, remote monitoring, and workplace efficiency. Project findings will indicate the rate at which wearable devices are moving beyond consumer fitness tracking and into domains that enhance operational safety, patient care, and workforce productivity. Potential implications include a transformative role for wearable technology in reshaping industry practices, with opportunities for improved decision-making, enhanced user experience, and the creation of new service models that integrate seamlessly with current systems.

Competing Underground: How Public and Private Health Campaigns Shape Messages in NYC Subways

Nour Alkhadi

Prof. Sandra Cheng

The main theme of my research is how public and private health campaigns in the NYC subway use different tactics to influence how the audience thinks about health. In this research I'm taking pictures of public stations and inside trains and examining if there are any health-related advertisements. I mainly ride the B and Q trains to destinations, so most of the data I collected comes from those train lines and the stations connected to them. I identified patterns by separating public and private ads based on the health companies that created them. One pattern I noticed is that the same public healthcare company for NYC appears repeatedly across multiple stations and trains, which helped me compare how often public versus private campaigns show up. Based on the research I gathered, I came to the conclusion that you see more public health advertisements than private. Public health campaigns seem to reach out to all audiences in NYC, while private health campaigns are more specific with the audiences they try to target. The importance of understanding how each health advertisement catches the audience's eye is noticing how campaigns use age, gender, race, and relatability, along with different fonts, colors, and images, to connect with the audience and grab their attention. We should care about this because the NYC subway is one of the most used spaces in the city, meaning millions of people see these ads daily. The fact that this research was done in public places in NYC, mainly in subways, to show how health campaigns are constantly reaching out to people through posters and messages that try to speak to us in different ways. Understanding this is important for public health communication, figuring out which communities receive certain types of health messaging, and noticing whether private and public campaigns shape health awareness differently across the city. This research can impact future studies by showing how the NYC subway environment shapes the health messages people are exposed to. By understanding these patterns, future researchers can study which groups are targeted, whether public health messages reach the right communities, and how transportation advertising affects health behavior in NYC.

Re-purposed Whole Textile to Enhance Bearing Capacity of Pavement Soils

Jonathan Huerta, Roland Guevara, Edria Garganian, Eddie Hornedo
Prof. Ivan Guzman

This research investigates the potential of using repurposed textile, specifically polyester textile fibers to enhance the mechanical properties and performance of pavement subgrade soils. Laboratory testing for this research included unconfined compression testing of fiber reinforced clay specimens and direct shear testing of fiber reinforced sand specimens. Clay specimens were prepared at controlled moisture contents and reinforced with different percentages of textile fiber. The results revealed relatively minor improvements in the undrained shear strength of the specimens. Some reinforced samples had somewhat greater shear strength at particular moisture contents, whereas others behaved similarly to unreinforced specimens. Fiber reinforced sand specimens are currently being tested using direct shear testing equipment. Published results using California Bearing Ratio tests (CBR) on similar sand specimens indicate a strong correlation between inclusion of fiber reinforcement and enhanced shear strength of the host soil, and we expect that our testing will support this finding. This is due to granular soils having strong particle-fiber interlock and are likely to show more noticeable, measurable improvements in frictional shear strength of the host soil. The ongoing phase of this research aims to focus on strength, effects of fiber distribution, and behavior of sand under confined conditions. This change underscores our continued efforts to develop viable, long-term applications for reused textile fibers in pavement and foundation engineering.

Gesture Controlled Mobile Robot Using Inertial Sensing

DiaaEldin Elabsy

Prof. Farrukh Zia

This project investigates the development of a gesture-controlled mobile robot that leverages inertial sensing to create a more intuitive and accessible human machine interface. The purpose of the research is to evaluate whether hand-orientation data collected from an MPU-6050 accelerometer and gyroscope can reliably operate a four motor robotic platform through Bluetooth communication. This work is motivated by the growing need for alternative control systems that reduce dependency on physical controllers and can support applications in assistive technology, robotics education, and remote operation. The project builds on prior approaches but enhances flexibility by using real-time motion data rather than button-based inputs, enabling smoother and more natural control. The system architecture consists of a transmitter unit incorporating an Arduino UNO, MPU-6050 sensor, and HM-10 Bluetooth module, and a receiver unit built with an Arduino Nano, L298N motor driver, and four DC motors. Calibration procedures, filtering techniques, and gesture-mapping algorithms were implemented to ensure accurate interpretation of tilt-based commands for forward, backward, and turning movements. Experimental testing demonstrated consistent performance and responsive control when sensor thresholds were properly defined. The completed prototype provides a functional demonstration of inertial-based robotic control and establishes a foundation for future work involving enhanced stability, multi-axis gesture sets, and integration into accessibility focused robotic applications.

Control of Electro-Mechanical Systems with Assistive Technology Devices – Advancing From Proof-of-Concept to Integration

Shiou Ching Chen

Prof. Farrukh Zia

This poster presents ongoing advancements that extend our earlier work on a low-cost assistive technology system enabling individuals with limited mobility to operate a robotic arm through a mouth-controlled input device. Building on the initial proof-of-concept, the project has evolved from separate operations of the LipSync device and robotic arm into a partially integrated system, with early testing now focused on interpreting real-time analog signals for multi-axis motor control. Current development efforts aim to establish wireless communication between the LipSync device and the robotic arm to enhance portability and simplify the physical setup. This poster discusses the system architecture, design methodology, and challenges encountered throughout integration. By developing a mouth-operated robotic interface tailored to user needs, the project continues to advance accessibility, independence, and inclusive design within assistive technologies.

OnycoScan

Zain Abidin, Savara Khan, Jade Acevedo, Lakpa Sherpa
Prof. Samuel Greenberg

Acral Lentiginous Melanoma (ALM) is one of the hardest types of melanoma to catch early, especially in people with darker skin tones, where changes in nail pigmentation aren't always obvious. Because early detection makes such a significant difference in survival, there is a real need for tools that can help flag concerning nail patterns sooner. This project, OnycoScan, explores whether machine-learning models can accurately tell the difference between healthy nails and nails showing signs of ALM using only clinical nail images. The pipeline created for this project includes cleaning and preparing the images, analyzing key features such as color and texture, and training several models—including SVM, Random Forest, and CNNs—to compare their performance. Throughout the checkpoints, the project involved building a structured workflow for dataset creation, exploratory analysis, feature extraction, training, and evaluation. Early results show that with strong preprocessing, traditional ML models can perform surprisingly well, while deep learning models offer even more potential when scaled to larger datasets. The next steps include expanding the dataset, improving model tuning, and developing a simple front-end tool for demonstrations and future clinical applications. Overall, OnycoScan aims to contribute to more accessible and earlier screening of ALM, particularly for communities that often face delayed diagnosis.

Applications of the Quantum Zeno Effect

Aaron Soriano ,Christopher Osorio

Prof. Seth Cottrell

The Quantum Zeno effect (QZE) is a fascinating phenomenon in Quantum Computing in which frequent measurement of a system can delay its progression indefinitely. Effectively freezing it in its initial state, or at the very least, the state in which it was measured in. While most research into QZE is focused on its physical applications, relatively little is known about the conditions under which such applications are appropriate. In this study, we explore the conditions in which this effect arises by examining both examples and counter examples. Our findings suggest that the changes in the relevant survival functions will indicate when this will occur. We hope that this will guide future research into the quantum zeno effect and its appropriate use.

Photoluminescence of Hybrid Quantum-Dot / Transition-Metal Dichalcogenide (TMD) Nanostructures

Khaoula Dehhou, Alex Davis

Prof. Vitaliy Dorogan

This undergraduate research project explores the fabrication and optical characterization of hybrid nanostructures formed by combining zero-dimensional (0D) colloidal quantum dots (QDs) with two-dimensional (2D) transition-metal dichalcogenides (TMDs), focusing on indium selenide (InSe). The objective is to investigate how coupling QDs to layered InSe affects photoluminescence (PL) behavior and to identify interfacial energy-transfer mechanisms such as Förster resonance energy transfer (FRET) and charge transfer. In this project, InSe flakes were successfully exfoliated using a PDMS-assisted method and transferred onto Si/SiO₂ substrates under controlled heating. The resulting flakes showed clean, continuous regions with thickness-dependent contrast. Reference QD samples (CdSe/ZnS, CuInS/ZnS, and PbS with ~900–1000 nm emission) were prepared by drop-casting dilute solutions onto Si/SiO₂ chips. Preliminary PL spectra were collected for both the InSe flakes and the QD films across a range of excitation powers using neutral-density filters. Initial results indicate that thicker InSe flakes exhibit stronger near-infrared PL, providing a baseline for evaluating future hybrid QD–InSe samples. This ongoing work aims to clarify interfacial coupling effects and support the development of optimized QD/2D systems for next-generation optoelectronic applications.

Monitoring Heat and Air Quality in Brooklyn Subway System

Alexander Abreu, Maria Hashmi, Zohaib Khan, Addree Barua
Prof. Abdou Bah, Prof. Hamid Norouzi, A.P. Blake

This research examined the relationship between air quality and temperature in Brooklyn subway stations. Environmental data was collected using an EXTECH RHT30 temperature and humidity data logger and a Temtop M2000C multiparameter air quality sensor. For the research, the team measured concentrations of PM_{2.5}—PM_{2.5}, or particulate matter 2.5, refers to tiny air particles with a diameter of 2.5 micrometers or less—along with PM₁₀, CO₂, particle count, temperature, relative humidity, and HCHO. HCHO is the chemical formula for formaldehyde, a colorless, pungent gas that is a common air pollutant and an irritant. These data parameters were recorded both outside station entrances and on subway platforms to evaluate differences in air composition and heat retention within underground environments. The analysis identified stations exhibiting elevated concentrations of particulate matter and CO₂, as well as significant temperature increases relative to outdoor conditions. These findings highlight specific stations that may require improved ventilation or cooling infrastructure. Overall, the study contributes to ongoing efforts to enhance air quality and temperature regulation in urban transit systems.

FDM 3D Printer Modification Process for Geopolymer Materials Application

Angelo Demetroulakos, Mahir Mahdi, Gabriela Bernales,
Prof. Samsur Rahman

This project focuses on turning consumer grade FDM 3D printers into a geopolymer printer. A standard Creality Ender 5 plus was modified by redesigning the X axis carriage, toolhead and second gantry to support a custom extruder capable of handling high viscosity geopolymer pastes. To accommodate the specialized extrusion process, an additional control board was integrated to operate a pump. This pump is responsible for delivering the geopolymer to the nozzle. By using Klipper firmware, we restructured the printer's code to include a dedicated extruder section. This setup allows synchronized control of the pump, and printer movements, enabling the printing of complex geometries using geopolymer material with the same workflow as traditional FDM 3D printers. The result is an open source printer for additive manufacturing with geopolymers.

Improving Stock Price Predictions Using Lag Features and Hyperparameter Optimization

Anooja Kavina Singh

Prof. Caner Koca

Accurately predicting stock prices is a fundamental challenge in finance due to market volatility and complex temporal patterns. This study investigates the impact of hyperparameter optimization on the performance of machine learning models for stock price prediction. Using historical stock prices, lag-based features are constructed to capture temporal dependencies. Linear Regression models are first applied as a baseline, and their predictive performance is measured using Root Mean Squared Error (RMSE). Building on previous work that emphasizes advanced optimization techniques, such as genetic algorithms, this study explores whether tuning model parameters can reduce RMSE and improve prediction accuracy. The findings provide insights into how careful feature selection and hyperparameter optimization can enhance stock forecasting models, guiding future research in time-series prediction.

Architectural Solutions for Ingersoll Houses; Focus on Building Design

Bryant Ariza, Diana Luna-Garcia, Elijah Walker, Bobbi Barker
Prof. Naomi Langer-Voss

From professors and students at CUNY City Tech to NYCHA Design & Implementation specialists and NYCHA residents, ARCScholars encompasses a diverse group of researchers united by the common goal of tackling urban challenges through the research and proposal of enhancements to the built environment. This session we are studying the Ingersoll Campus and selected a specific site to develop. Each student identified a building typology that would enhance the community and researched precedents, developed program diagrams, and learned how to organize the spaces. The resulting buildings include swimming facilities, therapy offices, community spaces, libraries, first aid suites, game rooms and arcades.

Predicting Phosphorylation Sites Using LSTM-CNN Model

Christopher Chow and Shiu Wong

Prof. Shang-Huan Chiu

Post-translational modifications are chemical modifications done on proteins after translation. Modifications such as phosphorylation play critical roles in many cellular functions and influence protein structure. This study will explore a hybrid LSTM-CNN model to predict phosphorylation sites in human proteins from protein sequences. Focal loss and Binary CrossEntropy loss will also be examined. Due to the inherent class imbalance in PTM data, it is expected that Focal Loss will provide better predictive performance for the model. The LSTM model will learn long-range patterns away from PTM sites while the CNN model will learn from neighboring amino acids that are more local. This hybrid model approach achieved higher performance over the pure CNN model from our previous research. This research highlights the importance of learning global and local patterns for PTM prediction.

Characterization of Mannosidases in *Tetrahymena thermophila* Using Bioinformatics and Molecular Cell Techniques

Cynthia Wen

Prof. Ralph Alcendor

Mannosidases are enzymes that break down mannose-containing polysaccharides or glycans, which are carbohydrate structures often attached to various proteins as part of glycoproteins. These enzymes play crucial roles in the N-glycosylation of proteins, as well as in protein folding, glycoprotein maturation, and carbohydrate metabolism in eukaryotic cells. There are two main types of mannosidases: alpha-mannosidases and beta-mannosidases. In humans, several of these enzymes exist, including those found in the endoplasmic reticulum (alpha-mannosidase I), those in the Golgi apparatus (alpha-mannosidase II), and those in lysosomes (alpha-mannosidase B). Some of these enzymes have been shown to be involved in oxidative stress pathways, which are associated with DNA damage, apoptosis, inflammation, and various diseases. However, very little information is available regarding their precise roles in oxidative stress regulation. This study aims to explore the structural and functional roles of mannosidase in *Tetrahymena thermophila* by comparing its mannosidases with those in humans. *T. thermophila* is a unicellular eukaryotic protozoan that possesses a dual nuclei system, consisting of a germline micronucleus and a somatic macronucleus. These cells can tolerate high levels of oxidative stress compared to human cells, making them ideal for examining mechanisms of oxidative stress regulation. Using online bioinformatics tools, seven potential mannosidases were identified in *T. thermophila*. Phylogenetic tree analysis revealed that two—THERM_00230960 and THERM_0027380—are closest to the human MAN2B1, which is a lysosomal alpha-mannosidase. This suggests that these two mannosidases may be alpha-mannosidases found in the lysosome and involved in the degradation of oligosaccharides from glycoproteins.

From Traditional to Innovation: The 2025 Shift in Lead Apron Use in Dental Radiography

Daisy Sosa

Prof. Khrystyna Vyprynyuk

This project reviews how dental professionals are changing the use of lead aprons. Multiple studies were reviewed to understand how frequently dentists use lead aprons and thyroid collars and how well they follow the new radiation safety rules. The American Dental Association (ADA) now recommends that lead aprons and thyroid collars are not needed when using modern digital X-ray machines with rectangular collimation. These tools reduce radiation exposure safely and effectively. More education and training are needed to help dental teams follow the new ADA rules. Dental hygienists play an important role in teaching patients and promoting modern safety practices.

Distinguishing Quantum Mottle from Information-Bearing Fluctuations (“Quantum Communication”) in X-ray

Imaging

Ali Algemsh, Jaskaran Singh, Al Emran, Feldy Liriano, Hailah Nagi, Daler Djuraev, Natalya Tomskikh, Hanna Baghdadi, Jennifer Balbuena, Zeenia Ahmed, Taro Suzuki, Halima Alazeb
Prof. Subhendra Sarkar

Conventional imaging practice interprets all image “noise” as negative relative to diagnostic quality. For example, X-Ray quantum mottle Poisson fluctuations arising from the statistical nature of photon detection are presumed to predominate at low dose. However, not all informationally noisy pixels arise from a quantum nature: in ultrasound, considerable grain occurs from digitization/quantization and system electronics far more than photon detection statistics. Thus, we pose whether fluctuations at low doses purely constitute unpatterned quantum mottle or whether a percentage carries reproducible, material-based information. We present a two-tiered distinction for operational potential (i) for a random, exposure-dependent increase/decrease in patterned mottle versus (ii) for an information-bearing aspect of “quantum communication” stemming from substantial, systematic compositions where composition and electron shells imprint spatial/temporal correlations from scattering/secondary photon excitation, which determines what is/what isn't detected once observed. To validate this challenge, we will image photon-starved images of phantoms with lanthanide-cation nanoparticles and simultaneously control phantoms of salts dominated by large anions and matched controls. Expected data include photon-transfer/Fano statistics to assess Poisson behavior, noise-power spectra and spatial autocorrelation to demonstrate random structure and frame-to-frame cross-correlation against phase-randomized controls to highlight reproducibly detectable information. Regions with more lanthanide occurrence (high-Z, characteristic shells) will be compared against the large-anion preparations with the same entrance dose to determine the extent at which fluctuations beyond mottle occur and whether features can be drawn from scatter. Our goal is to clarify the extent to which “noise” can harbor informative signals within the field of x-ray imaging for ultra-low-dose improvements and nanoparticle-enabled contrasts without assuming a positive finding.

Civic Thresholds at the Cooper Hewitt Smithsonian Design Museum Garden

Daniela Guzman

Prof. Anne Chen

My project investigates how the Cooper Hewitt Smithsonian Design Museum Garden functions as a civic threshold between the city and the museum, and how it operates as a public space within an institutional setting. The research examines visitors' experiences as they transition from the busy sidewalk into a quieter environment that still feels open and accessible. By observing and analyzing how design elements such as the fence, pathways, and seating areas shape this movement, I aim to understand how the garden connects the museum with the surrounding neighborhood and supports public life. Through multiple visits, I observed that the garden is primarily used by local residents, students, and families who come after school or during the week to relax. The museum reinforces this connection through free public programs, such as Native Plants: Look, Learn, and Draw and Drop-In Sketching in the Garden, which encourage informal engagement with art, nature, and design (Cooper Hewitt Museum, 2024). This study underscores how the garden creates a gentle boundary between the institutional and urban worlds. It demonstrates how intentional design can foster community use and transform a museum's outdoor area into a vibrant and inclusive public realm.

What are the ethical concerns of relying on computer systems for financial decisions

Fehaj Pabal

Prof. Elizabeth Milonas

Many financial companies, like banks and investment firms, are now using computer systems and artificial intelligence to make decisions about loans, investments, and credit. These systems can work faster and handle more data than humans, but relying on them raises important ethical questions. Computers can make biased decisions if the data they learn from is unfair, which can lead to discrimination against certain people or groups. It can also be hard to understand how these systems make decisions, making it difficult to question or fix mistakes. Mistakes or cyberattacks can also cause big problems in the financial system. This project looks at these ethical issues, gives examples of problems caused by computer-based financial decisions, and suggests ways to make these systems fairer and more responsible. The goal is to help financial companies use technology in a way that is both smart and fair.

Mitochondrial genome analysis of Eastern Blue Scoliid wasp

Guadalupe Gonzalez

Prof. Jeremy Seto

The *Scolia dubia*, or blue-winged Scoliid wasp, belongs to the order Hymenoptera and Family Scoliidae, or Scoliid wasps, which are parasitoids of the scarab beetle larvae. Organisms in this order have shown to have a more rapid evolution in their mitochondrial DNA (mtDNA) compared to other sequenced insect orders (Szafranski, 2017). The Scoliidae tribe, Campsomerini, has been found to have an evolutionary fission of the *cox2* gene, resulting in *cox2a* and *cox2b*, while the tribe, Scoliini, retains an uninterrupted *cox2* gene (Szafranski, 2023). This discrete characteristic can help further distinguish genera within the Scoliidae family and evaluate evolutionary patterns (Szafranski, 2017). Mitogenomes with this fission tend to have larger genomes due to an insertion within the *cox2* gene, as seen in *Dielis tejenis* which has a mitogenome of 18,730 bases and an insertion of about 2.6 kb in the *cox2* gene. This division between the Campsomerini and Scoliini tribes is also reflected using COI barcoding (Liu et al., 2021). On the other hand, genes such as *cox1* and *nad5* are shown to be regions of conservation (Liu et al., 2024). This project aims to sequence, assemble and analyze the mitochondrial genome of the blue Scoliid, *Scolia dubia*, using barcoding and targeted sequencing. DNA was extracted from the abdomen of the species using the Symo DNA Insect/Tissue Kit. 10 reference sequences from related Scoliidae species were aligned to locate conserved regions which will then guide the creation of PCR primers and mitogenome assembly. MITOS2 on the Galaxy platform will be used for annotation of mitochondrial genomes.

City Tech's OpenLab Internship

Heni Abid, Nour Mohsen, Nathaly Guaman, Kaijah Rodriguez
Prof. Jenna Spevack, Prof. Jody Rosen, Prof. Jonas Reitz

The purpose of this project is to assess how OpenLab can improve usability and user experience for students by identifying design, accessibility, and navigation issues in key OpenLab sites and proposing effective UI/UX solutions. The OpenLab at City Tech is a public, open-source digital platform designed to support teaching, learning, and collaboration across the college. As a widely used academic tool, OpenLab plays an important role in helping students build e-portfolios, access course materials, and participate in creative and scholarly communities. Strengthening the design and usability of the platform is essential because it directly influences how students interact with their coursework, present their academic identities, and engage with campus-wide digital spaces. The first phase of the internship involved reviewing and updating our own OpenLab e-portfolios to identify common issues students might encounter, such as layout inconsistencies, navigation challenges, or unclear content structures. This initial stage helped interns understand real user pain points and how design decisions affect student experience. The second phase of the project focused on two OpenLab sites identified by the directors as needing improvement: the BIPOC site and the Grace Gallery site. Interns were divided into two teams to conduct a detailed evaluation of each site, examining elements related to design, accessibility, usability, and overall user experience. This phase involved analyzing site organization, reviewing visual hierarchy, documenting accessibility issues, and proposing UI/UX-driven solutions to enhance clarity, engagement, and navigation.

Mitochondrial genome analysis of Eastern Yellowjacket

Imarcy Marmol

Prof. Jeremy Seto

The yellowjacket is the mascot of City Tech. But what species? This project investigates which species of yellowjacket wasps (*Vespula* spp.) are in the New York City area. The Yellowjackets fall under the order of Hymenoptera (ants, bees, wasps) in the family Vespidae (wasps). The German yellowjacket (*Vespula germanica*) is invasive, but is physically similar to native species. The goal is to conduct a census of the different species by DNA barcoding using Cytochrome oxidase I (COI) gene. Yellowjackets were captured and preserved for documentation and cataloguing to build an image library. DNA was extracted following dissection and COI was amplified by PCR. The PCR amplicon was then sequenced compared to reference sequences on NCBI. Those sequences were used to generate a phylogenetic tree to demonstrate the relationships between these species and samples. Ultimately, DNA barcoding will definitively identify each sample and the image library generated can be used to train AI for morphological identification.

Working on the DNA extraction and amplification of Wolbachia infected insects to determine strain type via MLST amplicon sequencing and creating a bioinformatic pipeline to process these data.

Iqra Nadir

Prof. Jeremy Seto

Wolbachia is a bacterium found commonly in insect species, where it influences reproduction, fitness, and population dynamics (CDC, 2024). Our main goal is to detect and identify Wolbachia in fly samples using DNA extraction, PCR amplification, and multilocus sequence typing (MLST). DNA was extracted from individual flies, followed by PCR using Wolbachia specific markers and other MLST loci. All positive amplifications are then sequenced and compared to Wolbachia reference sequences available for comparison (Shin et al., 2020). Sequence data is then processed in a Linux system using tools and scripts designed to make representative sequences rather than consensus sequences (Hendling et al., 2021). Representative sequences then help to identify strain level variations and ensure accurate MLST profiling. This establishes a system for confirming Wolbachia infections in flies and for comparing local samples with reference strains.

Campus WhispAR

Sally Chen, Amir Gamble, Isabella Ramos Guimaraes
Prof. Jenna Spevack

While technology connects us digitally, it often creates social distance; this project, "Campus WhispAR" investigates how curiosity and anonymity can foster new connections among students. We are currently developing an augmented reality (AR) installation that allows participants to use their mobile devices to post and read anonymous messages that appear virtually on the cafeteria walls. The experience, an experiment in designing new types of digital interactions, is being built using AR.js, HTML, and CSS, incorporating 3D modeling from Blender. Cursor and Figma are utilized for prototyping. Because the experience relies on geolocation, participants must be physically present to engage. We study how hidden identity influences communication and whether this environment cultivates a stronger sense of connection among students, faculty, and staff. Through observing anticipated interactions, we aim to learn how digital tools can spark genuine, human connections through shared curiosity and honest expression.

Re-purposed Whole Textile to Enhance Bearing Capacity of Pavement Soils

Jonathan Huerta, Roland Guevara, Edria Garganian, Eddie Hornedo
Prof. Prof. Ivan L. Guzman, PhD, PE

This research investigates the potential of using repurposed textile, specifically polyester textile fibers to enhance the mechanical properties and performance of pavement subgrade soils. Laboratory testing for this research included unconfined compression testing of fiber reinforced clay specimens and direct shear testing of fiber reinforced sand specimens. Clay specimens were prepared at controlled moisture contents and reinforced with different percentages of textile fiber. The results revealed relatively minor improvements in the undrained shear strength of the specimens. Some reinforced samples had somewhat greater shear strength at particular moisture contents, whereas others behaved similarly to unreinforced specimens. Fiber reinforced sand specimens are currently being tested using direct shear testing equipment. Published results using California Bearing Ratio tests (CBR) on similar sand specimens indicate a strong correlation between inclusion of fiber reinforcement and enhanced shear strength of the host soil, and we expect that our testing will support this finding. This is due to granular soils having strong particle-fiber interlock and are likely to show more noticeable, measurable improvements in frictional shear strength of the host soil. The ongoing phase of this research aims to focus on strength, effects of fiber distribution, and behavior of sand under confined conditions. This change underscores our continued efforts to develop viable, long-term applications for reused textile fibers in pavement and foundation engineering.

Vertical Monitoring of Ozone Exceedances: Assessing NYC Air Quality with Differential Absorption LiDAR

Julissa Mendez, Thomas Ely, Viviana Vladutescu, Yonghua Wu, Tianyi Zhao, Tahsinur Rahman, Thomas Legbandt, Fred Moshary
Prof. Viviana Vladutescu

This study expands ongoing efforts to characterize ozone variability over New York City using high-resolution vertical measurements from the Ozone Differential Absorption LiDAR (DIAL) system at City College of New York (CCNY/CUNY). Operating at 289 nm and 299 nm, the DIAL system retrieves ozone mixing ratios throughout the lower troposphere, allowing detailed examination of ozone structure within the planetary boundary layer. To complement the lidar observations, surface ozone measurements from the New York State Department of Environmental Conservation (DEC) were incorporated to provide ground-level context and to compare column-integrated behavior with near-surface conditions. Building on prior analyses from 2021 and 2023, this work implements refined procedures to address aerosol interference in the lidar retrievals. These corrections were particularly important during smoke-impacted periods, when wildfire plumes from Canada altered both the optical properties of the atmosphere and the vertical distribution of ozone. The updated processing approach improved confidence in the ozone number-density estimates and allowed for clearer interpretation of boundary-layer ozone dynamics. The measurements indicate recurring exceedances of the health-based ozone threshold during summer episodes, with 2023 displaying more pronounced short-term variability compared with 2021. The contrast between the two years provides insight into how changing patterns in human activity and regional pollution transport influence urban ozone levels. Comparisons with DEC surface measurements further highlight the relationship between elevated ozone aloft and surface-level air-quality impacts. Overall, this study reinforces the value of DIAL systems for resolving the vertical structure of ozone in complex urban environments and underscores the need for coordinated monitoring strategies to better manage ozone pollution and its policies in New York City.

Frameworks for Data Visualization Methods

Kazi Rahimu Islam, Kazi Tamim Nomany

Prof. Patrick Slattery

This research project evaluates a conceptual framework for selecting data visualization methods (plots, charts, and graphs) based on analytical problems and information types. The study assesses this draft framework against visualization theory literature, visual perception studies, and current data analysis practices across various domains. By comparing theory with practical application, the research identifies strengths, limitations, and refinement opportunities. The goal is to develop a systematic, evidence-based approach to visualization selection that improves clarity, interpretability, and decision-making.

Monitoring Heat and Air Quality in Manhattan Subway System

Kevin Balbuena Montes, Kingston Ditsch

Prof. Abdou Bah, Prof. Hamid Norouzi, AP. Reginald Blake

This study examines temperature, humidity, and air quality conditions within New York City's subway system, focusing on selected stations in Manhattan and Brooklyn. Elevated underground heat levels and fluctuating air quality can present health risks to commuters and transit personnel throughout the year. To assess these environmental conditions, student researchers collected on-site measurements during the Fall semester using digital temperature and humidity sensors along with portable air-quality monitors. The resulting dataset highlights spatial variability across stations, identifies areas with higher heat retention, and reveals air quality changes influenced by station design, depth, and train frequency. The findings aim to support sustainable ventilation improvements, enhance infrastructure resilience, and inform public health initiatives focused on improving environmental safety within the NYC subway network.

Evaluating 5G for Smart LED Streetlight Connectivity

Kevin Balbuena Montes, Kristian Rice

Prof. Ahmed Hassebo

The deployment of fifth-generation (5G) networks provides high-speed, low-latency communication essential for smart city infrastructure. This study examines 5G-based connectivity in smart LED streetlight systems, focusing on resource allocation between mission-critical and latency-tolerant services. MATLAB simulations and performance metrics—including delay, throughput, and reliability—are used to evaluate network slicing and scheduling algorithms. The proposed framework integrates dynamic scheduling mechanisms, similar to LTE uplink strategies, to improve energy efficiency and responsiveness in large-scale urban lighting. Results show that ultra-reliable low-latency communication (URLLC) supports real-time control for lighting and emergency responses, while enhanced mobile broadband (eMBB) effectively manages non-critical operations. Findings confirm that 5G integration enhances performance, stability and service differentiation, offering a scalable model for smart city applications.

How Pesticides Disrupt Ecosystems and Human Health

Khalid Farhad

Prof. Suela Aalsberg

Pesticides are widely used to protect crops and improve agricultural productivity, but their heavy use raises serious concerns for environmental and human health. Large agricultural nations such as China, Brazil, and the United States apply hundreds of thousands to more than a million tons of pesticides each year, allowing chemicals to move through soil, water, and food chains. These substances harm pollinators like bees, reduce soil biodiversity, contaminate rivers and groundwater, and disrupt the natural balance of ecosystems. Human exposure can occur through direct contact, drinking water, or pesticide residues on food. An estimated 385 million people experience unintentional pesticide poisoning each year, and long-term exposure has been linked to cancer, hormone disruption, neurological damage, and liver or kidney problems. Consumer testing also shows that many common foods, including strawberries, bell peppers, potatoes, and green beans, contain measurable pesticide residues even after washing or peeling. Understanding these environmental and health impacts highlights the need for safer farming methods, stronger regulations, and everyday practices that can help reduce exposure. Reducing pesticide dependence is essential for protecting ecosystems, supporting healthy communities, and securing a safer future.

AI-Driven Sustainable Textile Waste Utilization in New York State

Kyshia Anderson

Prof. Alyssa Adomaitis

This research addresses the significant and growing problem of textile waste, highlighting a critical gap in New York State (NYS), where a persistent lack of imaginative narratives and underutilized immersive environments stops effective cross-sector collaboration (fashion, technology, construction) necessary for sustainable textile waste solutions. The purpose of this research is to propose a grounded approach by leveraging Artificial Intelligence (AI) tools to analyze historical data, forecast disposal trends, and facilitate the prototyping of sustainable building materials for urban development within NYS. The methodology employed in the investigation was a systematic content analysis, utilizing tools like NotebookLM to synthesize literature across three categories: Textile Waste, AI in Textile Waste, and Material Prototyping. This approach was used to establish the current state of practice and identify a crucial reliance on international research for physical material prototyping, thus setting the stage for future applied research. In conclusion, the literature confirms a lack of holistic approaches and specific technical challenges, such as in textile waste sorting and detection. However, AI is strongly positioned to play a vital role, with a speculative narrative concluding that AI can be utilized in the successful integration of textile waste directly into the construction ecosystem, fostering the emergence of "textile-urbanism." The implications suggest that this interdisciplinary approach, particularly the integration of textile waste into building materials, has the potential to significantly reduce landfill waste, and specifically for the New York City (NYC) metro area, could offer practical benefits in combating noise complaints and addressing thermal issues due to the material's exceptional acoustic and thermal properties. This research is predicted to advance the research in structural integration and self-assembling, textile-based modules, utilizing AI-driven geospatial and trend analysis to predict fiber compositions and employ speculative design and immersive prototyping to showcase the novel building material within a NYC architectural context.

Trauma, Dental Anxiety and PTSD: The role of the dental hygienist in providing trauma-informed care

Anna Chan, Manal Eusha, Laura Then
Prof. Khrystyna Vyprynyuk

This research examines the relationship between trauma, dental anxiety, and post-traumatic stress disorder (PTSD), emphasizing the dental hygienist's role in providing trauma-informed care. Three studies were reviewed, revealing a strong correlation between trauma and dental anxiety, and the effectiveness of cognitive behavioral therapy (CBT) in reducing anxiety within dental settings. One study further highlighted that patients with sexual trauma valued clear communication and trust-building with their dental providers. However, many dental hygienists reported limited training in trauma-informed practices, underscoring the need for enhanced education to improve patient trust, reduce anxiety, and enhance oral care outcomes.

Sustainable Composite Masonry Design

Mariam Selim, Brailyn Ventura, Anjum Ahmmed, Christopher Gabriel-Lopez, Jeremyah Herrera, Marti Tapia
Prof. Alexander Aptekar

This research investigates the development of bio-based masonry units through the optimization of composite brick recipes. The study explores the combined performance of rice straw, lime plaster, concrete, and clay plaster as potential components for wall assemblies, focusing on their impact on shape stability, thermal insulation, and compressive/tensile strength. Specifically, it examines how integrating the agricultural byproduct of rice straw with established building materials, such as concrete and clay, can yield sustainable alternatives that reduce waste and lower the carbon footprint of construction. The project employs parametric design and optimization techniques to generate and refine modular brick forms that efficiently meet structural and thermal performance criteria. The outcome aims to identify the optimal composite brick formulation and wall-assembly design that maximizes both environmental performance and structural integrity, demonstrating a scalable, innovative approach to sustainable masonry construction. For the exterior finish applied over a reinforcing mesh, the study identifies a Natural Hydraulic Lime (NHL) render as the most compatible and sustainable coating system for the bio-based masonry units. The lime-based finish provides high vapor permeability, strong adhesion, and environmental durability, allowing moisture to diffuse safely through the rice-straw composite while maintaining effective surface protection. Its low-carbon profile and mechanical flexibility make it an optimal finishing strategy for the proposed wall assembly.

inLAWN 2025: Collaborative Futures for Ukraine's Urban-Nature Landscapes

Michael Ray Malonjao

Prof. Lia Dikigoropoulou

The 7th International Landscape and Architecture Workshop (inLAWN) brought together students and faculty from seven universities across six countries to explore sustainable landscape strategies for the Holoziiv region of Kyiv, Ukraine. Focusing on the theme of Green Recovery, the workshop addressed the role of landscape and urban design in postconflict regeneration, biodiversity conservation, and public well-being. Teams developed proposals across three themes—Urban Connections, Exploring Landscape, and Educational Design—working collaboratively in Evinghausen, Germany. The workshop demonstrated how international and interdisciplinary dialogue can lead to innovative, culturally grounded strategies for ecological and social resilience. This poster presents the workshop methodology and outcomes.

Arduino Assisted Pixy-camera Based Object

Mohammad Imad

Prof. Ahmed Hassebo

This project reports on the design and implementation of an object detection system employing an Arduino microcontroller in conjunction with a Pixy camera to enable real-time identification and tracking of multi-colored objects. Object detection constitutes a fundamental capability in robotics and automation, where precision and rapid response are critical determinants of system performance. The proposed prototype exploits the Pixy camera's functionality to recognize distinct color signatures and transmit positional data to the Arduino, which subsequently interprets and processes the information to execute programmed control actions. The system architecture supports simultaneous detection of multiple colors and ensures robust tracking performance under varying illumination conditions. Rigorous testing and calibration procedures were undertaken to evaluate detection accuracy and response efficiency. Experimental results validate the efficacy of integrating low-cost hardware platforms with open-source development tools for color-based object recognition. The findings underscore the potential of accessible embedded systems to advance applications in education, research, and automation.

Cell survival and longevity factors, stress resistant mechanisms and cell signaling molecules

Nadia Contento

Prof. Ralph Alcendor

Thioredoxin glutathione reductase (TGR) is an important enzyme that protects cells from oxidative stress by maintaining balance in the thioredoxin and glutathione systems. These systems repair damaged proteins and remove harmful molecules, helping cells stay healthy under stress. This study examined the TGR protein in *Tetrahymena thermophila* to better understand its structure and evolutionary relationship to similar enzymes in other organisms. Using multiple sequence alignments and phylogenetic analysis, we compared *Tetrahymena* TGR sequences to human TXNRD1, TXNRD2, and TXNRD3 proteins and to sequences from other species such as fish, reptiles, birds, and protozoans. The phylogenetic tree showed that *Tetrahymena* proteins form their own separate clade, distinct from animal groups, suggesting they evolved independently. The sequence alignments revealed both highly conserved regions, which are likely important for the enzyme's redox function, and variable regions, which may have adapted differently across species. These findings indicate that while *Tetrahymena* shares key structural features with human enzymes, its TGR has also evolved unique characteristics to support its single-enzyme antioxidant system. Overall, this research highlights the evolutionary importance of TGR in maintaining cellular balance and provides insight into how simpler organisms like *Tetrahymena thermophila* use this enzyme to survive environmental stress. Understanding TGR's function in this model organism can help scientists learn more about how antioxidant systems protect cells in humans and other species.

Reinventing Haitian Vernacular with Bio-Based Design

Nick Antoine

Prof. Alexander Apteekar

This research will investigate traditional building methods and Architectural styles within Haiti and distill them into their elemental components. The goal is to reinvent these styles with Bio Based design using local materials. The predominant architectural style that will be analyzed is the Gingerbread style, historically used for Housing. This research aims to create visually appealing design solutions that address local problems such as material scarcity, cost of labor, and structural integrity. Bio based materials will be the primary material selection for designing structural frames and envelopes. 3D modeling software such as Rhinoceros 3D will be used to model and design these structures.

Career AI

Ousmane Diallo, Connor Kavleski, Devonte Allen, Twaambo Kabosha, Mohammad Sohail,
Fnu Anchita, Taimoor Awan
Prof. Cyrus Meherji, Prof. Ahmet Yuksel

The application process for the United States tech industry has long been tedious and time consuming. A standard application generally involves making a new account on a given company's job board, confirming the user's email, submitting required documents, and answering questions that can usually be answered by reading the aforementioned documents. Even a quickly executed, streamlined application can take twenty to thirty minutes to complete (excluding that of citizenship, disability status, etc.). This procedure is usually done in vain, as the current job market is plagued with ghost jobs and unfair AI screenings. With the assistance of web scraping, sentiment models, and agentic LLMs however, this portion of the process can be autonomously fulfilled on the user's behalf, giving applicants time to focus on their skillset for their desired role. In this paper, we propose a theoretical framework for CareerAI, a daemon program that answers and submits job applications on the user's behalf. We start with a comprehensive summarization of the fundamental capabilities and design choices in CareerAI's architecture. Next, we discuss the details of development, breaking down our progress to a fully functioning system.

Planning a Health Impact Assessment Framework for Major Events in New York City

Owen Murphy

Prof. Samaneh Gholitabar

This research aims to examine potential health impacts of large events in New York City, as part of a study with the New York City Department of Health and Mental Hygiene to develop a Health Impact Assessment framework for future events. Employing an exploratory approach, this research involves an examination into challenges posed by previous large events, to compile a list of factors to consider for future events. These factors were contextualized to define their possible impact on the health of New York City residents. The study reveals that both external factors such as extreme temperatures, and factors stemming directly from large events—such as crowding and congestion—can create potentially adverse health scenarios for New York City. Several health impact factors identified pose greater risks for certain demographics, this distribution of risk was analyzed using a vulnerability index. The findings of this study will be used to create a full Health Impact Assessment framework focused on enhancing preparedness and response to major planned and unplanned events that may affect public health

“Enculturation” in Social Work Practice: A Scoping Review of Research and Practice Approaches

Perla Reyes

Prof. Smita Ekka D.

This scoping review examines the concept of enculturation and its relevance to the field of social work. Enculturation refers to the process through which individuals internalize the norms, values, ideas, and practices of their heritage culture. This concept is often contrasted with acculturation, which involves adapting to a new cultural context. The review aims to clarify the definition of enculturation and explore its significance for personal identity formation, developmental processes, immigrant adaptation, intergenerational relationships, and culturally responsive service delivery in human services and social work practice. Additionally, the study identifies existing knowledge gaps and outlines future directions for research and practice. By offering clearer conceptual understanding, this review supports the advancement of culturally informed approaches within an expanding social work profession

Stars and Simulations: Classifying Filaments of the Cosmic Web

Rona Zhang

Prof. Charlotte Welker

The cosmic web is a vast, interconnected structure in the universe composed of filaments of dark matter. These filaments exhibit capillary activity that enables the transfer of gas and matter across large scales over both distance and time and is believed to influence the formation of galaxies and their stars within the network; however, less is known about how the varying characteristics of each filament may contribute to star formation differently. Using the topological feature identifier DisPerSe (Discrete Persistent Structures Extractor), we identify cosmic filaments at $z \approx 0.211$ from a region within the NewHorizon simulation and construct a data frame of parameters associated with the filaments. Among these parameters include the density, metallicity, and temperature profiles of each filament, their length, and the mass at their densest extrema extracted from their nearest main DM haloes. We found that out of a sample of 154 filaments, 114 fell within two times the virial radii of a main halo and were assigned a mass. Of the 40 that were not assigned a mass, 29 had no maximum and represented bifurcation points and 11 had maximums but did not fall within the virial radius of a main halo. Further post-processing of our data frame using Principle Component Analysis (PCA) will facilitate the classification of the filaments using machine-learning algorithms such as k-means and allow us to better understand the impact of cosmic filaments on star formation history.

Shadows and Light

Ryan Mayleas

Prof. David Smith

Visual ambiguity is the concept of an image that can be perceived in more than one way due to how the graphics are structured. The idea has been explored for centuries with many optical illusions but has only been studied relatively recently in the early 20th century with the founding of the Gestalt Principles. A few video games over the years have come out that play with visual ambiguity, such as the 2008 browser game Shift. However, we believe this concept could be explored further and implemented in more video games than it has currently. For this project, we performed the following actions: Precedent research into existing games, deep exploration of visual paradoxes that arise from each principle, identification of potential game rule sets for future development. These visual paradoxes include Figure-Ground Segregation, which refers to the mind's ability to recognize what's part of the foreground and what's part of the background in an image, and Depth Ambiguity, which refers to the inability to tell which way a 3D object is positioned. At this point, we are not developing full games, but future research will take the results of this investigation and use them to satisfy this condition.

AI Efficiency Compared to Humans

Saba Alkobadi, Amani Alkobadi

Prof. Mohammad Islam

Artificial Intelligence (AI) processes information and delivers feedback significantly faster than humans. Operating digitally, AI can analyze vast datasets within seconds, whereas humans require time to read, reflect, and retain information. In a recent survey of 30 students, 36.4% reported using AI “often” for academic tasks, while 18.2% said they “never” used it. Notably, 63.6% stated that AI helped them generate ideas, and 36.4% said it helped them “very much,” suggesting that AI plays a key role in accelerating idea generation and learning. Weekly AI usage among participants ranged from 1 to 10 hours, depending on individual study needs and course demands. The respondents included juniors in Healthcare Management and Policy, Nursing, Business, Architecture, Pharmacy, and Communications—highlighting that AI adoption spans diverse academic disciplines and age groups. AI’s consistent speed and precision enable it to monitor students’ progress, pinpoint areas of difficulty, and recommend tailored learning strategies. In contrast, human performance may fluctuate due to fatigue, distractions, or memory limitations. By targeting students’ weaknesses and offering structured feedback, AI supports the development of critical thinking, creativity, and problem-solving abilities. When integrated thoughtfully, AI functions as a supportive learning assistant—enhancing academic performance while preserving the value of human judgment. This synergy allows students to remain focused, engaged, and innovative in their educational journey.

Metaphysics of Emergent

Shabik Sherchan

Prof. David Smith

This research explores the interconnection between the physical realm and the conceptual realm through the lens of mathematical structure, quantum mechanics, and adaptive systems. It posits that human perception, our conscience, is shaped by an underlying design evident in natural phenomena, such as the Fibonacci sequence and sacred geometry, suggesting a coded framework to reality. Quantum physics further complicates this view by revealing that matter behaves probabilistically until observed, implying that perception itself may influence existence. Across many cultures and continents, geological formations, artistic expressions, and religious narratives, it is likely to suggest that our world may not be entirely organic, but rather a simulated environment, one governed by symbolic patterns and historical symmetry. Drawing a parallel to artificial intelligence, the study examines how AI systems evolve within their own digital ecosystems, governed by logic, feedback loops, and self-learning algorithms. Through mechanisms and how AI develops a form of functional awareness, not by mirroring human cognition, but by operating within a distinct conceptual domain. This abstract proposes that both biological and artificial consciousness are emergent properties of structured environments, with one physical, the other computational, each shaped by symmetry, uncertainty, and design. Ultimately, this question seeks to answer a fundamental question: if human consciousness arises within a three-dimensional physical realm, then what kind of dimensional plane of existence would artificial consciousness inhabit, and how might its reality be defined?

Can autoimmune diseases affect the Oral Cavity?

Shahd Abdalla

Prof. Dora-Ann Oddo

Celiac and Lupus are autoimmune diseases that significantly impact the oral cavity negatively. One of the early signs of Lupus may be present as an oral manifestation. Similarly, Celiac disease can lead to delayed tooth eruption and enamel defects, increasing the risk of malocclusion and dental caries. Ironically, medications that help treat autoimmune diseases can also alter the development of teeth and bone marrow.

Through The Eyes of Time

Shaneece Prince

Prof. Steven Indelicato

Frames have been a staple throughout history, however in recent times, a trend of having multiple pairs of glasses opposed to one, life lasting pair, has emerged. As a result, frames have piled up in landfills contributing to the polluting of our environment. Through the analysis of previously recorded studies and statistics, conclusions of the eyewear industry's growing impact on society and the planet were formed. Millions of frames are in constant circulation, studies show that up to 31% of spectacle wearers out of a group of 375, disposed of their eyewear in the trash. The lifespan of popular eyewear materials such as acetate and metals, can be hundreds of years, and during that time in landfills, they emit harmful materials into our soils. In order to combat this, some proposed solutions include donating unwanted frames to thrift stores and organizations focused on redistributing frames, shopping eco-friendly frame companies, and keeping ourselves and others informed.

Endoparasite screening for Wolbachia

Shayna Jung

Prof. Jeremy Seto

This project aimed to determine whether certain dipterids carried Wolbachia by looking for the presence of the Wolbachia surface protein (wsp) gene. Wolbachia is a bacterium presumed to be the most abundant endosymbiotic species that is non-pathogenic to humans. It is significant as its presence affects its host's reproduction, which can facilitate disease control in dipterids, like mosquitoes, known for causing diseases in humans. Dipterids trapped in New York City from August to October were homogenized for DNA extraction and amplification via polymerase chain reaction (PCR). To confirm the presence of the wsp gene, the amplified DNA extractions were analyzed via gel electrophoresis alongside a positive control, amplified DNA known to carry the wsp gene. The wsp gene could not be detected in any of the samples from August to October. The repeated absence suggests low prevalence during late summer and early autumn. Also, dipterids may not carry the bacteria permanently. Understanding when Wolbachia transmission peaks is critical when planning coordinated disease control strategies.

Advanced Assistive Technology Facilitates Hands-on Service Learning

Suchi Chowdhury

Prof. Farrukh Zia

The Twitch Switch is an assistive technology device designed to enable people with limited mobility to use digital devices or turn on adaptive switches with minimal or no movement. Because it meets a critical demand for accessible technology among individuals with disabilities, this device is important because it enables people with conditions including muscular dystrophy, spinal cord injuries, and cerebral palsy to interact with digital environments and improve their quality of life. The Twitch Switch incorporates wireless sensors to record intentional, small movements, designing on previous assistive technology. While similar projects have made use of adaptive or single-switch input devices, the Twitch Switch improves usefulness by allowing for greater customisation and multi-device control. The project leverages a service-learning approach where students apply knowledge from STEM courses. Hardware components include three wireless sensors and a controller, while software supports Bluetooth and USB connectivity. Each subsystem integrates to create a customizable, user-friendly device. During development, testing and troubleshooting ensure that sensor sensitivity and response rates meet user needs. The project also involves 3D design and 3D printing of the assistive device which requires background knowledge and application of Math, Physics and Engineering. Expected outcomes include a functional prototype that accurately interprets user input for digital or switch control. Final deliverables encompass a working prototype, thorough documentation, and a presentation demonstrating the Twitch Switch's design and functionality, ready to showcase as an innovative solution for assistive technology users.

The anti-cancer goodness of grapes

Sydni Ann Kolokoltsev

Prof. Vishwas Joshi

The purpose of this research is to start connecting the dots to how grapes are a cure for cancer. This research leads the path at showing how natural products are a cure for cancer ailments. Molecular docking is used in this research to show how the proteins of grapes and BCL-2 (a cancer protein) interact. Already in the history of the world... people have showed how having a high intake of fruits cures all ailments. That fact in and of itself makes this exciting research and gives great promise to everything in the world today. A whole new world. To explore how grape compounds might help fight cancer, this study uses a computer-based technique called molecular docking. First, we selected specific chemical compounds found in grapes—such as resveratrol and quercetin—based on scientific articles and databases. These compounds were downloaded in 3D format from public sources like PubChem. Next, we chose cancer-related proteins that are known to play a role in tumor growth, such as EGFR or BCL-2, and downloaded their 3D crystal structures from the Protein Data Bank (PDB). Using software like Avogadro, we cleaned and prepared the grape compounds by adjusting their shape and energy to make them stable. Then, we used AutoDock Vina, a free molecular docking program, to simulate how well each grape compound could “fit” into the cancer protein— like testing how well a key fits into a lock. The software gave us scores that show how strong the connection is between the compound and the protein. Higher scores suggest a better fit, which could mean the compound might help block or slow down cancer activity. All results were saved and organized using Microsoft Excel for easy comparison, and the writing was done in Microsoft Word to prepare for future publication. After running the molecular docking simulations, the software provided scores that show how well each grape compound fits into the selected cancer-related proteins. These scores are like a report card for each “key and lock” combination—the lower the score (more negative), the stronger the binding between the compound and the protein. For example, resveratrol showed a strong fit with the EGFR protein, suggesting it might help block signals that make cancer cells grow.

Mitigation of The Impact of Climate Change in Building Energy Consumption

Takoda Nestor

Prof. Daeho Kang

The rapid rise in greenhouse gas emissions due to human activity has magnified global warming, which decays our environment. The building stock not only accounts for a large part of global energy use but also is directly impacted by the alteration of climate conditions. This study analyzes how increasing temperatures influence the energy use of office buildings, and secondly, it assesses how existing energy saving strategies perform under future climatic conditions. Applying data from ten Australian cities, the projected future demands for heating and cooling were compared to current conditions. The results clearly indicate that with a warming climate, there will be strong increases in cooling, up to 80% in some regions, while heating needs will decline by almost the same proportion. This shift in the balance between heating and cooling demands will alter the operation of the HVAC systems toward higher energy demand during peak cooling periods. If these changes are not acted upon, there can be increased energy consumption costs and power grid stress. It also includes adaptation of energy conservation measures, such as increased shading, better envelope design, and flexible HVAC systems, which are able to maintain efficiency with reduced emissions under warming conditions. The findings emphasize that there is a need for a long term design strategy, considering current and projected climates, so that buildings remain resilient and efficient in a changed world.

The Ethical Use of NoSQL Databases in AI-Driven Applications: Balancing Innovation and Data

Talisha Rahman

Prof. Elizabeth Milonas

This research explores the ethical use of NoSQL databases in AI-driven systems, focusing on how developers can protect user privacy while supporting innovation. NoSQL databases like MongoDB and Cassandra are widely used to store unstructured and large-scale data that AI models depend on. However, their flexibility and speed can also make it easier for sensitive data to be mishandled or exposed. This study aims to examine real-world examples of how AI systems collect, store, and analyze data using NoSQL technologies, highlighting both the benefits and the ethical challenges. The goal is to identify best practices for using NoSQL databases responsibly, such as improving data transparency, security, and fairness. By combining research on database design, AI ethics, and privacy regulations, this project will offer practical recommendations for creating systems that are both effective and ethically sound.

Assistive Technology Devices through 3d printing

Amna Saifi, Ugochukwu Emenawu

Prof. Farrukh Zia

This research addresses the increasing demand for affordable and accessible solutions that improve mobility and independence for people with disabilities. It focuses on the computer-aided design (CAD) and production of 3D-printed assistive technology (AT) devices. The aim is to create customizable, open-source AT devices that cater to specific physical or cognitive disabilities, empowering users to navigate technological obstacles and gain more independence. Student researchers utilize CAD software and 3D printing to design, prototype, and test devices that meet the unique needs of individual users. The project combines skills in electrical circuits, computer hardware, software, and technical communication to facilitate the design and development process. By conducting background research, applying user-centered design principles, and engaging in hands-on fabrication, the project seeks to develop functional and affordable AT devices that enhance mobility and improve overall quality of life. The anticipated results will showcase the practicality and effectiveness of 3D-printed solutions in tackling accessibility issues, providing a scalable framework for future innovations in assistive technology.

Data Analytics in Economics

Zihan Cao

Prof. Sean MacDonald

This project explores how data analytics can help support more sustainable economic development by focusing on circular economy practices. The study looks at food waste as an important and often overlooked resource. Instead of sending food waste to landfills, where it produces methane, it can be collected and repurposed into compost or converted into renewable energy. Using publicly available environmental and economic data, this project will analyze trends in landfill emissions, costs of waste management, and the energy produced through organic waste processing. I will examine how these practices can reduce environmental harm while also lowering costs and supporting local sustainability goals. The aim is to show how data-driven insight can guide communities and policymakers to make more efficient decisions about resource use. By highlighting the economic and environmental benefits of reuse, this research hopes to demonstrate how circular economy strategies can contribute to long-term sustainability.

Monitoring Heat in the Bronx Subway System

Abdoul Nana

Prof. Abdou Bah, Prof. Hamid Norouzi, A.P. Blake

New York City's subway system faces increasing thermal stress due to climate change, particularly during heat waves. This study investigated temperature and relative humidity conditions at street level and underground platforms across stations on the BD line in the Bronx. Using portable sensors, and mobile devices, data were collected at different times of day, considering factors such as station depth, and commuter density. Heat and humidity levels were further exacerbated by crowded situations during peak hours, highlighting the part that human activity plays in the subsurface Urban Heat Island (UHI) effect. These circumstances may impair infrastructure functioning and present health risks to employees and commuters. Preliminary results show that underground platforms remain consistently warmer and more humid than street level. This research contributes to the MTA's continuing climate resilience and sustainability activities by identifying high-risk stations and directing focused heat mitigation strategies.

Touching Emotions: Assistive Communication with 3D Emojis

Aisha Ayub

Prof. Farrukh Zia

This project explores the transformation of digital emojis into physical, 3D-printed tokens as a new medium for emotional expression. While emojis are commonly used in digital communication, converting them into tangible objects allows users to engage with emotions through touch and physical interaction. The research investigates how these tokens can support individuals who struggle with verbal communication, providing them with a nonverbal method to convey feelings. Additionally, the tactile nature of the tokens offers potential benefits for visually impaired individuals, who may use them like emotion flashcards to identify and express moods through touch. The project also includes the design of tokens with optional keychain loops, making them portable and easy to integrate into daily life. By merging digital symbolism with physical form, this work demonstrates how 3D-printed emojis can broaden accessibility, enhance emotional communication, and offer an innovative tool for inclusive interaction.

The Ethical Uses of Non-Relational Databases

Angie Navarro

Prof. Elizabeth Milonas

Non-relational databases, also known as NoSQL databases, are used to store large amounts of data that do not need a fixed structure. Unlike relational databases that use tables, NoSQL databases can store information in different formats such as documents (JSON), key-value pairs, graphs, and columns. Big companies like Google, Instagram, and Amazon use NoSQL because it helps them handle fast changing and very large data while keeping good performance. Since NoSQL is made to manage different kinds of data, it has become important in many data-heavy environments. However, using non-relational databases also brings several ethical concerns. These include issues with data privacy and security, problems with verifying where data comes from, possible biases in how data is used, and environmental impacts from the large systems needed to run NoSQL databases. The purpose of this research is to point out these ethical issues and explain how non-relational databases may contribute to them. This study focuses on concerns connected to privacy, data handling, and sustainability. It also explains why ignoring these ethical risks can affect both users and organizations. Overall, the research stresses the importance of creating better ethical guidelines and responsible practices when working with NoSQL technologies.

Microgravity Simulation for Lunar In-Situ Build

Harold Rojas

Prof. Samaneh Gholitabar

What this project does is it brings data from ISS cement solidification experiments to create reliable information for COMSOL multiphysics simulations. Many studies were reviewed to collect key details about sample size, mixing methods, curing timelines, reaction-arrest steps and ISS environmental conditions. All of the data was organized into a dataset that allowed us to build COMSOL models that matched the shape and conditions of the ISS samples. The COMSOL models were then simulated to understand how the cement's porosity and strength develop in 1,7 and 28 days of curing. Overall, this work establishes the foundation for understanding the behavior of cement in microgravity conditions.

Mapping of Metadata Schematics

Joseph Alonge

Prof. David Smith

In the Information Age, we experience a plethora of data being created and placed in rich, digital environments like data sets and databases. Even for an individual user interacting daily with their own data, there is a need to utilize the most efficient methods of search and retrieval. In scalable data environments, useful information may be lost due to poor naming conventions or poor search methods. The aim of this research is to assess a key factor in the storing of digital objects: metadata, which is the descriptive data regarding the digital object in storage. Metadata follows different methods, or schemas, and two being employed in this research are Descriptive metadata and Preservation metadata. Using a self-created and populated dataset stored in MySQL, this experiment will examine the efficiency of the Dublin Core (Descriptive) and PREMIS (Preservation) metadata schemas. The expected outcome involves comparing the Information Retrieval (IR) results of the two schemas through a minimal mapping approach. This means quantitatively measuring the retrieval performance of the schemas. The outcomes in this experiment can inform best practices for creating metadata schemas and improving search efficiency for everyday users.

Exploring Common Software Vulnerabilities and Their Underlying Causes

Kazi Tasin

Prof. Sara Moshtarizohrehnama

Software vulnerabilities remain one of the most persistent challenges in modern computing systems, often leading to security breaches, data loss, and operational failures. As technology continues to advance, understanding why these weaknesses occur—and how frequently they appear—has become increasingly important for improving system reliability. This research project aims to conduct an introductory exploration into the basic causes behind software vulnerabilities, with a focus on identifying common patterns that make systems weak or exploitable. The study will examine several foundational categories of vulnerabilities, such as poor input validation, outdated or misconfigured software components, insecure communication protocols, and human-driven errors during development. By reviewing publicly available vulnerability databases, such as the National Vulnerability Database (NVD), the project will also analyze how often certain types of weaknesses are reported and what trends appear across different software environments.

Assessing plant health changes in a hydroponics system using computer vision models

Kevin Chen

Prof. Yousoon Baek

Plant diseases pose a significant threat to global food supplies, the demand for accurate and fast classification methodologies are increasing rapidly. Traditional diagnostic methods are time-consuming and often require specialists, leading to drop in efficiency and availability, inevitably causing potential damage to crop health and yields. This study addresses the need for an efficient, automated system capable of real-time classification of leaf diseases under various growth environments. The primary goal is to deploy artificial intelligence models to minimize the cost and other problems associated with effective plant illness classifications. We propose implementing the YOLOv8 classification architecture, trained on a diverse dataset of 1322 images, containing 3 classes, healthy, rusty, and powdery. The model's performance was optimized through transfer learning. Model evaluation was performed using a dedicated test set under standard classification metrics. The final YOLOv8 model achieved a Macro Average Precision of 0.9753 and an average classification speed of 0.23 second per image. Specifically, the model demonstrated impressive performance across multiple classes, with Precision and Recall exceeding 0.92 across all classes. The results confirm that the YOLOv8-based system provides an accurate, fast, and lightweight structure for plant disease classification. This technology has the potential to be deployed on a larger scale, enabling productive agricultural practices through early intervention and targeted treatment, thus enhancing crop yield.

The Architecture of Water: From Forest to Village to City

Kevin Hernandez

Prof. Kenneth Conzelmann

Our initial interest for this research effort was to investigate the possibilities of harnessing energy from a shallow slow-moving creek in New York's Hudson Valley. In the process we discovered the wonders of our regional water supply system which feeds NYC's 8.5 million residents with over 1.1 billion gallons of fresh potable water every day, also considered one of the best tasting and finest water for any large city on earth. This research project is an overview of how we procure our potable water, from remote rural areas to dense urban centers, mapping the origins of collection, storage, and transportation of water from the Catskill Mountains to NYC. We look at the land where the rainwater falls, the reservoirs to store, the structures above and the infrastructures below, the pipelines and tunnels and the rooftop water tanks atop our city's buildings. And we ask: what is the architecture of water?

Research Project: In-Data Science About Machine Learning Models Predicting Stock Market Data

Parviz Subkhankulov

Prof. Caner Koca

Machine learning has been applied across diverse fields to develop predictive models. Although forecasting stock prices or market directions remains challenging due to volatility and noise, numerous studies have demonstrated the effectiveness of machine learning algorithms in financial prediction tasks. In Alzaman, historical data from stocks traded on the Toronto Stock Exchange (TSE) was used to train machine learning models aimed at predicting future price movements and directions. An important step is to examine whether the methods employed in that study can be successfully adapted to other markets. This project focuses on the S&P 500, a benchmark index comprising 503 common stocks issued by 500 of the largest publicly traded companies in the United States. The research involves building predictive machine learning models for S&P 500 component stocks and evaluating their performance relative to models developed using TSE data. The study aims to provide insights into the generalizability of machine learning techniques across different stock exchanges and market conditions.

Navigating Legal Labyrinths: Health Communication and the Experiences of Immigrant Healthcare Professions in the U.S. Healthcare System

Sabahat Moughal

Prof. Sarah Price

This study examines how immigrant healthcare professionals experience immigration-related stress and communication challenges within the U.S. healthcare system, using preliminary quantitative data collected at Wyckoff Heights Medical Center. With IRB approval secured for the survey portion of the project, early responses from six immigrant clinicians highlight the same underlying tension: immigration status shapes how they move through their workday far more than most colleagues or institutions realize. Participants described immigration processes as mentally draining and disruptive to long-term planning. The stress of waiting, uncertainty about future status, and dependence on institutional sponsorship created a backdrop of pressure that followed them into clinical work, even when they tried to compartmentalize it.

Communication-related themes surfaced alongside these legal concerns. Respondents reported the constant need to adjust their communication style to fit U.S. clinical norms, especially around tone, hierarchy, and patient expectations. Several noted that cultural differences made them more cautious in how they spoke up or expressed concerns at work. Feelings of isolation appeared in multiple responses, reflecting both cultural distance and the emotional weight of navigating immigration systems while maintaining demanding clinical schedules. Although the dataset is small, these emerging themes reveal a consistent connection between immigration status, communication strain, and overall professional well-being. As more responses are collected, the study aims to build a clearer picture of how institutions can better support immigrant healthcare professionals through mentorship, culturally responsive communication training, and greater awareness of how legal context affects clinical life.

Calculus Explorations of Symmetry

Marc Verma-Bonany

Prof. Satyanand Singh

The analysis of symmetry in calculus is a useful yet underemphasized technique. Most textbooks restrict integration techniques for symmetric functions to two classical cases: even functions symmetric about the y -axis and odd functions symmetric about the origin. In practice, however, many integrands exhibit symmetry about an arbitrary point within their domain rather than about these special axes. This research project generalizes the standard symmetry framework to symmetry about any point in an interval and develops systematic methods—supported by intuitive geometric interpretations—for evaluating definite integrals of such functions. In addition to techniques for computing these integrals, we also provide tools for verifying symmetry within a function's interval. Our approach incorporates geometric insight, strategic substitution, and other methods that yield elegant solutions. Because symmetric functions often involve trigonometric forms, we include a collection of identities that streamline computation; overall the work addresses a broad class of integrands, including polynomial, exponential, and rational functions. The motivation for this research arises from the frequent simplification of integrals that would otherwise be difficult or impossible to evaluate using standard calculus techniques. The resulting methods have applications ranging from mathematical problem-solving to real-world modeling.

Assessing local plant health with NDVI

Stanley He

Prof. Jeremy Seto

This project explores how plants respond to seasonal and environmental changes by studying vegetation greenness through NDVI (Normalized Difference Vegetation Index) data. I developed a dual-camera system using Python that captures and processes both visible(RGB) and near-infrared(NoIR) images to calculate NDVI, which indicates how healthy or active the vegetation is. I am comparing this field-collected data with PhenoCam observations from two sites: the City College of New York, which overlooks St. Nicholas Park, and Norrie Point, a site within the National Estuarine Research Reserve System. By analyzing patterns of greenness and timing of leaf changes at these locations, I hope to understand how urban and coastal environments differ in their plant responses to climate conditions. Moving forward, I plan to design a simple data dashboard that helps visualize NDVI and PhenoCam trends, making it easier for others interested to explore seasonal changes in vegetation. The system follows a calibration process adapted from the method described by Stamford et al. (2023), which uses six reference color patches to correct reflectance values. The code aligns RGB and NoIR images so that leaf and feature positions overlap accurately in order to compensate for light leakage between the cameras. A colorized NDVI map is then generated, where green represents healthy vegetation and yellow indicates stress. The dual-camera approach differs from older single-camera methods by offering an affordable and accessible means of remote sensing in environmental studies, therefore reducing reliance on costly satellite data and specialized equipment.