

جامعة نيويورك أبوظبي



# AY 22-23 UNDERGRADUATE RESEARCH REPORT





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# INTRODUCTION

At NYU Abu Dhabi, undergraduate research plays a pivotal role in shaping the academic, professional, and personal development of students. Spanning diverse disciplines from laboratory-based scientific research to film production and screenings, undergraduate research at NYUAD epitomizes innovation and exploration. With state-of-the-art facilities, cutting-edge resources, and a supportive community of scholars and mentors, NYUAD provides our undergraduate students with unparalleled opportunities to engage in meaningful research experiences that shape their intellectual growth and future aspirations.

This report serves as a testament to some of the outstanding undergraduate research endeavors undertaken during the academic year 2022-2023 and the summer of 2023. Conducting research nurtures critical thinking through immersive, hands-on learning and fosters both collaborative teamwork and individual initiative. Through active engagement with the research process, undergraduates develop a deeper understanding of their field of study and become familiar with research methods and design. Each contribution within this report represents not only the culmination of rigorous inquiry but also the ingenuity and creativity of our student researchers.

We take this opportunity to thank the numerous faculty members and researchers who served as guides and mentors by offering insights, support, and encouragement. These relationships not only enhance students' research skills but also facilitate personal and professional growth, as they learn from experts in their field and forge connections that can shape their academic and career trajectories.

We are especially grateful to the Office of Student Research Faculty Committee, comprising Andrea Macciò, Sarah Paul, Olivier Bochet, and Pradeep George, for their invaluable guidance in shaping the Office's programs, guidelines, and initiatives, as well as in reviewing research funding requests and fellowship applications. We would also like to extend our gratitude to Vice Provost and Associate Vice Chancellor of Global Education and Outreach Carol Brandt, who for more than a decade has overseen the development of NYUAD's summer programs of experiential learning, serving more than 300 students in internships and undergraduate research each year.

## **Erich Dietrich**

Vice Provost for Undergraduate Education

## **Farhana Goha**

Head of Visiting Students Program and Student Research

# STUDENT RESEARCH PROGRAMS BY THE NUMBERS

## SUMMER RESEARCH GRANTS

Offers competitive grants to support students across the divisions, who have secured summer research positions. Students may work on independent research projects or join existing faculty research projects.

## SUMMER RESEARCH ASSISTANT PROGRAM

Provides students the opportunity to assist faculty to advance their research projects through paid research work during the summer.

**197**  
STUDENTS  
APPOINTED

## VISITING SUMMER UNDERGRADUATE RESEARCH PROGRAM

Offers the opportunity for NYU New York, NYU Shanghai, and external undergraduate students studying in UAE-based universities to take part in research during the summer, supervised by NYUAD faculty members and funded by the Office of Student Research.

**31**  
STUDENTS  
PARTICIPATED

## POST-GRADUATION PRACTICAL TRAINING PROGRAM

Allows faculty to appoint NYUAD seniors graduating in May to work full-time on faculty research projects in the summer following their graduation.

**107**  
STUDENTS  
PARTICIPATED

## CONFERENCE PRESENTATIONS

Students may apply for conference grants to enable them to present their research and creative works at conferences and exhibitions.

## RESEARCH ASSISTANTSHIP POSITIONS DURING THE ACADEMIC YEAR

Provides students the opportunity to assist faculty with advancing their research projects through part-time paid research work during the academic year.

**671**  
STUDENTS

## VISITING UNDERGRADUATE RESEARCH ASSISTANTSHIP AND ARTS APPRENTICESHIP AWARDS PROGRAM

Students from NYU New York and NYU Shanghai who wish to build their research experience during a semester abroad may apply for competitive undergraduate research assistantship positions.

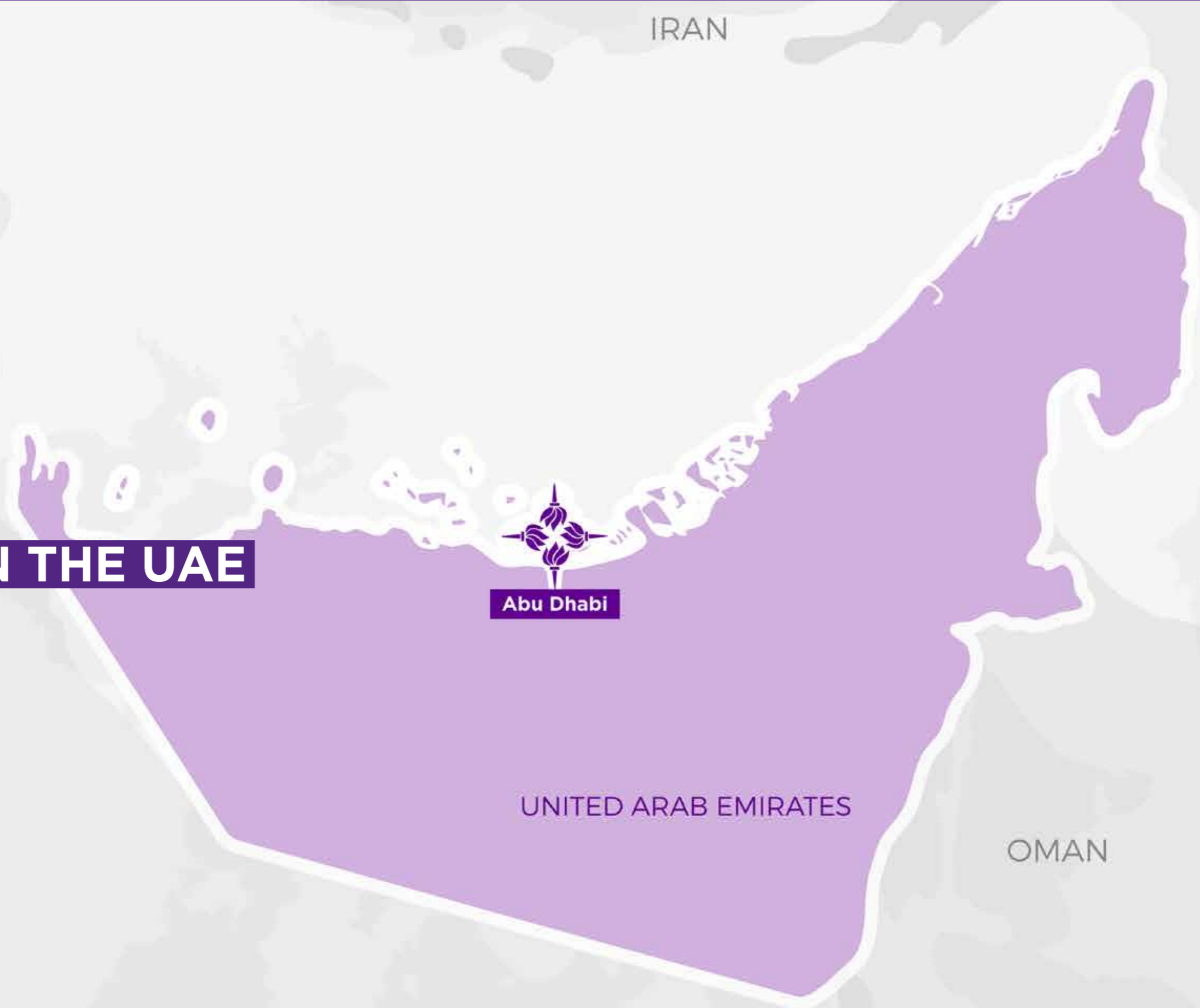
**54**  
STUDENTS  
AWARDED

## POST-GRADUATION RESEARCH FELLOWSHIP PROGRAM

Retains outstanding academic talent within the region by supporting a select cohort of exceptional NYUAD graduating seniors with a prestigious one-year research fellowship at NYUAD.

**11**  
FELLOWS  
SELECTED

# RESEARCH IN THE UAE



IRAN

QATAR

Abu Dhabi

UNITED ARAB EMIRATES

OMAN

SAUDI ARABIA



**AARUSHI PRASAD**

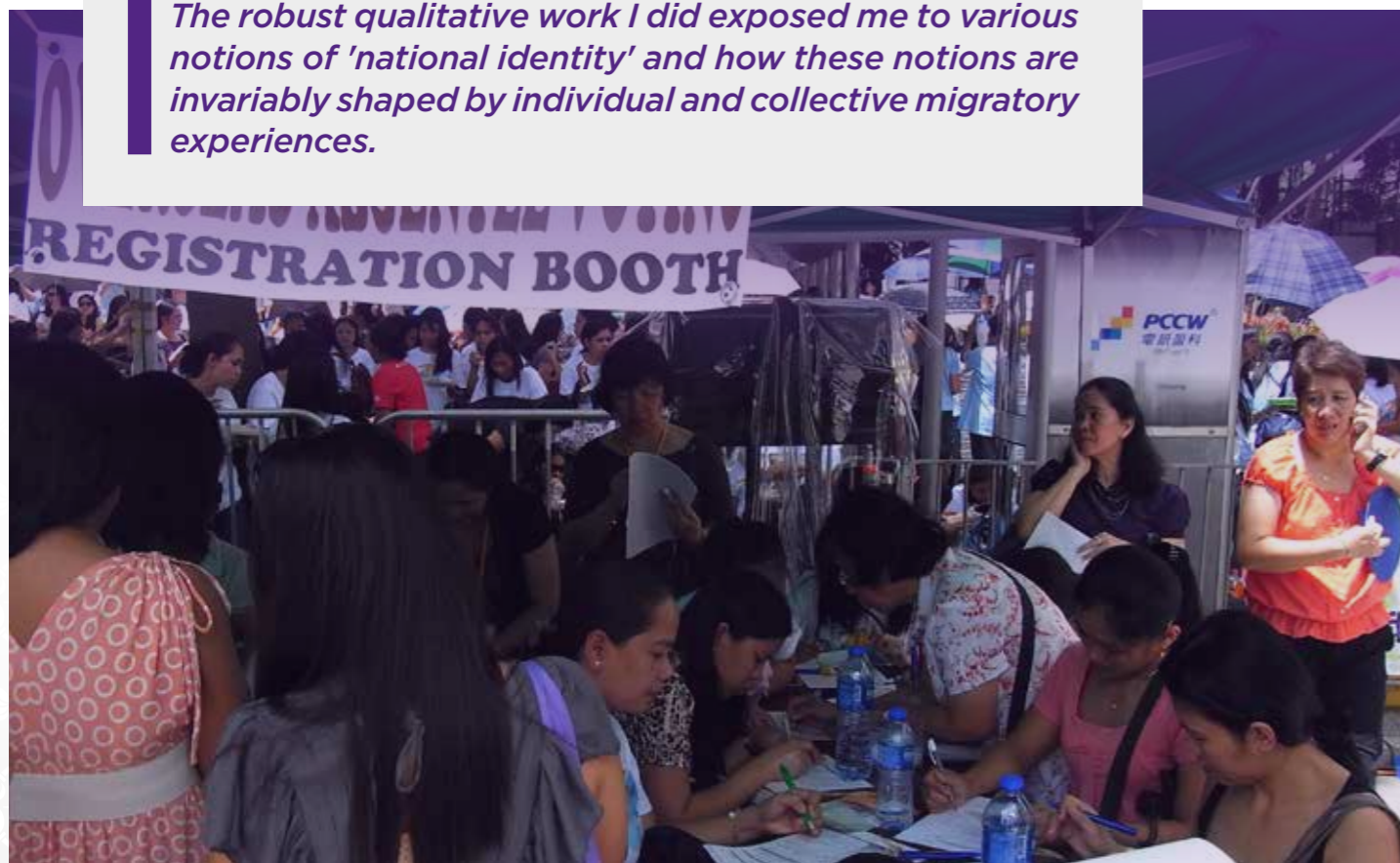
MAJOR: HISTORY

FACULTY SUPERVISOR: DAUNGYEWA UTARASINT

**THE DUTY TO VOTE:  
EXPATRIATE POPULATIONS AND ELECTORAL POLITICS**

Dabbling in electoral politics in the Philippines, our research primarily evaluated the effects of global migration on voter turnout and the ramifications of increasing globalization on the way that expatriate populations conceive their 'duty to vote' and the 'means' through which they exercise this duty. Segmenting the Filipino migrant population by profession, I conducted interviews with Filipino expats belonging to different socio-economic strata in Abu Dhabi probing into voter registration mechanisms, attitudes toward voting and the efforts made by the government to encourage their participation in the electoral process. We also liaised with the Filipino Embassy in Abu Dhabi to learn about expatriate voter registration, voter turnout and voting methods for expatriates.

*As an expatriate, what does it mean to have your voice heard in your home country? This was a question that I consistently grappled with throughout my research. The robust qualitative work I did exposed me to various notions of 'national identity' and how these notions are invariably shaped by individual and collective migratory experiences.*



An example of an overseas absentee voting booth set up after the passage of Republic Act No. 9189, which enacted a mechanism for qualified Filipino voters to cast their vote from their country of residence.



A flyer which was part of the public ad campaign run by Embassy of Philippines in Singapore, urging Filipino residents to register for casting their votes.



**FATIMA FAROOQ**

**MAJOR:** COMPUTER ENGINEERING

**FACULTY SUPERVISORS:** OZGUR SINANOGLU AND LILAS ALRAHIS

### IMPLEMENTING UNSAIL

Leading semiconductor companies such as Apple and Qualcomm deploy third party foundries that gain access to the companies' Integrated Circuit (IC) designs. There may be attackers present in the IC supply chain that can compromise the security of the underlying hardware during fabrication, testing, assembly, and packaging through launching hardware-oriented attacks. Logic locking intends to protect the intellectual property of IC designs throughout the globalized supply chain, however the SAIL attack, based on tailored machine learning models, circumvents combinational logic locking. Therefore, the objective of my summer research project was to implement UNSAIL, an effective technique to overcome oracle-less, machine learning based attacks on logic locking. UNSAIL's main algorithm involves inserting specific key-gate structures that confuse machine learning (ML) models like those used in SAIL. Firstly, I implemented random logic locking through preparing C++ scripts that handled gate level netlists. I then encoded the specific gates which constituted a key input, through preparing a separate script. Then, I synthesized the locked circuit and then worked out an algorithm and coded it that compared the key gate structures before and after synthesis. After comparison, I was able to achieve the prime purpose of UNSAIL, to insert specific key gate structures into the synthesized locked circuit (the gates that were modified during synthesis), to ultimately achieve UNSAIL.

```
//Secret key is: 0011100101111100
//Module:

module b21 ( P2_WR_REG_SCAN_IN, SI_31, SI_30, SI_29, SI_28, SI_27, SI_26,
SI_25, SI_24, SI_23, SI_22, SI_21, SI_20, SI_19, SI_18, SI_17,
SI_16, SI_15, SI_14, SI_13, SI_12, SI_11, SI_10, SI_9, SI_8,
SI_7, SI_6, SI_5, SI_4, SI_3, SI_2, SI_1, SI_0,
P2_RD_REG_SCAN_IN, P2_STATE_REG_SCAN_IN, P2_REG3_REG_7_SCAN_IN,
P2_REG3_REG_27_SCAN_IN, P2_REG3_REG_14_SCAN_IN,
P2_REG3_REG_23_SCAN_IN, P2_REG3_REG_10_SCAN_IN,
P2_REG3_REG_3_SCAN_IN, P2_REG3_REG_19_SCAN_IN,
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P2_REG3_REG_2_SCAN_IN, P2_REG3_REG_18_SCAN_IN,
P2_REG3_REG_6_SCAN_IN, P2_REG3_REG_26_SCAN_IN,
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P2_DATA0_REG_14_SCAN_IN, P2_DATA0_REG_13_SCAN_IN,
P2_DATA0_REG_12_SCAN_IN, P2_DATA0_REG_11_SCAN_IN
```

Software coding for hardware design; inserting locks into chip hardware.



**YIXIAN LI**

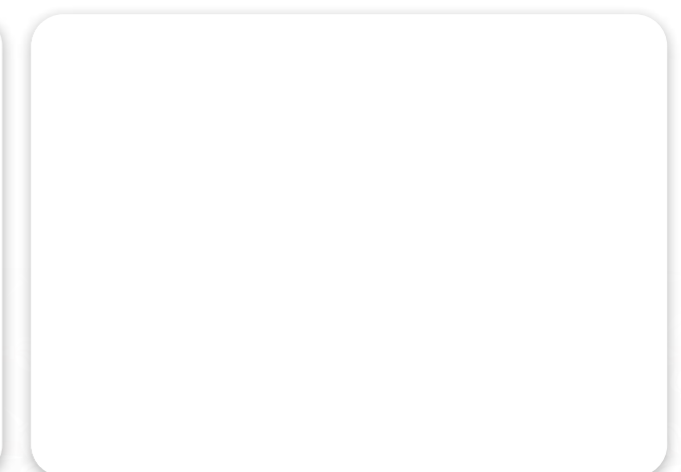
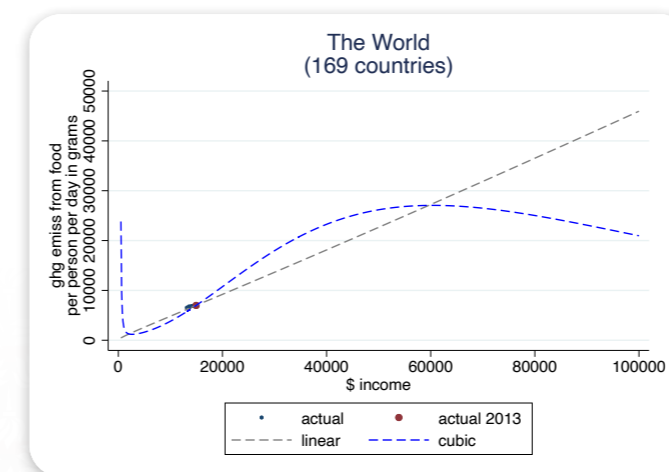
**MAJOR:** MATHEMATICS & ECONOMICS

**FACULTY SUPERVISOR:** JORDAN NORRIS

**SCHOOL:** NYU NEW YORK

### ECONOMIC GROWTH AND GREENHOUSE GAS EMISSIONS FROM FOOD: COMPOSITION AND SCALE EFFECTS

I worked on discovering the dynamics between greenhouse gas emissions from food consumption and economic growth. Using a dataset on the typical per person per day food consumption of more than 100 countries over 40 years, merged with the Penn World Table, an economic dataset of countries' population sizes, GDP, etc., we conducted regression analyses and traced out how people's diet changes with respect to income, which allows us to compute counterfactual food consumptions at any arbitrary income level, e.g. what would happen if all countries have the US's, China's, or Luxemburg's income. For each type of food, we have a specific greenhouse gas emission multiplier that translates calories consumption into CO2 equivalent greenhouse gas emission along the supply chain. Applying this methodology, we were able to plot the Environmental Kuznets Curve (EKC), compute the counterfactual emissions from food in a variety of scenarios and visualize the results in over 50 plots.





**OSCAR WANG**

**MAJOR:** ELECTRICAL ENGINEERING

**FACULTY SUPERVISORS:** AHMAD BAZZI AND MARWA CHAFII

### RIS (RECONFIGURABLE INTELLIGENT SURFACE)-ENABLED ISAC (INTEGRATED SENSING AND COMMUNICATION) FOR 6G SYSTEMS

Research around the world has begun to piece together a vision for 6G. It is sure that in the near future, 6G should be able to support a vast number of services such as blockchain, haptic telemedicine, extended reality (XR) remote services, holographic teleportation and so on by running on innumerable devices, especially Internet of Things (IoT) devices. Hence, Integrated Sensing And Communication (ISAC) has been proposed to save bandwidth by performing both sensing and communication through one set of resources.

My research considered a novel architecture of combining Reconfigurable Intelligent Surfaces (RISs), which are surfaces that can ingeniously reconfigure their electromagnetic propagation environment and Passive Radars (PR) which perform localization of targets without using self-controlled emissions. Moreover, existing state-of-the-art work may require channel estimation, user equipment feedback, or knowledge of the number of targets, but my work does not. The goal of my research was to devise algorithms to perform joint localization and detection of the targets and characterize the performance of the system. I first studied the group's previous work on estimating the Angles Of Arrivals (AoAs) through a Normalized Least-Mean-Squares (NLMS) batch algorithm. Next, through extensive research on 5G New Radio (NR) and 4G Long-Term Evolution (LTE) protocols, I decided to use Zadoff-Chu sequences for estimating Times Of Arrivals (ToAs) mainly due to its Constant Amplitude Zero Autocorrelation (CAZAC) property. Next, I designed a correlator to perform the estimation. To associate ToAs and AoAs and to estimate the number of targets, I deployed the specialty of the RIS by changing the beamforming matrix each time. Finally, by designing a transformation algorithm based on finding the intersection of a line and ellipse, I recovered the cartesian coordinates.

For the tests, I designed a 2D test environment and the test parameters and wrote the simulation code on MATLAB. I also learned how to perform batch simulations with the help of the NYUAD Jubail High Performance Computer. The test results showed nice performance, and we also observed increased accuracy of localization through more RIS elements.

*Summer research is a transformative experience. The opportunity allowed me to learn how to apply my skills that I learned in the classroom (e.g. signal processing, communication theory and MATLAB) in a real academic setting and how to use them to make educated choices, decisions, and solve the problems that appeared in my work.*

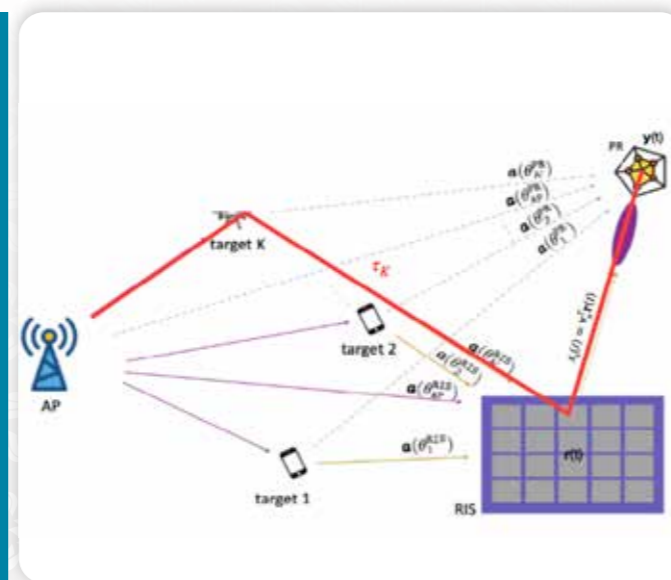
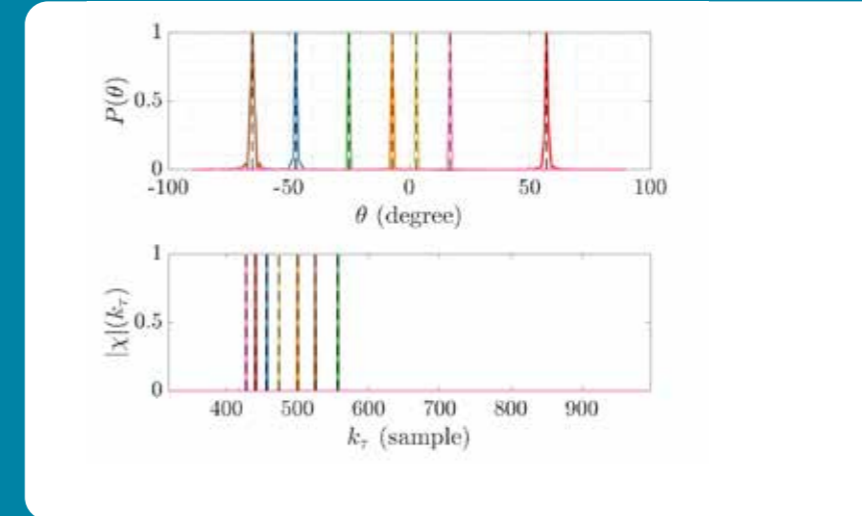
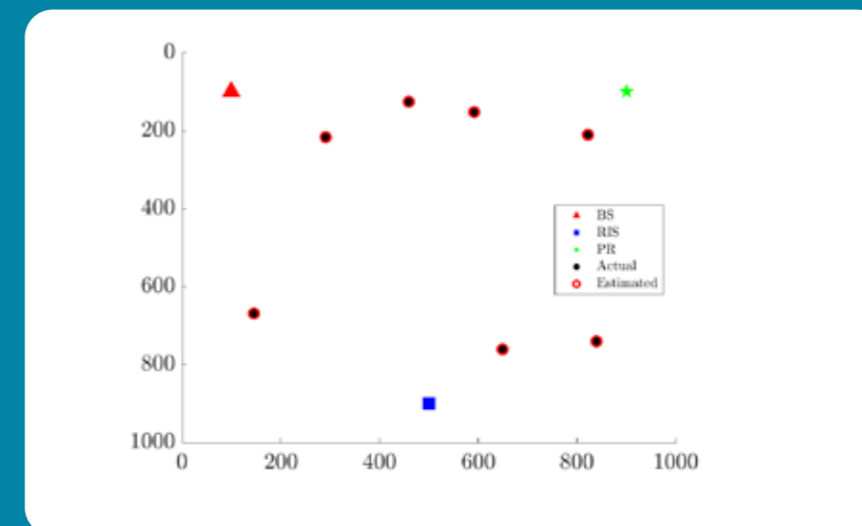


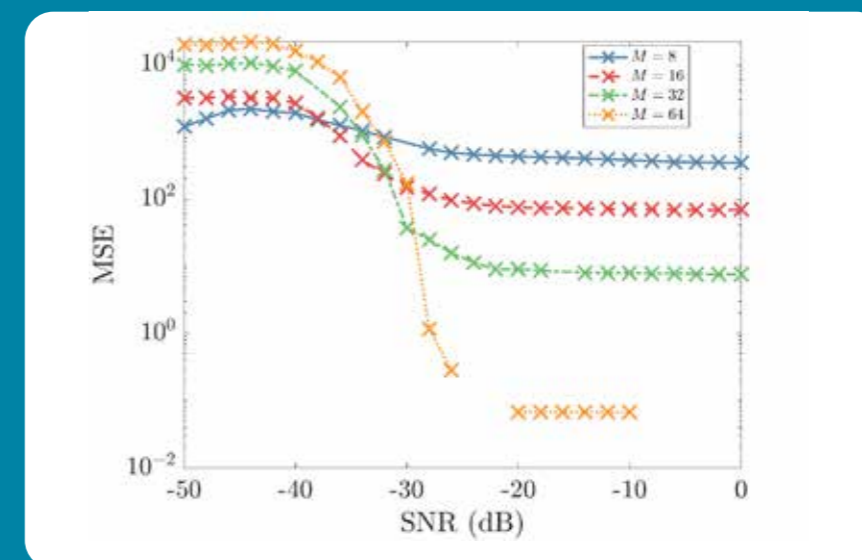
Illustration of the system model.



Association of ToAs and AoAs.



Visualization of the target localization results.



Mean squared error of the system versus signal to noise ratio at the RIS.





**SOYINI ALEXANDER**

**MAJOR:** PSYCHOLOGY

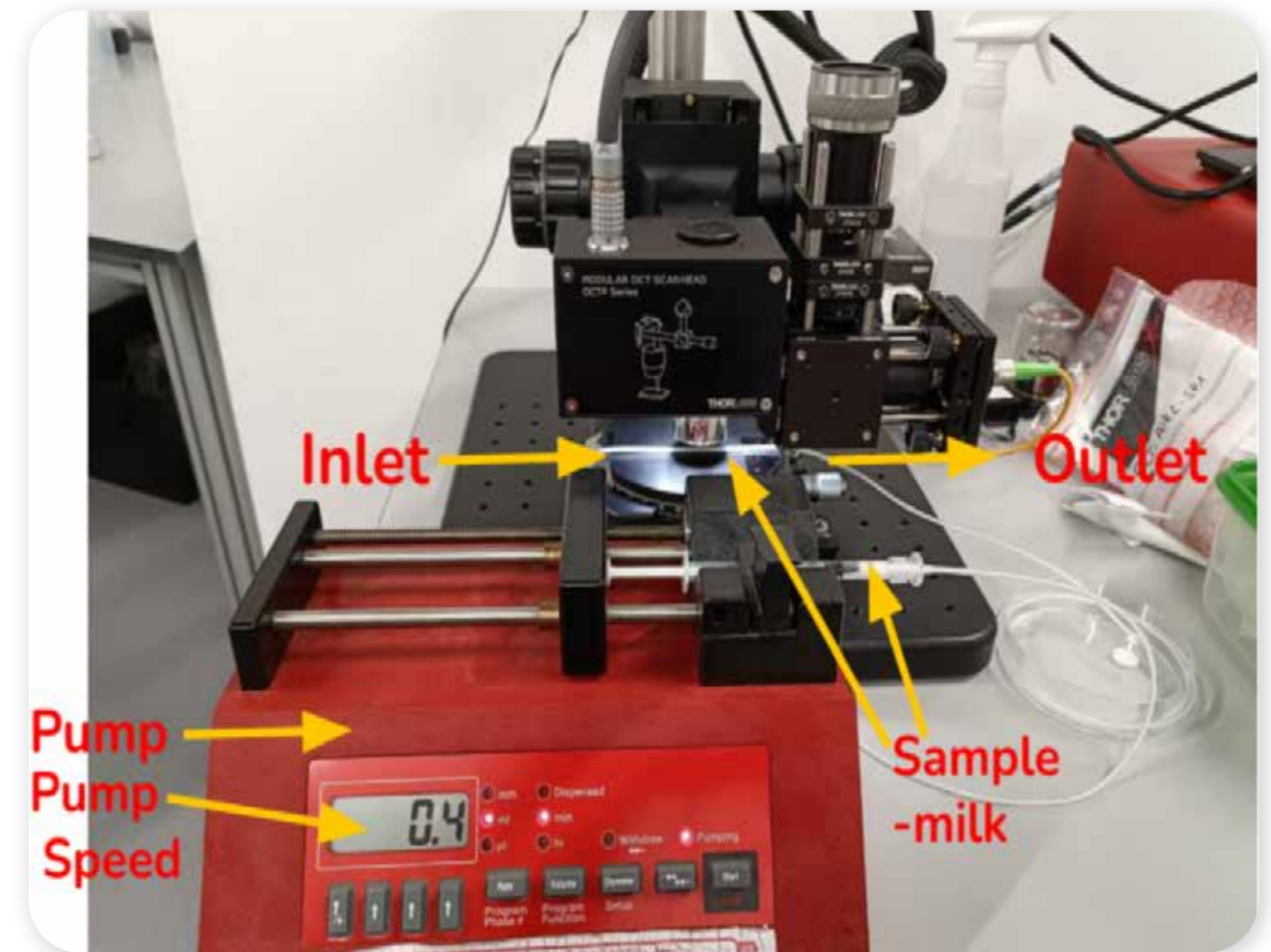
**FACULTY SUPERVISOR:** AZHAR ZAM

### BIOMEDICAL APPLICATIONS OF OPTICAL COHERENCE TOMOGRAPHY

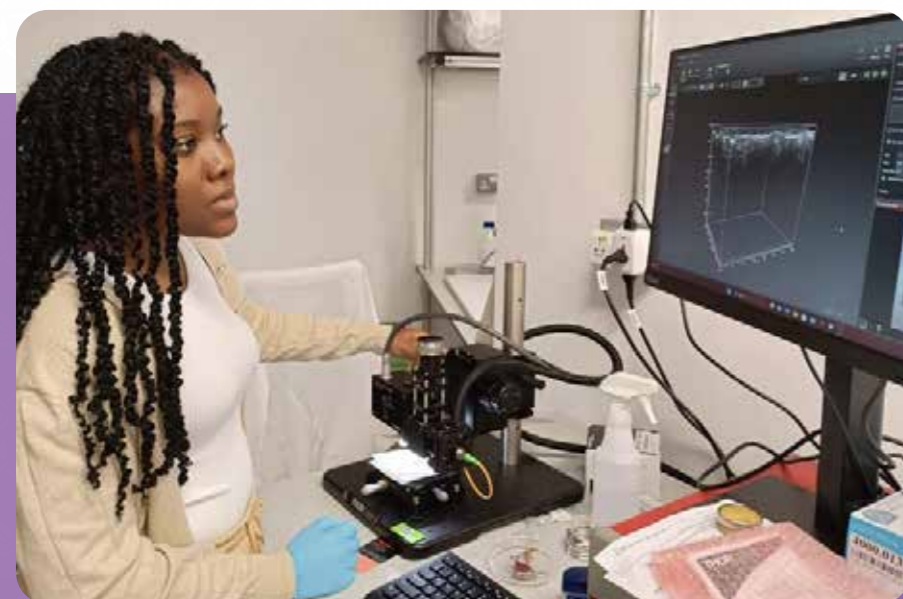
Optical Coherence Tomography (OCT) is a non-invasive medical imaging technique that delivers high-resolution cross-sectional images of biological tissues. Various imaging modes like 2D, 3D, speckle variance, and Doppler modes were used. In Optical Coherence Tomography (OCT), the "speckle mode" is one method for OCT-A that uses the variance of consecutively acquired images to detect flow at the micron scale. The "Doppler mode" utilizes the Doppler effect to measure the velocity of moving structures within the imaged tissue or sample by detecting changes in the frequency of the backscattered light, enabling the visualization of blood flow or other dynamic processes.

Throughout the summer, I learned experimentally and theoretically, about the diverse applications of Optical Coherence Tomography. Experimentally, I delved into OCT's role in microcirculation. In one particular experiment, I observed fluid flow, simulating blood circulation scenarios by using samples like milk, with and without nanoparticles, as well as water through a tube facilitated by a pump. This experiment enabled me to witness the flow dynamics in both Doppler and speckle modes, conclusively demonstrating OCT's capability to capture blood flow.

Additionally, my exploration extended to imaging ex vivo tissues (bovine), including muscle, fat, and bone. Notably, despite variations in tissue material properties that influenced the depth of penetration—such as the greater penetration of muscle compared to skin or bone—OCT consistently revealed distinct tissue layers in all samples. Moreover, I acquired skills in correlation mapping techniques using MATLAB, further enhancing my ability to interpret and analyze the images obtained from the microcirculation experiments.



Experimental setup of OCT to analyse microcirculation using speckle variance and correlation mapping.



Imaging of ex vivo (bovine) bone sample using OCT system.

*I am deeply appreciative of the invaluable opportunity to work in the Laboratory for Advanced Bio-Photonics and Imaging (Lab-π), Division of Engineering, under the mentorship and continual feedback from Professor Azhar Zam and Dr. Pauline John. This experience has allowed me to acquire new skills and broaden my exposure, which will undoubtedly enhance my path in both the pursuit of a minor in Engineering, and my knowledge of imaging techniques.*



**FADHEL BARAKAT**

**MAJOR:** CIVIL ENGINEERING

**FACULTY SUPERVISOR:** SAMER MADANAT

## ASSESSING THE IMPACT OF SEA LEVEL RISE ON TRAFFIC INFRASTRUCTURE IN NEW YORK CITY

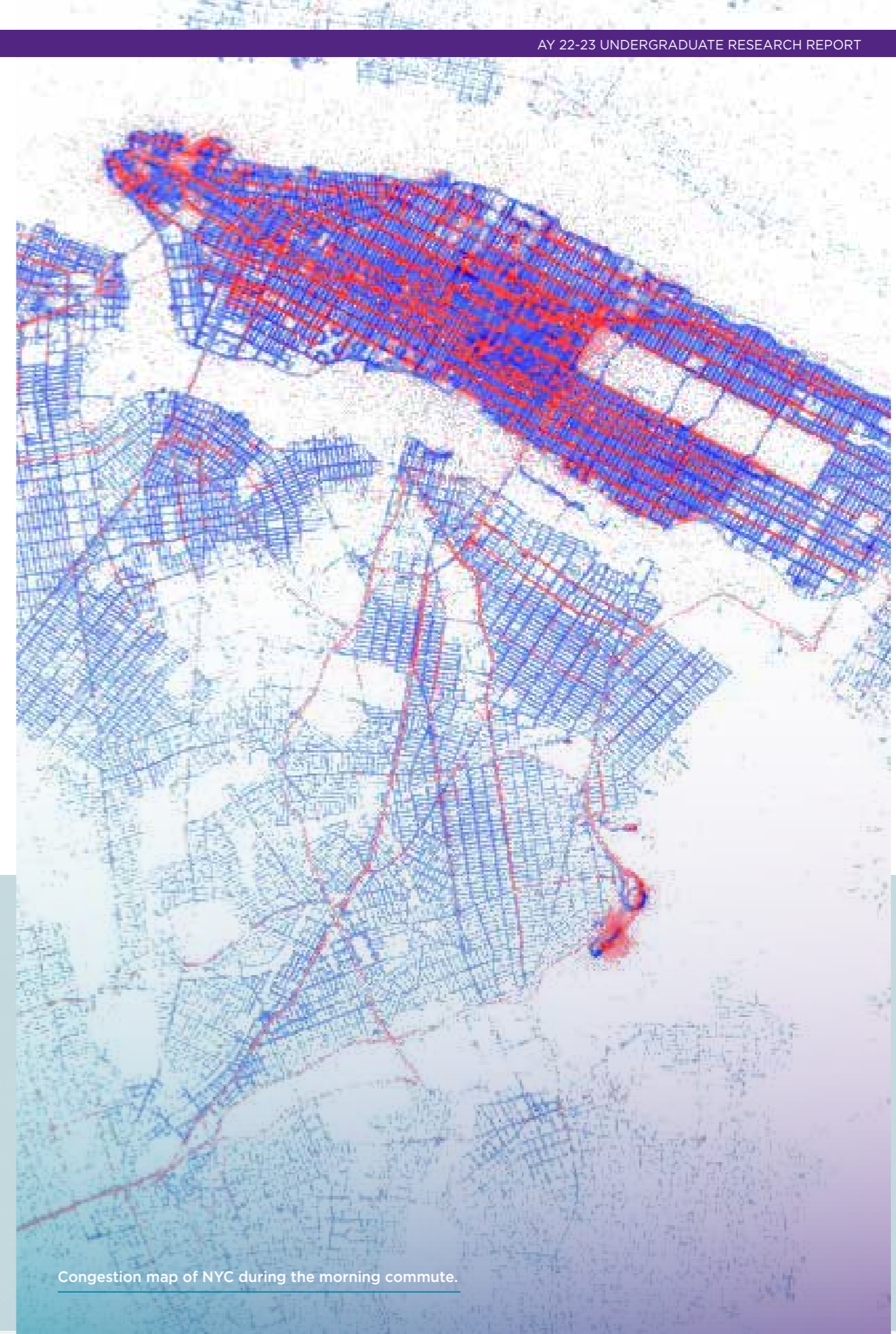
I undertook a research project centered around assessing the impact of sea level rise on New York's transportation infrastructure. My primary objective was to understand the potential vulnerabilities and disruptions that rising sea levels could impose on the traffic patterns of New York. This, in turn, would allow Professor Madanat's research team and I to identify which precincts to protect against sea level rise.

To initiate this project, I engaged in a process of categorizing New York's precincts based on their coastal proximity and borough affiliations, utilizing ArcGIS for precise mapping. This initial step was pivotal for laying the groundwork for subsequent simulations.

The next step of the project was focused on conducting hydrodynamic simulations. These simulations were instrumental in identifying those precincts likely to be flooded by rising sea levels. By visualizing these scenarios, I gained invaluable insights into the areas most susceptible to transportation disruptions, aiding in the strategic planning of future mitigation efforts.

Further enhancing the project's depth, I executed traffic simulations that quantified the impact of inundation on traffic patterns, through the use of the traffic simulation software MATSim. These simulations demonstrated how the changing landscape could lead to shifts in traffic flow and potential congestion hotspots. Such findings are crucial for devising adaptive strategies that ensure the continued functionality of transportation networks in the face of evolving environmental conditions.

*It was a privilege to work under such a well-established individual in the transport field, Professor Madanat. Throughout my experience I was able to expand my knowledge in the field, and take on many challenges that will grant me familiarity with the industry. This opportunity will serve as a valuable experience to aid in my transition to graduate school.*



Congestion map of NYC during the morning commute.



**SARTHAK PRASAD MALLA AND TASNIM AHMED**

**MAJOR:** COMPUTER SCIENCE & APPLIED MATHEMATICS

**FACULTY SUPERVISOR:** MUHAMMAD SHAFIQUE

### IMAGE CLASSIFICATION USING HYBRID QUANTUM CLASSICAL NEURAL NETWORKS

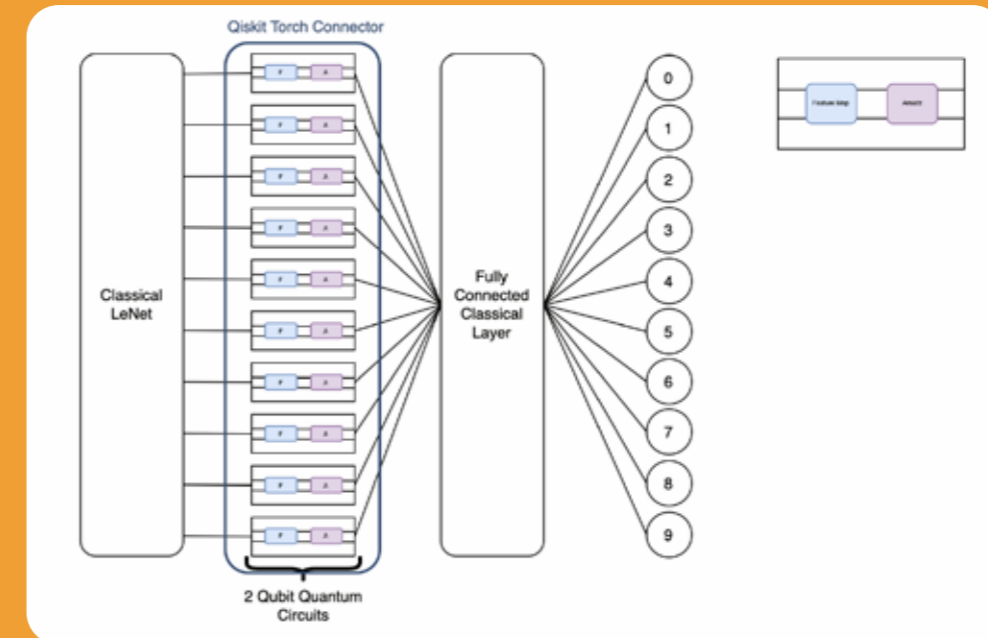
Machine Learning has revolutionized the contemporary world by introducing unprecedented levels of automation, insight, and predictive power. However, the physical limitations of the present hardware have imposed constraints on the further advancement of machine learning capabilities. Hence, scientists have been exploring the field of quantum computing to surpass the limitation of conventional computation and achieve a paradigm shift in computational power. Within this context, Quantum Machine Learning has emerged as a transformative approach, aiming to alleviate the physical limitations faced by neural networks and offer a significant boost in computational prowess.

Our research explored quantum machine learning models and algorithms, and compared them to their classical counterparts. Our focus was on implementing several hybrid quantum-classical machine learning models and comparing their performances. We measured the quantum usability by experimenting with quantum circuit input within state-of-the-art classical neural network architecture for image classification tasks.

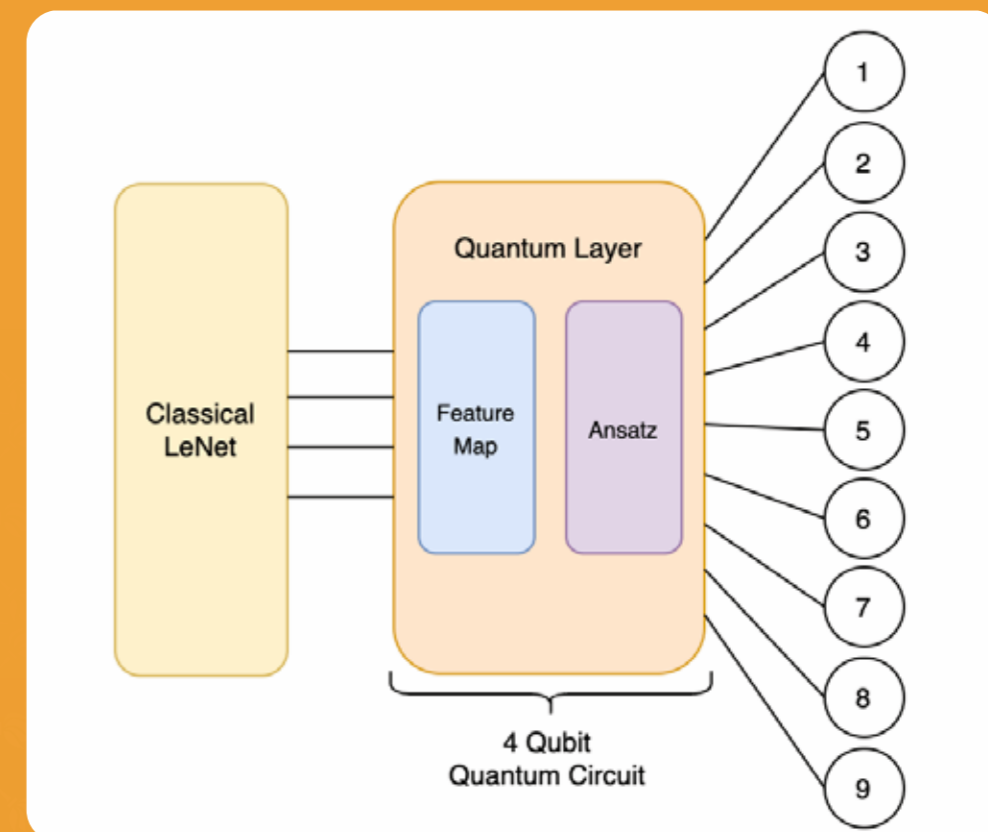
Under Professor Shafique’s guidance, we used our foundation in machine learning concepts and approaches to dive into newer fields. We were able to navigate through the relatively new field of quantum machine learning, dissecting the ground-breaking principle and concepts in quantum computing, and gaining insights into their potential applications.

*I uncovered the complex connection between quantum mechanics and machine learning algorithms when I traveled into the scarcely-explored region of quantum machine learning. Through this experience, I was able to comprehend the subtleties of variational quantum circuits, quantum gates, and entanglement—a group of tools that contained the secret to utilizing quantum computing to improve machine learning procedures.*

Sarthak Prasad Malla



Hybrid model architecture with repeated quantum circuits for each input node.



Hybrid model architecture with one quantum circuit for all input nodes.



**SISHIR SURJIT**

**MAJOR:** CHEMICAL AND BIOMOLECULAR ENGINEERING

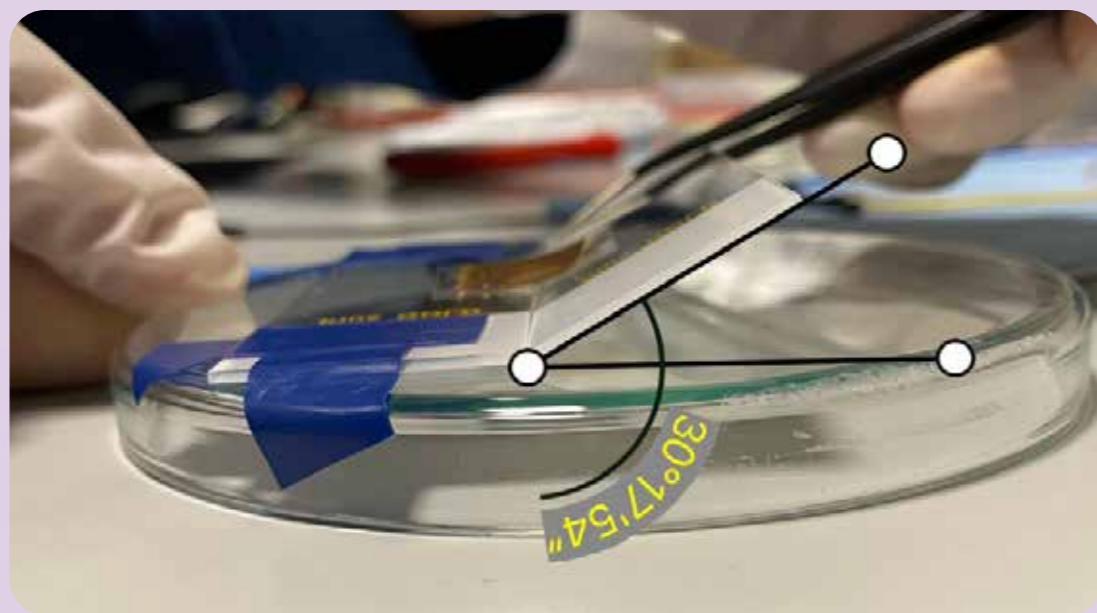
**FACULTY SUPERVISORS:** SADAF USMANI AND KHALIL RAMADI

**SCHOOL:** NYU NEW YORK

**FLEXIBLE ELECTRODE FOR SEROSAL STIMULATION OF GUT TISSUE**

My research involved creating a flexible electrode that was able to encapsulate the gut tissue and provide surface stimulation to the tissue. This device and the provided stimulation was meant to help assist gastrointestinal disorders and ideally interface with and stimulate regions of the brain. This interfacing would have occurred through the gut-brain axis which is the bidirectional connection between central and enteric nervous systems, and links the cognitive parts of the brain to the gut system, thus leading to reduction in neurological disorders. I fabricated the electrode by using PDMS, a flexible and resilient material that was capable of bending to high degrees without tearing. I then deposited a layer of gold onto a region of the PDMS structure in order to make it conductive. After the deposition, I performed various characterisation tests on the electrode such as a bend test, tensile strength test and scanning electron microscope (SEM) imaging before and after tests to ensure that no component was tearing significantly under tension and would remain conductive under tension. Once these tests were complete I proceeded to connect the structure to the necessary wiring for both the stimulation and its readings. This completed electrode was then later placed around the gut tissue of a mouse in order to obtain impedance readings.

*I was able to improve upon my skills of 3D design and printing while also acquiring new skills such as SEM imaging, cryosectioning, histology and stereolithography 3D printing.*



Sishir working on an experiment.



**CALVIN GUTSA**

**MAJOR:** ELECTRICAL ENGINEERING

**FACULTY SUPERVISOR:** KHULOOD ALAWADI

**PLASTIC RECYCLING**

I embarked on a research project centered around plastic recycling within the NYUAD community. My responsibilities encompassed a wide range of tasks, including the hands-on collection, washing, sorting, and shredding of plastic materials obtained on campus. Moreover, I took an active role in operating recycling machines to craft functional components using recycled plastic, contributing to sustainable practices. Engaging in research and applying critical thinking was a vital aspect of my role. I systematically explored potential solutions to prevailing challenges, such as optimizing the recycling process and enhancing its efficiency. Collaborating with fellow student assistants was instrumental in generating innovative ideas not only for the lab's activities but also for the development of new products and initiatives aimed at promoting sustainability. Amid these responsibilities, I played a pivotal role in maintaining the lab's organization, ensuring a conducive environment for our research endeavors. I was also deeply involved in the logistics of Plastic Recycling Lab activities, including workshops and events that aimed to raise awareness about plastic pollution and recycling techniques among the public.

*The hands-on experience I gained through this research project has been incredibly rewarding. Engaging with various recycling machines in the lab has provided me with practical insights into the intricate process of transforming plastic waste into valuable resources. This experience has not only expanded my technical skills but also deepened my appreciation for sustainable practices and environmental stewardship. One of the most fulfilling aspects was organizing and conducting public workshops where I was able to share knowledge about plastic pollution and its solution to a wider audience.*



NYUAD Plastic Recycling Lab workshop with high school students.



**BASIL AHMED**

**MAJOR:** COMPUTER SCIENCE AND INTERACTIVE MEDIA

**FACULTY SUPERVISOR:** MUHAMMAD SHAFIQUE

**ADVANCED DRIVER ASSISTANCE SYSTEMS (ADAS) AND MACHINE LEARNING SECURITY**

I worked on the robustness of the deep-learning models used in self-driving cars. By implementing state-of-the-art adversarial attacks on these models, which may cause their neural networks to misjudge their decisions, I helped make such models more resilient and accurate under various conditions as they can be trained with additional defenses for those specific attacks. Additionally, I worked with the CARLA Simulator, an open-source platform to support the development and testing of autonomous driving systems, to test perception and control algorithms under different situations, such as in urban or rural roads, or various lighting, weather, and traffic conditions. These tests helped refine the algorithms to work well under many different, real-life conditions.



3D Vehicle Detection in CARLA.

*The opportunity to work with the CARLA Simulator under the guidance of Professor Shafique has allowed me to become familiar with many different software development tools and techniques such as version control systems and integration and development pipelines. Additionally, I am grateful to have had the opportunity to collaborate and share knowledge with fellow researchers and engineers, helping me grow both personally and professionally.*



**MUHAMMAD IBRAHIM**

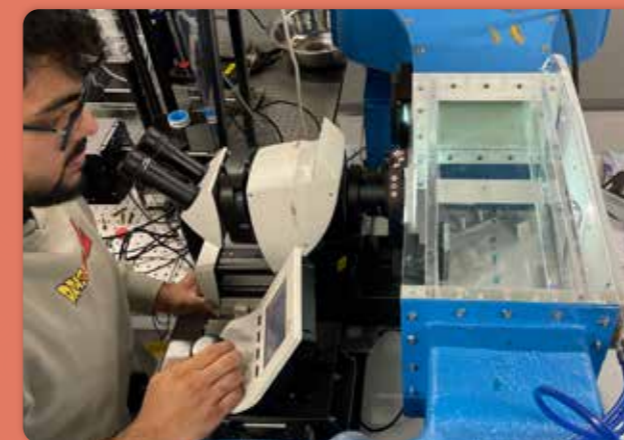
**MAJOR:** MECHANICAL ENGINEERING

**FACULTY SUPERVISORS:** YU LIANG AND NADER MASMOUDI

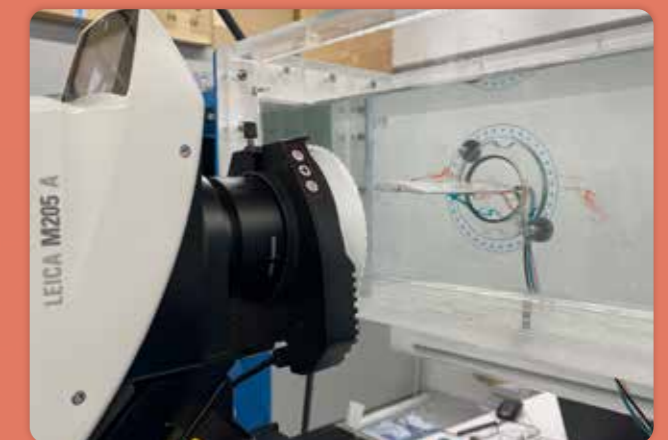
**INSTABILITY AND BOUNDARY LAYER SEPARATION**

I conducted an experimental investigation of boundary layer separation on an aerofoil within a water tunnel. The study utilized outlets strategically placed on the aerofoil to disperse ink into the flow, facilitating the visualization of the separation phenomena. Notably, I observed instances of reverse flow, which were documented using backscattering techniques and a Leica M205A microscope. This combination of methods provided a detailed and qualitative visual representation of the flow properties around the aerofoil. Photographic analysis using the water tunnel apparatus and microscope revealed that various angles of attack produced different flow regimes, highlighting the sensitivity of flow behavior to changes in aerofoil orientation.

Guided by Yu Liang and Professor Nader Masmoudi, I employed high-speed cameras alongside coordinate transformation methods to further understand the behavior of chaotic systems. Through data collection, I identified key factors that gave rise to instabilities and characterized the features of flow separation within the water tunnel. The insights gained from observing the reverse flow and boundary layer behavior have been crucial for advancing aerofoil design. The findings have significant implications for improving aerodynamic performance and optimizing flow control strategies in various engineering applications, including aviation, wind turbine technologies, and broader aerospace applications. Specifically, these results hold potential for enhancing flight control operations.



Ibrahim utilizing the experimental setup involving a microscope aligned with the water tunnel apparatus featuring an aerofoil, prepared for ink dye insertion to study perturbed fluid flow patterns.



Close-up of the water tunnel test section with an aerofoil installed to investigate flow separation and vortex generation.



**ARYA GAUTAM**

**MAJOR: BIOLOGY**

**FACULTY SUPERVISOR: AASHISH JHA**

## CANINE GUT MICROBIOME VARIATION ACROSS LIFESTYLES AND LIFE STAGES

Interindividual differences in the human gut microbiome (GM) pose a major challenge to studying associations between GM and diseases. While mice have traditionally been used as model organisms to establish causality between GM and health, recent research suggests that due to differences in diet and environment, the GM structure in mice does not resemble that of humans. Since dogs have lived and coevolved with humans over the last 30,000 years, and share similarities in their diet and environment, we hypothesize that they may be a better fit as model organisms to study the relationship between human GM and health. However, the canine GM is still understudied, with most research focused exclusively on pet dogs in industrialized nations.

In addition, canine microbiome studies are challenged by inconsistencies in experimental protocols from sampling to data analysis. To bridge this gap, we first conducted a pilot study to standardize sampling and experimental protocols. Based on its results, we used an economically viable preservative buffer to collect fecal samples from 267 dogs from Nepal, Thailand, UAE, and USA, including pet, community and free-ranging dogs, and characterized their gut microbiomes using 16S V3-V4 sequencing. We compared differences in GM composition and diversity between dogs across age groups from non-industrialized/traditional societies in Nepal and those living in industrialized cities in Thailand, UAE, and USA. We also compared the microbial structure of dogs from various human populations practicing different lifestyles within Nepal.

Our findings show strong differences in the dog gut microbiomes across dogs from traditional versus industrialized lifestyles and these differences mirror GM variations in humans. More importantly, similar to humans, the GM of dogs living industrialized versus traditional lifestyle diverges at 10 months. These results suggest that dogs may be a promising model organism for human microbiome studies, and provide a foundation for future research in this area.

*My research experience at NYU Abu Dhabi included field work for sample collection, lab experiments, and data analysis. This opportunity has been instrumental in helping me ascertain my passion for scientific research and preparing me for further academic pursuits. I am excited to continue learning about microbes and their awe-inspiring influence in and around us.*

# Characterization of variation in the canine gut microbiome across lifestyles and life stages

Authors: Arya Gautam<sup>1</sup>, Anique Ahmad<sup>1</sup>, Dinesh Bhandari<sup>2</sup>, Aashish Gyawali<sup>2</sup>, Aashish R Jha<sup>1</sup>

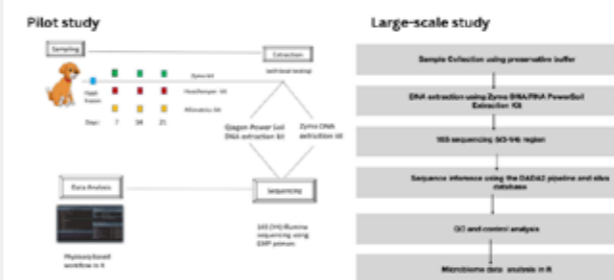
Affiliation: 1. Genetic Heritage Group, 2. Center for Health and Disease Studies Nepal



### Background

Interindividual differences in the human gut microbiome (GM) pose a major challenge to studying associations between GM and diseases. While mice have traditionally been used as model organisms to establish causality in between GM and health, recent research suggests that due to differences in diet and environment, the GM structure in mice does not resemble that in humans. Since dogs have lived and coevolved with humans over the last ~30,000 years, and share similarities in their diet and environment, we hypothesize that they may be a better fit as model organisms to study the relationship between human GM and health. However, the canine GM is still understudied, with most research focused exclusively on pet dogs in industrialized nations. In addition, canine microbiome studies are challenged by inconsistencies in experimental protocols from sampling to data analysis. To bridge this gap, we first conducted a pilot study to standardize experimental protocols for a large-scale canine microbiome study. Based on its results, we used an economically viable preservative buffer to collect fecal samples from 267 dogs from Nepal, UAE, US, and Thailand, including pet, community and free-ranging dogs, and characterized their gut microbiomes using 16S V3-V4 sequencing. We compared differences in composition and diversity between dogs across age groups from non-industrialized/traditional societies in Nepal and those living in industrialized cities in the UAE, US, and Thailand. Additionally, we also compared the microbial structure of dogs from various human populations practicing different lifestyles within Nepal.

### Methods



### Results from pilot study

#### Standardization of sampling protocol for a large-scale canine GM study

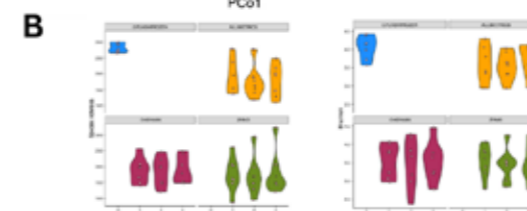
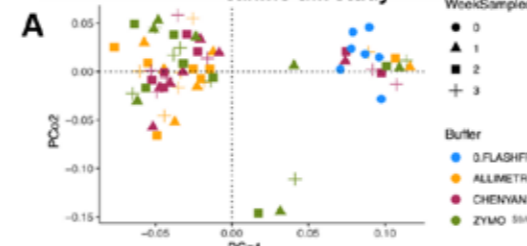


Fig 3. Comparison of samples collected using different methods. (A) Unweighted UniFrac distance/Bray-Curtis Dissimilarity/Principal Coordinates Analysis (PCoA) of 30 total variables (4 variables generated using different sampling methods from each of the 7 biological samples and kept at room temperature for a different time periods). (B) Species richness (left) and Shannon's H (right) at a resolution depth of 1000 reads per sample.

### Discussion

Results of the pilot study suggested reliable preservation of dog fecal microbial community using Huecheryan buffer during fieldwork when flash freezing is not feasible. Combined with its economic viability, it allowed us to conduct a large scale canine microbiome study with 267 samples, with the inclusion of community and free-ranging dogs. Our findings from the study suggests stark signals of differences between dogs following industrialized versus non industrialized lifestyles. Similar to humans, the GM of dogs living the two lifestyles starts diverging at ~10 months. We also see a gradient in the GM composition of dogs within Nepal belonging to various lifestyle categories. Our work provides direction for future research that seeks to utilize dogs as model organisms for human microbiome studies.

### Results from large-scale study

#### Age and lifestyle affect the canine GM composition

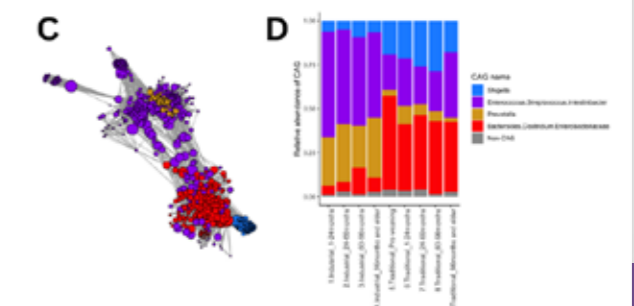
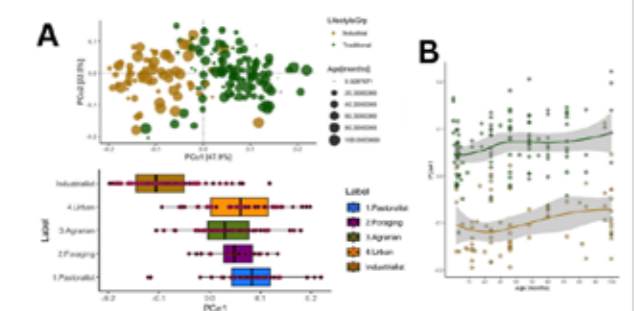


Fig 4. Age and Lifestyle are associated with canine gut microbiome. (A) Unweighted UniFrac distance/Principal Coordinates Analysis (PCoA) (top left panel) of 267 dog fecal samples across based on engineered amplicon sequence variants. (B) Box plots (middle panel) show the distribution of PCo1 (left) and PCo2 (right) for different age groups. (C) Network plot showing correlations between OTUs that make up the co-occurring groups (OTUs). Size of nodes represents the abundance of respective OTUs and the width represents strength of correlation. (D) Relative abundance of OTUs by age group and Lifestyle. Two in parenthesis are the most abundant taxa in a clade.

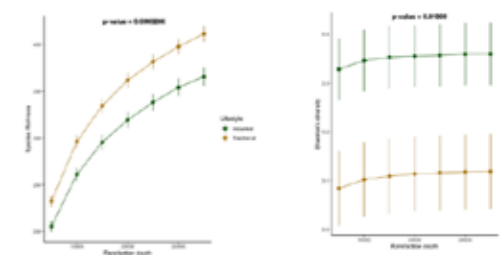


Fig 5. Species richness (left) and Shannon's H (right) at resolution depth of 1000 reads per sample for 267 fecal samples aggregated by lifestyle (traditional vs industrial).

Results of the research showcased at a poster presentation.



**JAE HYUNG LEE**

**MAJOR:** PSYCHOLOGY AND HISTORY

**FACULTY SUPERVISOR:** ANTJE VON SUCHODOLETZ

### UNDERSTANDING EMOTION REGULATION: BEHAVIORAL AND PSYCHOPHYSIOLOGICAL CONNECTIONS IN PARENT-CHILD DYADS IN THE ARAB-MUSLIM CULTURAL CONTEXT

Developing social-emotional competencies in early childhood is critical for children’s later success. The family environment is an important social context for children to learn social-emotional skills. Exploring family dynamics, such as parent-child interactions, helps researchers understand which parental behaviors support healthy regulatory systems. To date, most research exploring family dynamics involved samples from the United States, Western European and East Asian countries. Little is known about developmental processes and mechanisms in families with an Arab cultural background.

As part of my Capstone research, I participated in the NYUAD Teaching, Learning, and Development Lab’s “Learning about Emotions and Experiences in Parenting” (LEEP) Project, focusing on the Middle East and North Africa (MENA) region and the Arab-Muslim cultural context. Through physiological data collected in the form of electrocardiogram (ECG) data, we analyzed heart rate variability (HRV), the degree of variation between successive heartbeats either by frequency or over time which acts as an indicator of an individual’s sensitivity to a stressor. ECG data was analyzed in three different states, Baseline, Frustration, and Recovery. Through processing and studying HRV in each of these states, the goal of this research was to connect physiological response patterns of the parent and child to the kinds of emotion regulatory behavior that are engaged both individually and as a dyad.

*This research was a wonderful blend of understanding underlying psychophysiological theories and engaging in practical skill development such as processing raw HRV data for analysis, and using statistical programs to conduct a preliminary analysis. As I am using data from this project for my Capstone, the summer research project has prepared me with the skills and mindset to dedicate myself to this research.*



**VIR MALHOTRA AND MOHAMMAD AMJED**

**MAJOR:** COMPUTER SCIENCE & COMPUTER ENGINEERING

**FACULTY SUPERVISOR:** MOUMENA CHAQFEH

### DEMYSTIFYING INTERACTIVE THEOREM PROVING FOR A BROAD AUDIENCE

In the world of Mathematics and Computer Science, Interactive Theorem Provers (ITPs) are powerful software tools designed to tackle the challenging task of theorem proving, by facilitating human-machine collaboration. ITPs are typically utilized by experts, primarily because of their cumbersome learning curve. But what if we could unlock their true potential? Our summer research project aimed squarely at demystifying ITPs to undergraduates and curious minds from various disciplines.

To achieve our ambitious goal, we integrated a set of Artificial Intelligence (AI) models into a software tool that empowers human provers with the ability to predict the next steps in a given incomplete proof, and offer explanations for every step. We are proud to have succeeded in building the first draft of this remarkable tool, a task that entailed integrating disparate software components into one cohesive web-based interface. Early testing demonstrated the power of the tool to gently guide students and non-experts through the process of constructing proofs, step by step. Our commitment is to refine and optimize this tool, hoping to contribute in revolutionizing the way Mathematics and Computer Science are taught and practiced, and welcoming a broad audience to the world of ITP.

*I personally gained an immense amount of experience in the art of research, from selecting topics to changing goals, to finding and creating datasets. I also learned the inner workings of ChatGPT, a tool that has taken the world by storm, and how it can be used to create a myriad of programs that serve unique functions.*

Vir Malhotra



A screenshot of the software tool used.



**RITA FAHMY**

**MAJOR: BIOLOGY**

**FACULTY SUPERVISOR: AASHISH JHA**

**COMMUNITY ENGAGED RESEARCH IDENTIFIES GENETIC HISTORIES, BASIS OF MALARIA RESISTANCE, AND EVOLUTION OF SHORTER STATURE IN LOWER ALTITUDE (<1400M) HIMALAYAN POPULATIONS**

Within the already-limited pool of genomic studies conducted on non-European individuals, most research surrounding the Himalaya have exclusively studied high-altitude populations, revealing adaptations to hypoxia. The lower-altitude regions - home to over 200 ethnolinguistic groups spanning four major language families - have remained underexplored and underserved by genomics.

For Capstone and PPTP, we conducted community-engaged research to generate, merge, and analyze genome-wide genotyping data from 4,000 individuals from global reference populations, and 1,205 individuals belonging to 74 Himalayan populations spanning Tibet, Bhutan, and Nepal. Using multiple global ancestry approaches, we detected differences in proportions of East and South Asian ancestries in all Himalayan populations along an East-West longitudinal and North-South altitudinal gradient.

Genome-wide scans on select populations of the hills (1000-4000m) and Terai plains (<400m) revealed several genomic regions evolving under strong positive selection. We detected candidate single-nucleotide polymorphisms (SNPs) associated with strong immunity-related phenotypes (potentially, malaria resistance) in multiple independently-evolving populations cohabiting the malaria-endemic Terai plains. We also identified signals of selection on several height-related genes in two indigenous Tibeto-Burman populations of the middle hills, which do have shorter stature based on measurements taken during our sampling.

Results from this study will help elucidate patterns of evolution and adaptation across the largely under-studied Himalaya, and furthermore, have profound social and health-based impacts for populations for whom genomic research and its benefits have been limited.

*I am excited to be continuing this project as part of my post-graduation research fellowship with the Center for Genetics and Systems Biology. I am also looking forward to presenting my findings in an oral platform presentation at the American Society of Human Genetics Conference 2023.*

## Genetic basis of malaria resistance, pigmentation, and shorter stature in lower altitude Nepali Himalayan populations

Rita Fahmy, Easwarkhanth Muthukrishnan, Mark A Peguelli, Yoshina Gautam, Dinesh Bhandari, Sarmila Tendukar, Shirley Sutton, Kathryn Spees, Genevieve L. Wojcik, Guru Prasad Gautam, Jeevan Bahadur Sherrchand, Carlos D. Bustamante, Alexander G. Ioannidis, Aashish R Jha

Genetic Heritage Group, NYUAD, Public Health Research Laboratory, Institute of Medicine, Maharajgunj, Kathmandu, Nepal, Department of Biomedical Data Science, Stanford University, Palo Alto, California, USA, Department of Geography, Tribhuvan University Nepalgunj, Nepalgunj, Nepal

### Background

Most genomic studies in the Himalaya have focused on populations residing at high altitudes, revealing adaptations to hypoxic environments. The lower-altitude regions of the Himalaya - home to over 200 ethnolinguistic groups spanning four major language families - have remained under-explored due to limited sampling and limited detection power by standard methods like genome-wide association studies (GWAS). Here, we generated, merged, and analyzed genome-wide genotyping data from 1205 individuals belonging to 74 Himalayan populations and 4000 global reference individuals. Using multiple global ancestry approaches, we determined that Himalayan populations are distributed along the longitudinal and altitudinal gradients. Tibeto-Burman speakers in the eastern, high-altitude Himalaya show minimal admixture with South Asians, as opposed to central and western Himalayan Tibeto-Burman speakers. Indigenous Indo-European speakers of the Terai plains are admixed between East and South Asians. These ancestries imply a potential for indigenous populations to respond to local selection pressures that differ across the longitudinal and altitudinal gradients.

We performed genome-wide selection scans on two Nepali populations that are indigenous to the middle hills (1000-4000m) - the Chepang and Tamang - and identified signals of selection in height-related genes. We detected positive selection on several malaria-related genes in two independently-evolving indigenous populations - the Tharu and Mushahar - that inhabit the plains (<400m), where malaria was endemic until recently. The Mushahar also demonstrated novel signals of positive selection in pigmentation genes. Many of the candidate SNPs with strongest signals of selection have been associated with body height, red blood cell counts, immune functions, and pigmentation in previously published GWAS.

### Methodology

### Global Ancestry Analysis

**Fig. 1. Global ancestry analysis.**  
 (A) Principal Component Analysis (PCA) panel revealing Himalayans distribute along west-east longitudinal and north-south altitudinal axes.  
 (B) ADMIXTURE plot. Each column shows individuals separating into different ancestries that reflect both clines and the differing genetic profiles of the Himalaya.  
 (C) Identity by Descent plot reveals network of shared chromosomal segments and continue ancestry across Nepal; selection scan populations highlighted in yellow.

### Selection Scan Analysis

**Fig. 2. Selection scan analysis; 99.99th percentile SNPs highlighted.**  
 Integrated haplotype score (iHS) test results for Tharu and Mushahar show signals of selection over malaria and immunity-related genes. Scan results for Chepang and Tamang show signals of selection over height-related genes.

### Gene and Variant Identification

**Fig. 3. Visualizations of malaria-related gene activity.**  
 (A) TLR5-dependent candidate vaccines for malaria.  
 (B) APDN implicated in anemic phenotypes that disrupt the mechanisms by which malaria binds to red blood cells.  
 (C) HMX1 implicated in beta deoxygenation; under expression may halt this process and kill malaria invasion.

### Selection Scan Analysis

**Fig. 4. Selection scan analysis; 99.95th percentile SNPs highlighted for Mushahar.**  
 Integrated haplotype score (iHS) test results for Mushahar show signals of selection over pigmentation-related genes. (B) Illustration of melanogenesis pathway, with pigmentation-related genes TYR and ASIP highlighted in red.

SNP	chr	POS	BP	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene	Gene
rs11111111	1	11111111	11111111	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP	ASIP
rs22222222	2	22222222	22222222	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR	TYR

**Table 1. 99.99th percentile SNPs in Chepang and Tamang and previous GWAS height associations.**  
 Table shows 99.99th percentile SNPs that were associated with height in previous genome-wide association studies. In purple are SNPs where the Chepang and Tamang exhibit the non-effective alleles at high frequencies.

Contact Us!  
<https://www.geneticheritage.org/>  
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 rrf286@nyu.edu  
 Aashish Jha  
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Results of the research showcased at a poster presentation.





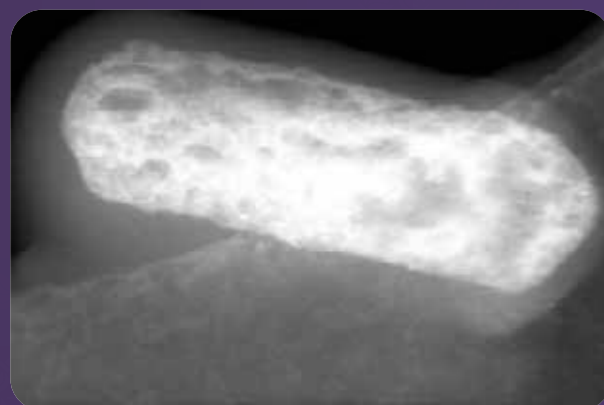
**RAJNEIL CHAUDHARY**

**MAJOR:** BIOLOGY

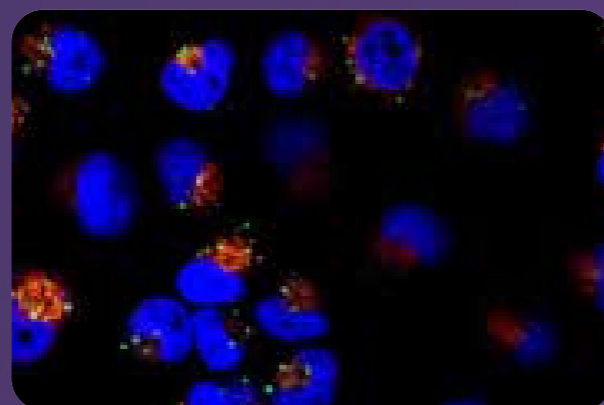
**FACULTY SUPERVISORS:** PANĀE NAUMOV AND WEGOOD AWAD

### INCLUSION OF ORGANIC CRYSTALS INTO CELLS

Due to the fact that cancer cells demonstrate chemoresistance, conventional treatments are sometimes unable to adequately target diverse and constantly mutated tumor sites. Nanoparticle-based cancer nanomedicine has recently emerged, and it has the potential to overcome chemoresistance and act as an alternative to orthodox cancer treatment measures. Clinical studies for cancer treatment using drugs based on nanoparticles have highlighted the positive impact of nano-chemotherapy. When coated or combined with drug-carrying polymers, nanoparticles can be powerful delivery vehicles for targeted drug delivery as they improve medication distribution, lessen systemic side effects, allow controlled drug release, and also increase the rate of absorption. I worked with the members of the Smart Materials Lab to synthesize and study the effect of new nanoparticles based on organic crystals. This new concept explores organic crystals of known bioactive compounds such as santonin for delivery of drugs to living cells. We successfully characterized these nanoparticles by using a variety of techniques for materials characterization, including diffraction, scattering, and electron microscopy.



A coated nanocrystal imaged using Transmission Electron Microscopy (TEM).



Cellular uptake analysis of the particles in cancer cells. The green, red, and blue colors in this analysis indicate the coated particles, mitochondria, and nuclei, respectively.



**AMITEASH PAUL**

**MAJOR:** BIOLOGY

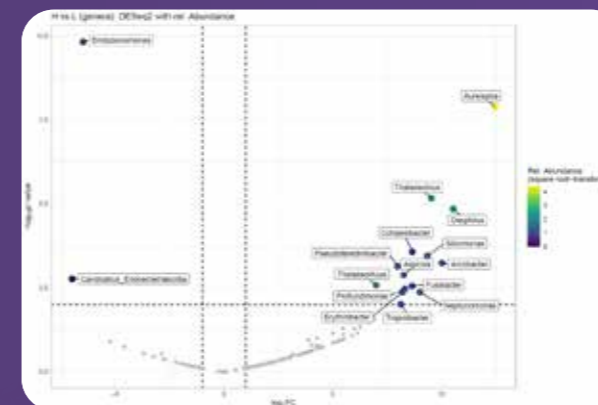
**FACULTY SUPERVISOR:** SHADY AMIN

### MICROBIOME CHANGES DURING ONSET OF CORAL WHITE SYNDROME DISEASE

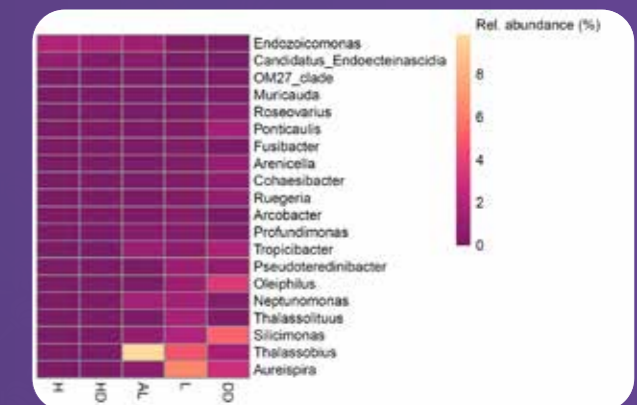
The coral microbiome is critical for regular function of the holobiont. Disturbances in coral-associated microbial communities are often associated with disease outbreaks like white syndrome disease and white pox disease. Climate change is often cited as a major driver of dysbiosis and coral disease. It is believed that warmer sea temperatures provide a suitable environment for the invasion and growth of pathogenic microbes. However, the mechanism of disease onset and the key species involved are yet to be fully discovered.

Through 16S rRNA amplicon sequencing, I tracked bacterial community changes during disease outbreaks in Arabian Gulf acroporid corals. I performed statistical analyses which showed significant differences in microbial community diversity and composition between samples from lesions and healthy tissue. Primarily, Endozoicomonas, a well-studied genus of symbiotic bacteria, was found to be highly depleted in lesion and diseased tissue samples, while bacteria from Rhodobacteraceae, Saprospiraceae, Oleiphilaceae, Cellvibrionaceae, and some other families were found to be highly enriched. Bacteria from these taxa were also discovered to be indicators of disease. We are now utilizing multi-omics techniques (metagenomics and metabolomics) to study the biomolecules they produce, which could shed light on the role these bacteria play in coral disease development.

*I am extremely grateful for this opportunity and the mentorship from my supervisors at the Marine Microbiomics Lab. I was able to learn key skills and techniques in bioinformatics, which will be very helpful during my Capstone project. A paper including these results, along with the results of the multi-omics analysis, is currently in the drafting process.*



Volcano plot of significantly differentially abundant bacterial genera in disease lesion.

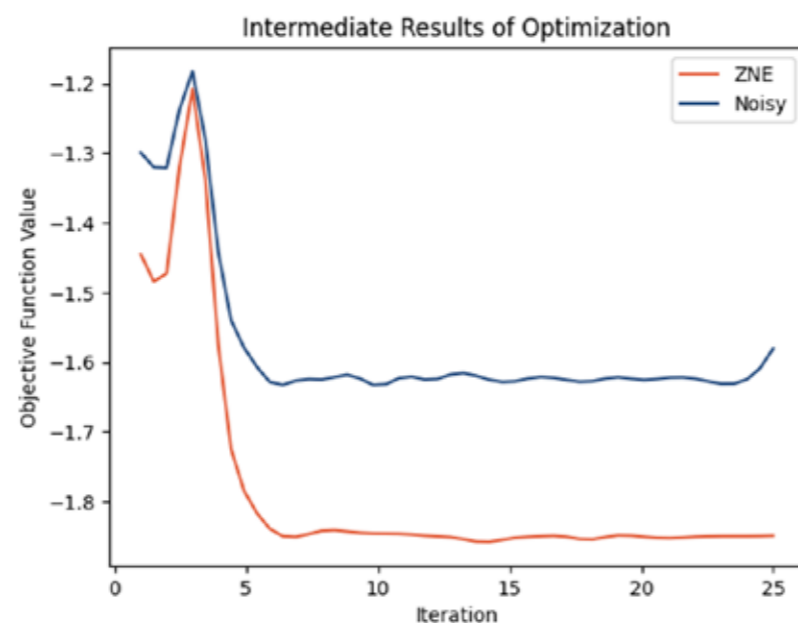


Heatmap of differentially abundant bacterial genera across healthy (H/HD), lesion-adjacent (AL), lesion (L), and dead (DD) coral tissue.

**AJLA ŠAČIĆ****MAJOR:** COMPUTER SCIENCE**FACULTY SUPERVISORS:** ASIF EQUBAL AND AMARIA JAVED

## ADVANCING VQE ON SPINQ GEMINI THROUGH ERROR MITIGATION TECHNIQUES FOR QUANTUM COMPUTING

By applying Zero Noise Extrapolation (ZNE) to the Variational Quantum Eigensolver (VQE) Algorithm on both a Model Noisy Quantum Backend and the SpinQ Gemini, a 2-qubit quantum computer at NYUAD, I aimed to enhance the results obtained for finding the ground state energy of a hydrogen molecule. Since ZNE is an error mitigation technique rather than an error correction technique, I was able to apply it to a small-scale system without the need for extra qubits. I applied random local gate folding to increase noise levels within the quantum circuit. Through the use of Richardson extrapolation, I obtained results for both the unmitigated and mitigated experiments, which demonstrated that ZNE significantly improves the accuracy of the outcomes.

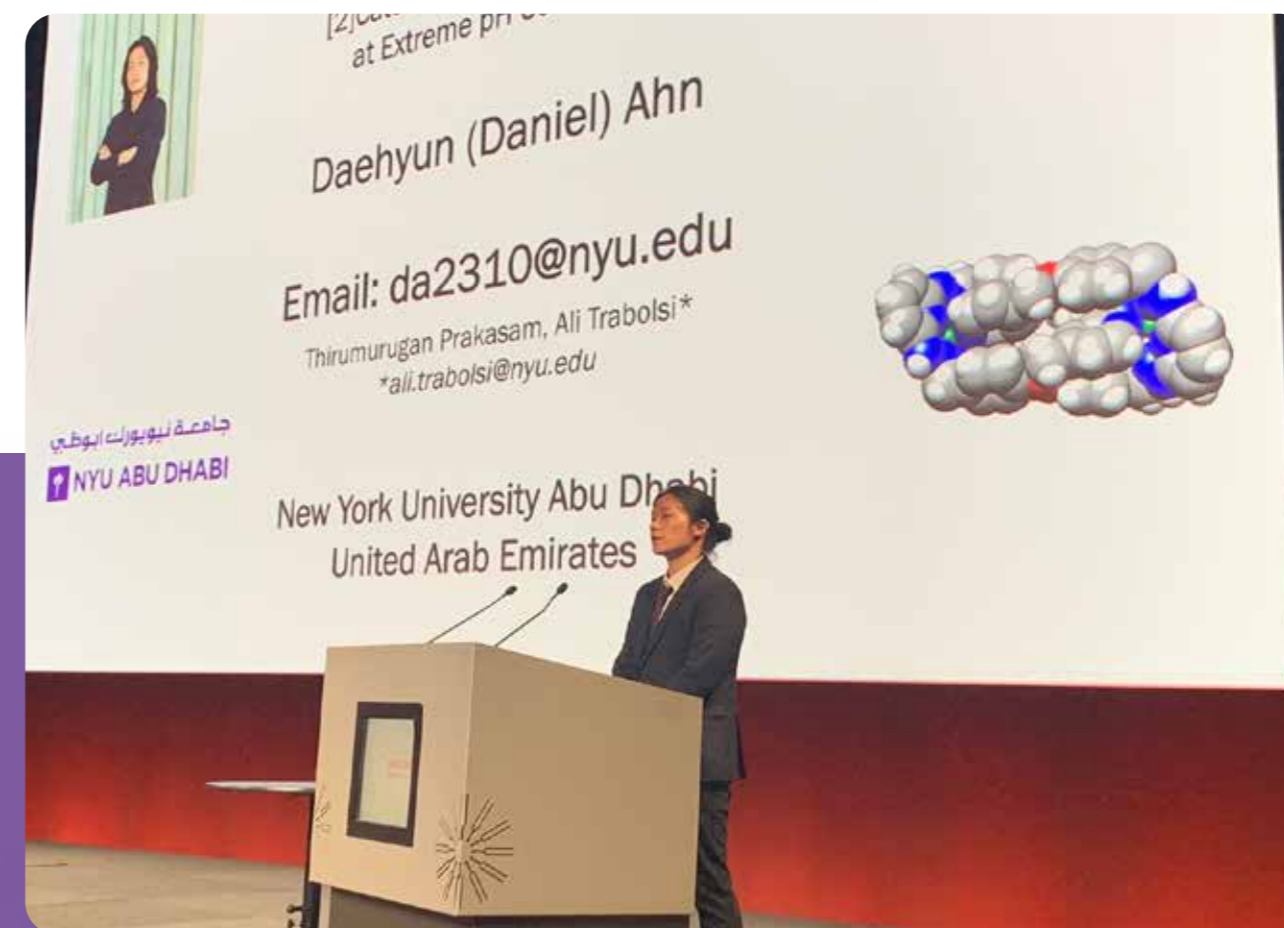


*I aspire to further my research in the field of Quantum Computing and Mechanics, with the ultimate goal of undertaking my Capstone project in the realm of Quantum Machine Learning. This research endeavor has significantly enhanced my comprehension of the principles governing Quantum Mechanics and Computing, to the extent that I can confidently assert my grasp of the subject. Despite prior familiarity with Quantum Computing, delving into the foundational principles has proven immensely advantageous, and I am eager to continue delving deeper into these concepts as I progress in my studies at NYUAD.*

**DANIEL AHN****MAJOR:** CHEMISTRY**FACULTY SUPERVISOR:** ALI TRABOLSI

## HYDRAZONE-BASED [2] CATENANE WITH HIGH STABILITY AT HIGH AND LOW PH CONDITIONS

Mechanically interlocked molecules (MIMs) and topologically unique molecules have been of interest to scientists since the 1960s, not only for their esthetic beauty but also because of their applicability as molecular machines, host-guest binding, and catalysts. Hydrazone bonds are considered a great alternative to imine bonds in MIM synthesis because they can also participate in DCC while exhibiting higher acidic and thermal stability in water. This is because hydrazone bonds have a higher mesomeric effect that reduces the electrophilicity of the C=N bond. Therefore, hydrazone bond has great potential not only in the field of MIM synthesis but also in a variety of areas that relies on DCC, such as COFs and molecular machines. In this project, we report the synthesis of a hydrazone [2] catenane and test its structural integrity at different pH conditions compared to the corresponding imine [2] catenane.



The project was presented at the 17th International Symposium on Macrocyclic and Supramolecular Chemistry in Reykjavik, Iceland.



**ARWA ALABBASI**

**MAJOR:** PHYSICS AND MATHEMATICS

**FACULTY SUPERVISOR:** FRANCESCO ARNEODO

**DEVELOPMENT OF AN X-RAY SPECTROMETER FOR IN-SITU ELEMENTAL ANALYSIS**

The aim of my research was to design, build, and test an X-ray fluorescence spectrometry instrument for a lunar rover. This design enabled in-situ analysis of the elemental composition of the moon's surface. Depending on the X-ray (and possibly alpha particle) source, the successful implementation of this instrument will allow for greater understanding of the composition of the southern pole of the moon and to better characterize the existence of water in the region. This information will provide invaluable insights into the formation and evolution of the moon and critical data for future lunar exploration and scientific research.



**MALAK ELMALLAH**

**MAJOR:** PSYCHOLOGY

**FACULTY SUPERVISOR:** ANTJE VON SUCHODOLETZ

**LEARNING ABOUT EMOTIONS, EXPERIENCES, AND PARENTING (LEEP)**

My research project is situated at the intersection of advancing educational outcomes and supporting healthy family dynamics. This project aims to support community initiatives exploring the social-emotional development of families living in the United Arab Emirates, by aiming to understand how parents and their children regulate and co-regulate their emotions. This understanding is vital as children's early emotional skills are tied to their future skills such as their problem-solving strategies, and can be used as predictors for things such as their future social bonds and mental health.

Throughout the academic year and the summer, I assisted in the collection of data from mothers and children whom we invited up to the lab. This entailed working on an array of methods of in-person inquisition, which were questionnaires, narrative assessments where parents reflected on their childhood experiences, the child playing a social-emotional "game" with me or my fellow research assistants, heart-rate data sampling (HRV data), and a parent-child co-regulation activity.

*Throughout the summer I learned the valuable skill of behavioral coding which truly gave me a greater appreciation for the importance of the collection of qualitative information, and the great depth of understanding that this method allows. It was almost as if I put behavior under a microscope in order to question my biases, forcing me to ask big questions about how we in psychology assign meaning to certain actions.*



Malak performing the Affect Knowledge Test, which measures preschool children's receptive and expressive knowledge of emotion through identification of emotions.



**HONEY HTUN**

**MAJOR:** PHYSICS

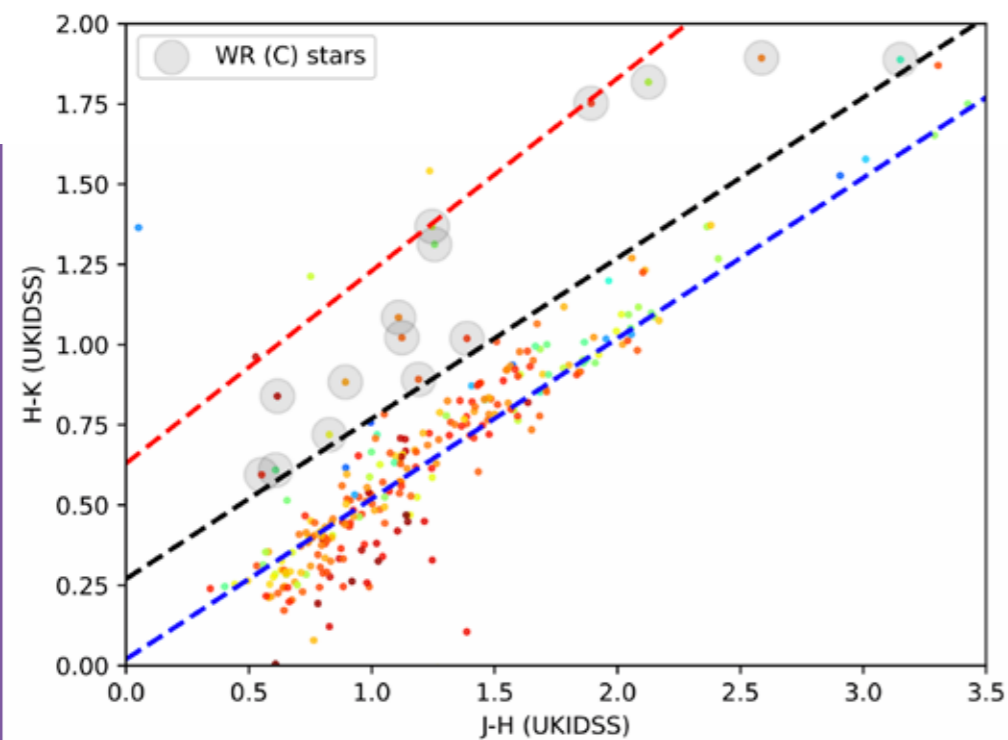
**FACULTY SUPERVISOR:** JOSEPH GELFAND

### WOLF-RAYET CANDIDATES INSIDE KES 75

Previous work studying the gamma ray emission from Pulsar Wind Nebula (PWN) Kes 75 suggested that the highly relativistic electrons and positrons are illuminated by an extremely intense hot photon field - likely from a rare Wolf-Rayet (WR) star embedded inside the nebula.

Over the summer, I analyzed nearby infrared sources detected by the UKIDSS survey to identify this WR star. Expanding on prior work, I examined sources within a one arc-minute radius of Kes 75 aiming to spot potential candidates.

Using IR data and WR star characteristics, I refined the magnitude and color criteria used to identify candidates. Employing other catalogs like GAIA, IPHAS and WISE to reduce and filter these candidates, two standout objects emerged, one of which was notably close to the center of the PWN. This implies that it could be the binary companion of the Pulsar's progenitor. To validate this, I applied the overall algorithm used in the search to 100 random positions along the same line of sight to mark the significance of the results.



Dotted lines represent the color selection criteria from Faherty et.al, the area between red and black line is for WR(C) stars and the area between black and blue line is for WR(N) stars. The individual color of all the sources represents their K magnitude.



**SHUBHAN BHATIA**

**MAJOR:** PHYSICS

**FACULTY SUPERVISOR:** ANDREA V. MACCIÒ

### AN EXPLORATION OF FUZZY DARK MATTER PROPERTIES USING NOVEL HYDRODYNAMICAL SIMULATIONS

I embarked on an exploration of the intricate formations within a Universe dominated by Axion Dark Matter (ADM, also called fuzzy dark matter), distinct from the established Cold Dark Matter (CDM) model. Using advanced cosmological simulations powered by the Pynbody analysis package, I uncovered the evolution of substructures in dwarf galaxies, revealing insights into ADM's influence on galaxy formation. I also addressed the core-cusp problem in CDM-based galactic halos, investigating ADM's potential in resolving this enigma.

Central to my study is the development of innovative software, enabling a deep dive into the complex dynamics of stars within dwarf galaxies. Beyond contributing to our understanding of galaxy formation, my findings hold implications for ADM's role in shaping the Universe's structure.

*Having been introduced to the intricate workings of a research group, I've garnered invaluable insights and experiences that have primed me for a successful Capstone project.*



Dark matter density map for two haloes colliding in a Axion Dark Matter Universe.



**GULSIM AZIRAKHMET**

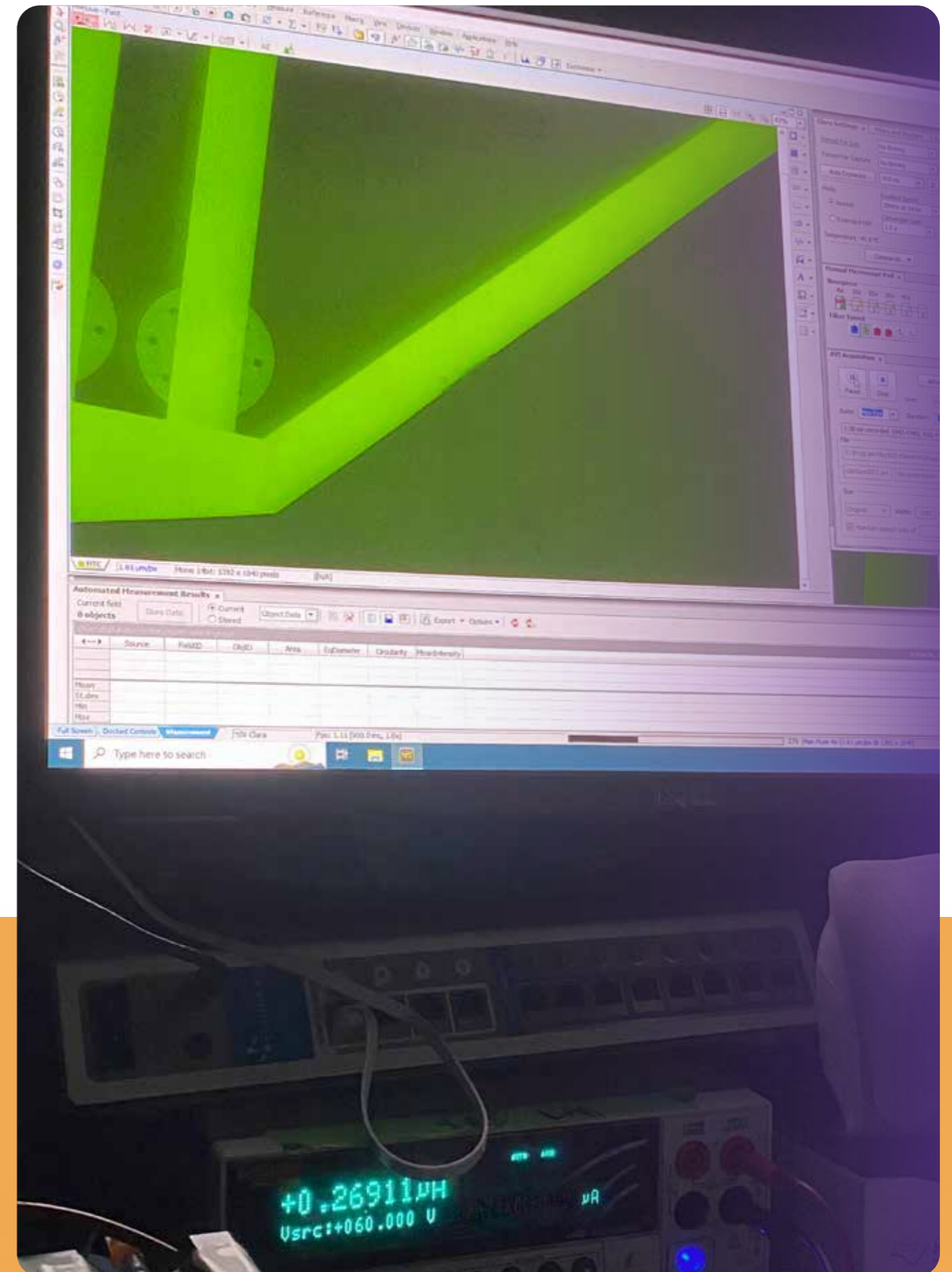
**MAJOR:** BIOLOGY

**FACULTY SUPERVISORS:** YONG-AK (RAFAEL) SONG AND JONGMIN KIM

**MICROFLUIDIC BIOCHIP FOR WATER DESALINATION**

The main question that captured my intellectual interest was: "How can a marine iguana's salt gland biomimicked and be optimized and applied to address global water scarcity and sustainable water desalination?" As our planet faces increasing water scarcity due to factors such as population growth, climate change, and pollution, exploring nature-inspired solutions becomes essential. Marine iguanas, native to the Galápagos Islands, have evolved a unique salt gland that enables them to survive in a harsh, saline environment. By understanding and emulating the principles of this system, we can potentially develop novel, eco-friendly desalination technologies to alleviate water scarcity. Together with my research team, we successfully created a 5-channel biochip with hydrogel membranes inserted for desalination purposes. I also had the opportunity to work on designing Polydimethylsiloxane (PDMS) biochips and test them. I successfully designed the channels and filled them with hydrogel to simulate the removal of salt from saltwater. In the future, I plan to focus on conducting rigorous experiments to validate the efficiency and effectiveness of the desalination process.

*While working on this project, I started to realize the potential of nature-inspired desalination systems as a viable solution to address water scarcity. By drawing insights from marine iguanas' salt glands, we can potentially overcome some of the challenges faced by conventional desalination technologies, such as high energy consumption and environmental impacts. However, I have also come to understand that developing biomimetic technologies involves complex engineering and requires a deeper understanding of biological processes.*



Testing the 5-channel, hydrogel-embedded biochip with Alexa dye under FITC using a microscope and NIS elements.



**NOUR ALNAJAR**

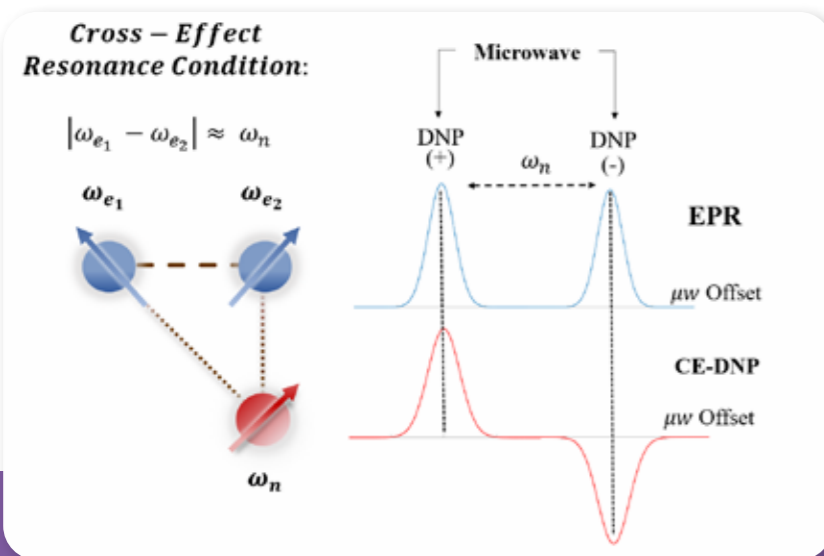
**MAJOR:** PHYSICS

**FACULTY SUPERVISOR:** ASIF EQUBAL

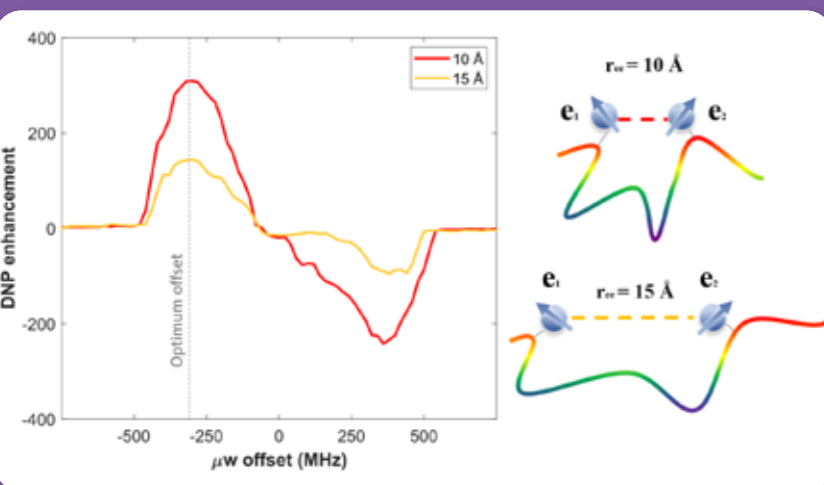
**SCHOOL:** KHALIFA UNIVERSITY

### DYNAMIC NUCLEAR POLARIZATION-ENABLED QUANTUM SENSING FOR INVESTIGATING PEPTIDE CONFIGURATIONS

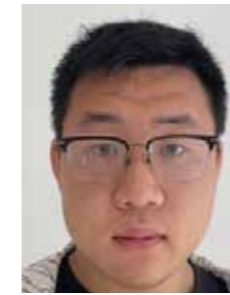
The project on which I worked with Dr. Asif Equbal, now published in Nature Springer, focused on developing the use of Dynamic Nuclear Polarization (DNP) to measure distances between spin-labeled peptides. The article, titled 'Dynamic Nuclear Polarization-Enabled Quantum Sensing for Investigating Peptide Configurations,' introduces a cutting-edge method for the quantum sensing of proteins. It combines DNP with Site-Directed Spin Labeling (SDSL), enhancing the sensitivity of solid-state NMR. This enables more accurate measurements of shorter distances between electron spins in peptides, utilizing higher magnetic fields. By merging the strengths of NMR and Electron Paramagnetic Resonance (EPR), it overcomes the limitations of traditional techniques, offering a significant advance in understanding protein and polymer structure.



To the left, a spin system composed of two dipolar-coupled electron spins and one hyperfine-coupled nucleus, which meets the requirements for Cross-Effect-DNP. To the right, the EPR and DNP characteristics of the spin system are conveyed.



The red and orange profiles illustrate the CE-DNP enhancement of two model peptide systems obtained from the results of the research.



**KAILE CHU**

**MAJOR:** COMPUTER SCIENCE

**FACULTY SUPERVISOR:** DJELLEL DIFALLAH

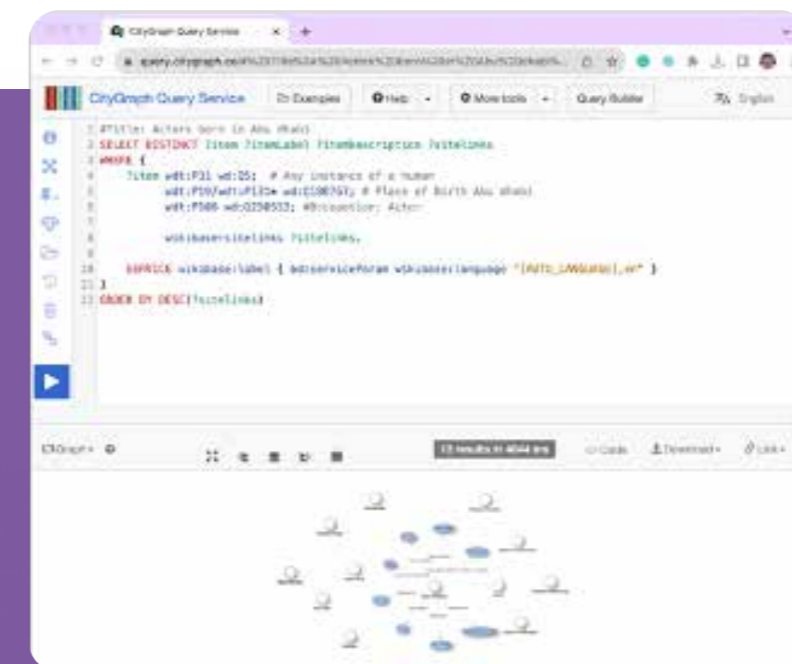
**SCHOOL:** NYU SHANGHAI

### CITYGRAPH

I primarily worked on investigating query tools for CityGraph project, a knowledge graph to manage urban data. During my time at Prof. Difallah's Lab, the experience provided invaluable opportunities for learning various aspects of the industry that otherwise would have remained unfamiliar to me. Notably, I gained insights into the RDF format and its subformats, and how it represents structured data. Additionally, I discovered the significance of Node.js and its compatibility with TTF-written tools, particularly in converting internet-scraped data formats like CSV into machine-readable RDF formats for easier processing and visualization.

Another significant technical skill I acquired involved untangling the intricacies of the Wikidata Query Service GUI and comprehending the correlation between query results and visualization types. This process deepened my understanding of complex website architectures, particularly the functioning of JavaScript. Moreover, my personal exploration of JavaScript further solidified my grasp on the subject and motivated me to consider a potential career in web development.

*The project's requirements exposed me to essential concepts such as SPARQL queries, Wikibase, and their integration with databases like MYSQL. This newfound knowledge opened my eyes to the realm of online structured data management, a field I had not previously explored.*



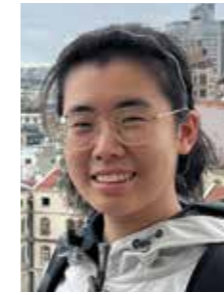
The tool used by Kaile Chu to work on the CityGraph Project.

**AHMAD WALEED AL HOMRAN****MAJOR:** PHYSICS**FACULTY SUPERVISOR:** HISHAM SATI**SCHOOL:** KHALIFA UNIVERSITY

## SHOR'S ALGORITHM

My research project delved into the fascinating world of quantum computing, investigating the complex interplay between quantum algorithms and their practical implementation. I concentrated my efforts on the implementation of Shor's algorithm using Qiskit. As I embarked on an immersive journey through the mathematical foundations of the algorithms, delving deeply into the theoretical foundations that governed their functionality. This included a focused exploration of the mathematical concepts that were shown on how these algorithms work. The use of Shor's algorithm in quantum computing increased the possibility of factoring large numbers with exponential speed as well as effectiveness when compared to classical computers. This research project aimed to understand the capabilities and limitations of Shor's algorithm and its potential impact on various fields, especially in the realm of cryptography.

*I gained valuable skills in quantum mechanics, algorithm design, and quantum programming using platforms like Qiskit. This has provided me with a deeper understanding of the power and potential of quantum computing. As Feynman said: "Nature isn't classical, dammit, and if you want to make a simulation of nature, you'd better make it quantum mechanical." This experience fueled my curiosity to explore the field of quantum computing further, and it instilled in me a drive to contribute to the advancements in this rapidly evolving field.*

**YU SHEN****MAJOR:** CHEMISTRY**FACULTY SUPERVISOR:** SERDAL KIRMIZIALTIN**SCHOOL:** NYU SHANGHAI

## MECHANISM OF ETHANOL-INDUCED DNA CONDENSATION

Ethanol has been used as a DNA condensation agent for decades. However, the mechanism of this process remains unclear. To study this process, we have simulated three setups: 1) two DNA pairs in pure water; 2) B-form DNA pairs in ethanol-water solution; 3) A-form DNA pairs in ethanol-water solution. First, we aimed to study the free energy profiles of inter-DNA distances. We found that DNA-DNA interaction in water is repulsive while DNA in ethanol shows condensation. We then compared how the solution changes when the DNA pairs change from free state to the condensed state. In the case of EtOH-DNA, Na ions show strong accumulation. Ethanol shows depletion at the interface, leaving its place to water at the condensate.

One interesting observation we made was that both the dielectric medium and Debye length were dramatically reduced in the case of ethanol, which suggests that electrostatic interactions become shorter but stronger in the case of EtOH.

We also looked at the H-bond formation during the condensation. Surprisingly, we found that H-bonding does not support the condensation, therefore it cannot be the main reason for the DNA condensation. Then we turned our attention to ions, using a two-dimensional radial distribution function to quantify the ion-correlations. We believe Na & Cl ions forming a highly condensed salt mixture is one of the factors driving the process to condensation. Secondly, we looked at the concentrations of ions. We see that Na accumulates much more at the surface of the DNA in ethanol.

In summary, we proposed that in the case of EtOH the DNA condensation occurs due to reduced dielectric constant which leads to stronger electrostatic forces leading to more positive charges to accumulate on the DNA-DNA interface. These cations are further stabilized by Cl ions through ion-correlation effect. The stronger cation condensation together with ion-correlation stabilizes the DNA condensates.

*I recall Prof. Serdal noting that we are journalists recording and reporting the observations. This provided me with a new understanding about doing research - and that doing experiments and simulations is only one part; the way we communicate the research to others also matters.*



**KARU MBUGUA**

**MAJOR:** ANTHROPOLOGY, PRE-MED TRACK

**FACULTY SUPERVISOR:** JEREMY TEO

**SCHOOL:** NYU NEW YORK

**USING FACS TO FIND A PROTOCOL TO INCREASE CELL VIABILITY IN IMMUNE CELL RESEARCH**

In immune cell research, there are several methods for studying the behavior of immune cells in cell cultures, but many result in a poor yield of cells that can be addressed. My project sought to remedy this by seeking a method that produces the highest cell viability in cell cultures.

In addition to the traditional 2D cell culture, my research focused on employing 3D cell culture technology using collagen gels, which provide a more accurate in vitro tissue model. Utilizing these cell culture techniques, I studied the viability of THP-1 and macrophages in 2D and 3D cell cultures under different conditions. To create the different conditions of the microenvironment, I changed variables such as the cell tracker dyes used for imaging, digestive enzymes for breaking down 3D collagen matrices, and the buffered salt solutions used for hydrating the samples.

The effects of these conditions were analyzed using flow cytometry, one of the main methods of analyzing large cell populations, and more specifically, Fluorescence-Activated Cell Sorting (FACS). FACS is the technique used in flow cytometry for sorting cells based on their fluorescent properties for analysis. With FACS, I was able to analyze the live/dead populations of my samples, which allowed me to investigate the most effective protocols for immune cell research.

*My summer experience working with the Laboratory for Immuno Bioengineering Research and Applications (LIBRA) was the perfect introduction to professional research. I have learned invaluable lessons about data analysis, cell culture techniques, and life in a professional environment. My time with LIBRA has launched my interest in the field of immune mechano-biology, and I can't wait to learn more and further develop my skills!*



**KHALID SULIMAN**

**MAJOR:** APPLIED MATHEMATICS AND STATISTICS

**FACULTY SUPERVISOR:** AMAR AHMAD

**SCHOOL:** KHALIFA UNIVERSITY

**STATISTICAL MACHINE LEARNING**

Missing values are often unavoidable in empirical research and can lead to distortions in many cases. In addition, "I don't know" and "I'd rather not answer" responses are common in public health research. However, statistical approaches to dealing with "I don't know" and "I'd rather not answer" responses can affect the validity of the survey and the researchers' ability to interpret the results.

During my research, I studied the effect of missing values under different assumptions, using machine learning based on empirical data from a study on depression symptoms in patients with coronary heart disease. Moreover, I examined the effect of the complete case analysis and multiple imputation on parameter estimates and confidence intervals using machine learning approaches such as CART and RF.



**MUHAMMAD HASSAN KHAN**

**MAJOR:** MATHEMATICS

**FACULTY SUPERVISOR:** ADA NATOLI

**DUBAI DOLPHIN SURVEY**

The purpose of the Dubai Dolphin Survey was to assess the status and distribution of three small cetacean species that regularly occur in Dubai waters - the Indo-Pacific finless porpoise, the Indo-Pacific bottlenose dolphin, and the Indian Ocean humpback dolphin. The study aimed to provide detailed information on the species' home range, possible migratory patterns, population trends, and main threats that may hamper their long-term survival in heavily anthropogenic-impacted waters. Additionally, the study sought to assess the residency and social structure of humpback and bottlenose dolphins, and to record the occurrence of less common species.



**MUSTAFA AQEEL; LYNA AMMAGUI; CADENCE CHEAH; AIGANYM KHAMITKHANOVA; SUSANNE NIEMANN; SAVAIZ NAZI; MANDIP SUBEDI**

**FACULTY SUPERVISORS:** SAMUEL MARK ANDERSON, LAURE ASSAF AND PIIA MUSTAMAKI

**PARTICIPATION IN ABU DHABI’S PUBLIC SPACES**

Abu Dhabi’s rapid urbanization since the 1960s was shaped by oil revenue and infrastructure meant to mitigate its desert environment. This project explored the transformation of Abu Dhabi’s urban spaces in light of the Anthropocene and examined the tensions between the design of public spaces and their lived uses/accessibility. It sought concrete information on the experiences of diverse communities: How do they define, appropriate, and use city spaces? Which environmental and social factors shape their access and why? How might this intersect with nationality, race, class, and gender? We suggested that Abu Dhabi’s arid climate intersects with its political climate in complex ways that condition the possibilities for its communal spaces and forecast transformations of the conception of publicity and privacy in the wider, warming world. To that end, we sought to redefine publicity and privacy in the context of Abu Dhabi, in part by considering hybrid formations such as the public use of private spaces (car culture, malls, and digital platforms) and intimate uses of public spaces (families gathering for a picnic in a park). While our methods were primarily ethnographic, the project embraced multiple disciplines and modes of practice—creative writing, photography, film, drawing, mapping, soundscapes, etc.—as it experimented with ways to collect and share these experiences both publicly and privately. This project continues to develop, driven by students’ interests and discoveries.



Group of the students with involved faculty (Laure Assaf, Corinne Stokes, Lyna Ammagui, Aiganym Khamitkhanova, Cadence Cheah, Piia Mustamaki, and Mandip Subedi) at an exhibition of the students’ findings in September 2022.



Student research in Electra Park.



**SHOUQ ALZAABI**

MAJOR: BIOMEDICAL ENGINEERING

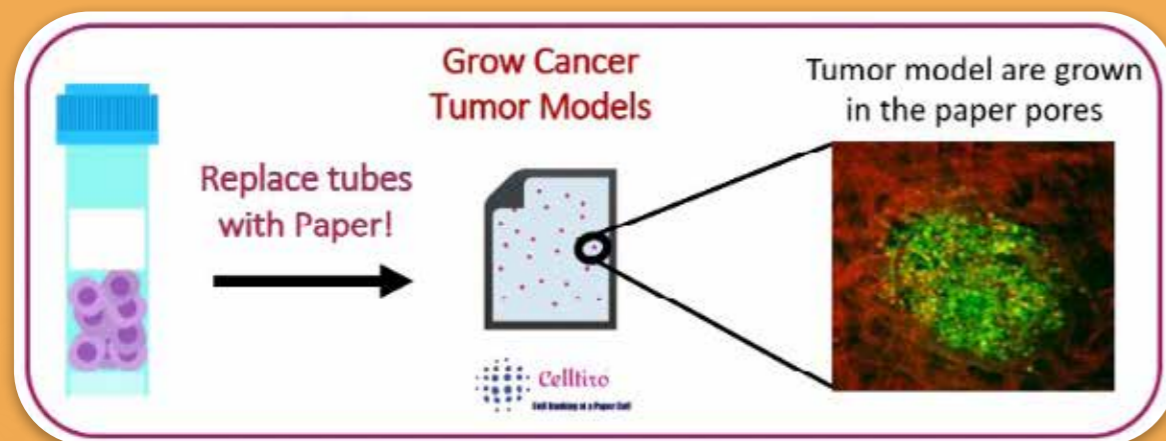
FACULTY SUPERVISOR: MOHAMMAD QASAI MEH

SCHOOL: KHALIFA UNIVERSITY

**THE ADVANCED MICROFLUIDICS AND MICRODEVICES LABORATORY**

Cell culture is a fundamental technique in biomedical research, allowing scientists to study cellular behavior and functions. Traditional cell culture methods utilize flat surfaces, often plastic or glass, as substrates. However, growing cells on paper has emerged as an innovative approach with potential advantages and applications. Paper is not only sustainable, affordable and easy to handle, but it also has a porous structure that gives cells a lot of surface area on which to cling and proliferate. Moreover, the fibers within paper platforms can cause cells to aggregate and form spheroids, which are 3D cell culture systems that better mimic in vivo cellular environments. Growing spheroids on paper substrates holds significant potential as it presents a range of biomedical applications such as tissue engineering, drug testing, and cancer research. My research was focused on collecting preliminary data for the optimization of a paper platform that can be used as a substrate for cell culture. At the beginning, I used fluorescent beads to study and compare the release and retention capabilities of different paper platforms. Then, after concluding that Whatman 1 papers are the most suitable for growing cells on paper, I repeated the characterization experiments using MCF-7 cells to confirm my findings.

*I am delighted and grateful for the enriching hands-on experience I have gained while working in the lab. The knowledge and expertise I have acquired hold great value to my academic journey, allowing me to connect theory with practice and make meaningful contributions to the field of biomedical engineering.*



**YANA HOLOVATSKA, PAULINE WEE, AND DRUCE CHUA**

MAJOR: COMPUTER SCIENCE

FACULTY SUPERVISOR: YI FANG

**V.I.V.I.A.N. (VIRTUAL INTERACTIVE VISITOR INFORMATION AND NAVIGATION)**

We undertook a research initiative to address challenges faced by visitors in institutions like museums and universities, often struggling due to limited background knowledge, language barriers, or disabilities. Traditional methods of assistance, such as brochures and human guides, have proven inadequate and costly. In response, we introduced V.I.V.I.A.N. (Virtual Interactive Visitor Information and Navigation), an innovative robot guide equipped with advanced AI. V.I.V.I.A.N. converses with visitors in multiple languages, identifies their interests, and guides them using computer vision and navigation algorithms. We focused our research project on museums, but this adaptable solution aims to enhance accessibility and visitor experiences in all kinds of public institutions.

*In the synergy of group research, we developed a project for the common good, combining our collective curiosity and expertise to illuminate the path of discovery.*

Yana Holoovatska





**ANDREA COLUMBA SANTILLAN**

**MAJOR:** ECONOMICS AND SOCIAL RESEARCH PUBLIC POLICY

**FACULTY SUPERVISOR:** ERNESTO REUBEN

**ANALYZING THE PISA 2018 RESULTS:  
A DEEP DIVE INTO UAE’S STUDENT PERFORMANCE**

The Programme for International Student Assessment (PISA) measures the educational competencies of 15-year-olds across 79 countries. While most cross-country studies focus on educational attainment, which is captured by average scores, there is increasing recognition that it is equally important to understand the causes of inequality in educational outcomes, which can be described by the scores’ variance. For my study, I used fixed-effects regression analysis for the PISA 2018 dataset, concentrating on the UAE, a country displaying a wide test score variance. I found the following significant factors influencing this variance: school type (private or public), parents’ immigrant background, gender, and parental university education.

In the PISA results, the UAE ranked the second-largest variance in both math and reading scores and ranked sixth in science. Girls consistently outperformed boys across all subjects. Private schools scored notably higher than public ones in all areas, with gaps in math, reading, and science, respectively. Native students consistently scored below their peers with foreign-born parents. In all three subjects, a parental university education correlated with better student performance. Recognizing the causes of score disparities is crucial to the development of effective policies targeting educational advancements.



**KHOA ANH TRAN**

**MAJOR:** LEGAL STUDIES

**FACULTY SUPERVISORS:** BERNARDO BORTOLOTTI AND BARBARA SCHECK

**THE SIGNATURE IMPACT FRAMEWORK: TRANSITION INVESTMENT  
LAB’S APPROACH TO IMPACT MEASUREMENT**

Poles apart from its humble beginnings in the early 2000s, impact investing has since grown to garner the interest of global investors aiming to generate positive social and environmental impact alongside financial returns. However, a significant obstacle still facing eager investors is the lack of high-quality impact data to demonstrate the effectiveness of impact investment interventions. In collaboration with Professor Bernardo Bortolotti, Professor Barbara Scheck, and Terry Chen, I authored a paper that revolves around the development of The Signature Impact Framework (SIF). This framework aimed to address this issue by providing a methodology for conducting a rigorous, actionable, and cost-effective assessment of a business’s impact. The project’s goal was to increase confidence in impact investment opportunities, ultimately mobilizing large-scale investments from institutions that have been hesitant to embrace sustainable investments thus far. The results of this article have been featured in The National and Sustainability Middle East.



**AYA ABU ALI**

**MAJOR:** ECONOMICS

**FACULTY SUPERVISOR:** ETIENNE WASMER

**THE GREAT RETURN OF LAND IN WEALTH:  
LAND WEALTH, INEQUALITY AND REDISTRIBUTION**

As a PPTP student, I spent the summer collecting, cleaning and refining complex datasets concerning land wealth, inequality, and pricing dynamics across various European nations. These datasets were instrumental in augmenting the English edition of the esteemed work, “Le Grand Retour de la Terre” authored by Etienne Wasmer and Alain Trannoy and endorsed by Nobel Laureate Jean Tirole, which delves into the intricate realm of land taxation, mostly in France.

Apart from collecting the new data and preparing them, I produced a set of illustrative charts and graphs that would add more country evidence of the crucial role of land in economic outcomes in the new edition of the book. Additionally, I conducted a comprehensive review of the translated content of the book, diligently ensuring that it maintained a seamless flow of clarity and coherence throughout. Moreover, I assumed the role of actively offering suggestions on the book to both challenge and propel forward some of the ideas promoted within its pages.



**İLAYDA ÖZDEMİR**

**MAJOR:** PSYCHOLOGY AND THEATER

**FACULTY SUPERVISOR:** ANNE MAASS

**EFFECTS OF WORD ORDER ON MEMORY, INTEGRATION OF SENTENCE  
ELEMENTS, AND SYSTEMS OF THOUGHT**

I pursued my own research in the Social Attitudes and Neurolinguistic Dynamics Lab (SANDLab). I specifically investigated English, Turkish and Korean. I explored how the canonical verb placement in languages can affect people’s processing of information. In Turkish and Korean, the verb is situated at the end of sentences, whereas in English, it is right after the subject. I got the opportunity to further my Capstone thesis by broadening the scope of the language by including Korean, and devising two new experiments. One of these experiments focused on pictorial representation, and the other on aural reception and processing.



**PAMELA MARTÍNEZ**

**MAJOR:** FILM & NEW MEDIA AND SOCIAL RESEARCH & PUBLIC POLICY

**FACULTY SUPERVISOR:** SURABHI SHARMA

**ILLEGAL ALIEN: HOW CAN ART BECOME A SPACE FOR SOCIOLOGICAL RESEARCH TO EXPLORE AFFECTIVE KNOWLEDGE ABOUT THE GENDERED MIGRATORY PATHWAYS OF VENEZUELAN WOMEN INTO THE US?**

My joint Capstone was an unfinished exhibition - a space where sociology, public policy and film communicated with each other while giving visibility to the process of engaging with research-based art. This was a self-questioning practice derived from questioning how the stories of Venezuelan women who migrated to the US can be represented. As I started contacting Venezuelan women for my sociological paper about gendered migration, I found it difficult to prioritize one of the many topics that gendered migration entails. Initially, I was interested in inquiring about the process of extending legality through marriage. However, as I started interviewing my research participants, I realized I needed to expand my research into one that could encompass the richness of experiences of migration, which goes beyond the process of migrating in itself. *Illegal Alien* inquires into Venezuelan women's physical and emotional journeys while migrating, some forcibly, away from home. It interweaves artistic forms to archive Venezuela's contemporary history while exploring the politics of agency and representation. It reconfigures the dichotomy between instrumentality and emotionality within marriage law. It also provides components of art activism as it proposes public policy interventions to current social issues that affect Venezuelan migrant women's experiences inside the US.

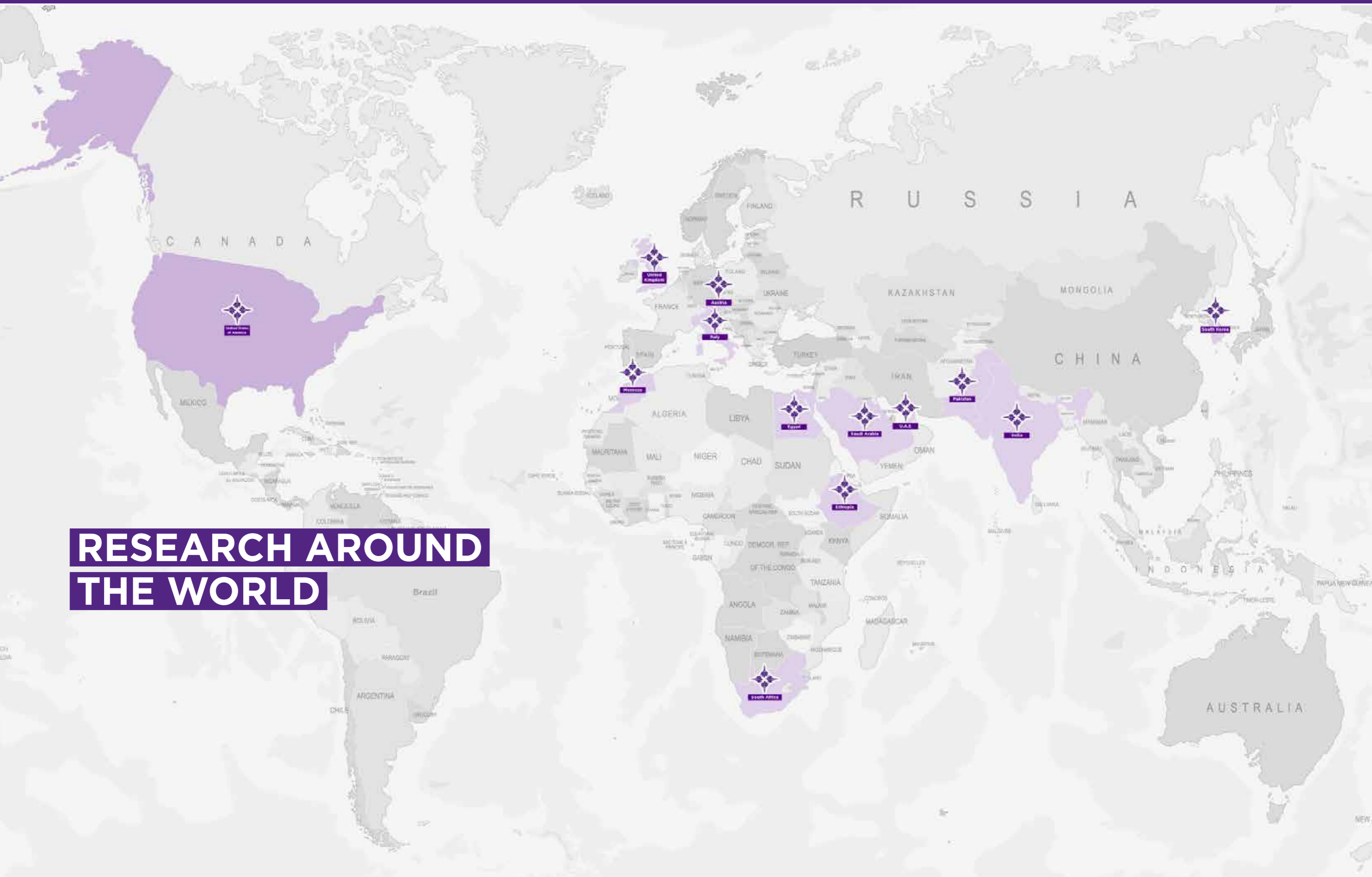
*I felt it imperative to recognize the need to preserve these Venezuelan women's stories, as a way of archiving Venezuela's contemporary history.*



Presenting the installation at the NYUAD Arts Center.



Stills from *Illegal Alien: the prelude*.



# RESEARCH AROUND THE WORLD



**SARUUL ZORIGT,  
DARIGA BOLATBAY, JAKUB JURKOVIC**

**MAJOR:** BIOLOGY

**FACULTY SUPERVISOR:** YOUSSEF  
IDAGHDOUR

**RESEARCH LOCATION:** MOROCCO

### THE MOROCCAN IMMUNE CELL ATLAS

We conducted summer field-based research in Morocco as part of the African Ancestry Immune Cell Atlas project funded by the Chan Zuckerberg Initiative. The project sought to study the immune system at single-cell resolution on a population scale, powering association studies between environmental, genetic, and immunological variables. This initiative involved the participation of an international team of community health workers, geneticists, computational biologists, single-cell biology experts, and immunologists, and it uses a community-based participatory research approach to generate an immune cell atlas in rural and urban populations of African ancestry. We actively participated in the research project in coordination with local researchers and students. They helped with the capacity-building of a laboratory at a local university and had first-hand experience with various aspects of data collection and genetic research including the processing of biological samples collected from study participants. We will be involved in follow-up work including the generation of various types of genomic data and bioinformatic analysis of the data.

*I am very grateful to Dr. Idaghdour for providing this amazing learning opportunity. This experience has provided me with great insight into the immense amount of planning and careful execution it takes to collect samples that are the basis of the research that we do. I have gained a new-found appreciation for all the data I have been fortunate to work with.*

- Saruul Zorigt



Jakub, Dariga and Saarul in the fields of a rural village in Morocco, where people follow a traditional way of life.

*It's thrilling to be a part of such a large collaborative project, as it offers a fresh perspective on the vast effort that goes into generating the data I often overlook or take for granted.*

- Jakub Jurkovic



The NYUAD team with local Moroccan collaborators at Ibn Zohr University in the city of Agadir.

*I realized how important it is to establish effective communication and collaboration in science. I have gained a better understanding of the processes involved in collecting samples and setting up a research project, which was a crucial insight for my scientific journey.*

- Dariga Bolatbay



The team of researchers overlooking the rural village of Ighrem in an Atlas Mountain valley.



**MAYA MUWANGA**

**MAJOR:** HISTORY

**FACULTY SUPERVISOR:** MARTIN BOWEN

**RESEARCH LOCATION:** NEW ORLEANS, USA

**FUTURES WE CAN RETURN TO: BLACK NEW ORLEANS AND THE MEMORY OF MARRONAGE**

The main topic of my Capstone project is living memory of maroons by Black/Creole New Orleanians. *Marronage* is defined as the process by which groups and individuals pursued self-liberation from enslavement, forming communities and social enclaves outside of slave society. My Capstone project emerges amidst attempts by historians as well as scholars and activists across disciplines to examine *marronage* and the intellectual, political, and creative possibilities it opens up as both an object of study and an analytical perspective. Drawing on scholarship about African American cultural memory, knowledge transmission, performance, and *marronage*, my project analyzes evocations and enactments of *marronage* by members of the Black community in New Orleans, Louisiana. During my time in New Orleans, I conducted oral history interviews which comprise the main primary sources for my final Capstone project. All of my interviewees can be labeled as community elders who have participated in various forms of activism or public history work for several decades and who through their work and personal lives demonstrate concern and interest in the history of *marronage* in Louisiana. Additionally, I performed research at the New Orleans public library and through visits to various public historical venues including the Louisiana State Museum.



Photos taken in New Orleans.



**NOORA JABIR AND LOUISE SIMPSON**

**MAJOR:** ARAB CROSSROADS STUDIES, SOCIAL RESEARCH AND PUBLIC POLICY/POLITICAL SCIENCE

**FACULTY SUPERVISORS:** ALIA YUNIS AND MELINA PLATAS

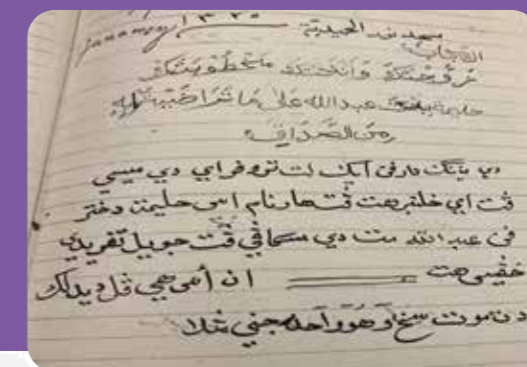
**RESEARCH LOCATION:** CAPE TOWN, SOUTH AFRICA

**THE INTERSECTION OF RACE, RELIGION, AND LANGUAGE: AN ETHNOGRAPHIC STUDY OF IDENTITY POLITICS AMONG AFRIKAANS-SPEAKING CAPE MUSLIMS**

For our research, we explored questions around the use and preservation of Cape Afrikaans and how it is linked to questions of identity and power in post-apartheid South Africa. Through visits to museums, exhibits and archives, and interviews with museum curators, artists and locals, we looked at the ways in which the revival of Arabic Afrikaans is portrayed by various stakeholders, and how it connects to larger national narratives of race, language and identity. We closely studied many available Arabic Afrikaans manuscripts, through which we were able to understand what Afrikaans meant for the early Cape Muslims, and how they spoke in and about this language. Afrikaans is a language that is broadly associated with white South Africans, and with its dominance as the Apartheid regime's official language. However, only about 40% of South Africans who speak Afrikaans at home are white, and the language itself has roots in both indigenous languages and in Arabic. The language's ties to this history, and its use in non-white culture in South Africa is generally under-researched (and among white communities is often also disregarded and delegitimized). Our focus for this project was on the Afrikaans-speaking Muslim population in Cape Town. We investigated the ways in which the historical and sociopolitical contexts of post-apartheid South Africa have influenced the use and preservation of Cape Afrikaans. Additionally, we aimed to understand the implications of these dynamics for language rights and linguistic diversity in the country.

*I'm currently working on a visual interactive project that captures the connections between language, landscape and colonialism using the Arabic Afrikaans script. By relying on my experience with interactive media and Arabic calligraphy, I'm hoping to find a way to translate what I've learnt into something that is accessible and interesting. Especially since my research focuses on script and landscapes, both very visual concepts, I feel like an artistic medium will allow me to create something I'm more satisfied with, and that gives the audience a better sense of my arguments.*

Noora Jabir



Arabic manuscripts found in Cape Town.



**NAIN RYU**

**MAJOR:** LITERATURE AND CREATIVE WRITING

**FACULTY SUPERVISOR:** HARSHANA RAMBUKWELLA

**RESEARCH LOCATION:** SOUTH KOREA

**THE AESTHETICS/IMAGERY OF KOREAN FOLKTALES AND THEIR IMPACT ON IDEAS OF “KOREAN-NESS”: A STUDY OF 별주부전 (BYEOL-JU-BU-JEON/THE RABBIT’S LIVER)**

My research critically explores how aesthetics/imagery and the narrative content of the Korean folktale **별주부전** (Byeol-ju-bu-jeon/The Rabbit’s Liver) work together to generate and disseminate ideas of “Korean-ness”. I look at specifically how visualizations of the tale in mass media such as television have contributed to building a representative image of Korean identity. The goal of my research was to gather visual materials that capture the aesthetics/imagery characteristic of the folktale. I explored and captured the way the folktale is visualized in the media/pop culture over time and what these adaptations of the folk tale might tell us about contemporary Korean identity. I was also interested in understanding the social resonance of the subversive political criticism embedded in the narrative content of the Korean folktale **별주부전** (Byeol-ju-bu-jeon/The Rabbit’s Liver), and how it impacts the formation of Korean personality/character -- because the story is about how the ‘weak’ manage to survive in conditions that are hostile to them and suvert dominant power structures through their wit and intelligence. By “Korean personality” I allude to something like a collective Korean political consciousness.



**ZAINA AWAN**

**MAJOR:** HISTORY AND LEGAL STUDIES

**FACULTY SUPERVISOR:** NELIDA FUCCARO

**RESEARCH LOCATION:** OXFORD, UNITED KINGDOM

**IN BECOMING PERMANENTLY DEPORTABLE: THE STATUS OF SOUTH ASIAN MIGRANTS IN THE TRUCIAL STATES PRIOR TO AND AFTER THE FORMATION OF THE UAE FEDERAL LAW NO.17 OF 1972 ON NATIONALITY AND PASSPORTS**

My research questions included firstly, what informed the promulgation of Federal Law No. 17 specifically and secondly, how the law altered the lives of South Asians that had migrated to the area before the formation of the UAE. There has been growing attention on Gulf history in the last few decades, with a particular interest in examining how modern systems such as kafala and the migrant hierarchies that operate today came into being. This research aimed to add to the growing literature by providing more insight into how the status of individuals who migrated from the sub-continent was defined and how the introduction of the nationality law altered their status. The research is critical to understanding why individuals from the sub-continent were and continue to be cast out of the UAE nation-state narrative. I was able to collect information from archives in the UK and use this to prepare for my Capstone project.



**SAIKI PADHY**

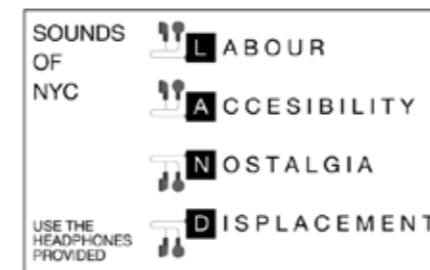
**MAJOR:** FILM AND NEW MEDIA

**FACULTY SUPERVISOR:** JOHANN DIEDRICK

**RESEARCH LOCATION:** NYU TISCH SCHOOL OF THE ARTS; NEW YORK, USA

**MAPPING THE SONIC SPACE OF NEW YORK CITY: A SOUND AND FIELD RECORDING EXPLORATION**

I explored the relationship between sound and the socio-cultural dynamics of New York City’s boroughs using a framework I developed, called “L.A.N.D”’: Labor, Accessibility, Nostalgia, and Displacement. Conducting fieldwork throughout Manhattan and Brooklyn, I utilized various sound recording tools, including hydrophones, contact microphones, and parabolic microphones, to capture a spectrum of city sounds and noise. The culmination of this work was a four-track installation at Central Park’s Seneca Village, designed to provide an insightful urban perspective on the city’s diverse acoustic landscapes and the challenges in urban policymaking in New York City.



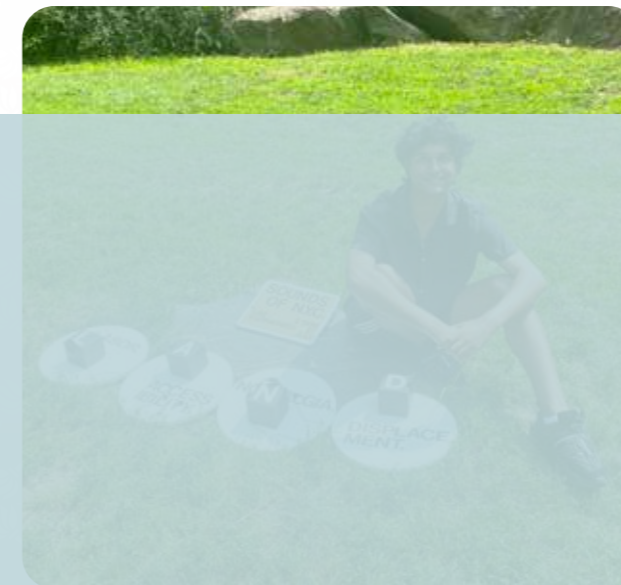
Prototype for the project’s webpage.



Flyer for the Exhibit.



The L.A.N.D Sound Installation Exhibit at Seneca Village.



The L.A.N.D Sound Installation Exhibit at Seneca Village.







**GHIDA SHAWAF**

**MAJOR:** CIVIL ENGINEERING

**FACULTY SUPERVISOR:** CASSANDRA THIEL


**RESEARCH LOCATION:** NYU TANDON SCHOOL OF ENGINEERING; NEW YORK, USA

## SUSTAINABLE MEDICINE

Sustainability is a pressing concern within the healthcare industry, and prompts the need for innovative strategies to mitigate its environmental impact. During the summer, I worked in Dr. Casandra Thiel's Lab for Sustainable Medicine in New York City, as part of the Tandon Undergraduate Research Program. My research project covered two interconnected methods for reducing the environmental footprint of the medical sector. The first approach was to minimize waste in the Operating Room by tracking single-use equipment and packaging materials, in order to then explore options for recycling and reuse.


As part of this work, my team and I interned at the NYU Langone Hospital in the eye care surgery department, where we performed waste audits for cataract surgeries and interviewed healthcare professionals on their commitment to sustainability. The second approach was a retrospective study of the disruption of Personal Protective Equipment (PPE) orders during the COVID-19 pandemic, which helped us design solutions for bolstering supply chain resilience in hospitals.

*Throughout my program, I got to meet industry professionals and academic faculty from NYU and other institutions such as the Wharton School and Johns Hopkins University. Keeping in touch with contributors in the field and collaborating on different projects not only helped me expand my knowledge and hone my technical skills, but it also provided a holistic understanding of the importance of sustainable healthcare. Then, working in a close knit team of undergraduate and graduate researchers helped bring our work together efficiently despite the short amount of time.*



### Sustainable Medicine: implementing changes in US healthcare

Aleema Ahmed, Emma Pak, Ghida Shawaf, Gerardo Elguézabal  
New York University - Tandon Undergraduate Summer Research Program

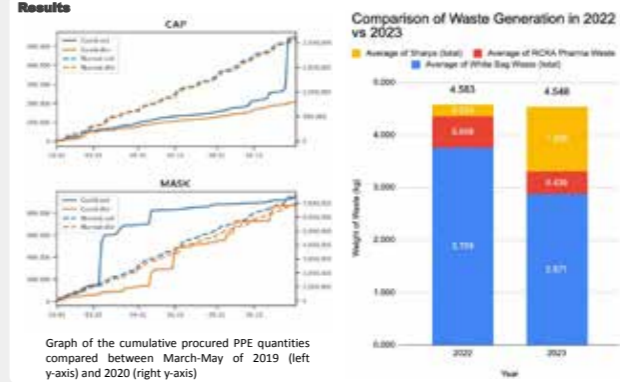


**Abstract**  
This research highlights sustainability within US healthcare, focusing on reducing waste from cataract surgeries and bolstering PPE supply chain resilience post-COVID-19. NYU Langone Health waste audits and interviews with practitioners unveiled opportunities for adopting reusable instruments. Analysis of COVID-19-induced supply chain disruptions emphasized the need for strategies like increased collaboration and vendor visibility for a resilient, eco-friendly future.

**Introduction**  
Sustainability is pivotal for the future of US healthcare, both in waste management and supply chain resilience. With cataract surgeries, a major waste contributor, as our focus, we explore eco-friendly alternatives to prevalent disposal practices, as evidenced by NYU Langone Health audits and practitioner interviews. Concurrently, lessons from the COVID-19 pandemic guide our examination of PPE supply vulnerabilities and strategies for a resilient, green healthcare system.

**Materials & Methods**  
Financial data and EMR records were sourced from the hospital. From June-July 2022, data was gathered at a NYC ambulatory care center, with waste audits conducted across two floors, totaling 49 audited cases. Excluding joint procedures, surgeries without CPT codes 66982 or 66984 were omitted. Financial data was refined for accuracy and appropriate categorization.

**Results**



Graph of the cumulative procured PPE quantities compared between March-May of 2019 (left y-axis) and 2020 (right y-axis)

Comparison of Waste Generation in 2022 vs 2023

Year	Average of Sharps (Total)	Average of RCRA Pharma Waste (Total)	Average of White Bag Waste (Total)
2022	1,719	1,408	4,583
2023	2,871	1,000	4,548

**Conclusion**  
The analysis of COVID-19 supply chain disruptions highlights weaknesses in the healthcare system's emergency response and suggests ways to prevent future shortages. This research project examines waste during cataract surgeries and PPE order disruptions, providing a framework for sustainable medicine. Healthcare institutions and policymakers can use these findings to improve supply chains and promote environmentally-friendly practices.

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Cohen J, Rodgers Y van der M. Contributing factors to personal protective equipment shortages during the COVID-19 pandemic. *Preventive medicine*. December 2020.  
Bhattacharya S, Hossain MM, Singh A. Addressing the shortage of personal protective equipment during the COVID-19 pandemic in India-A public health perspective. *AIMS public health*. April 15, 2020  
Spieske A, Gebhardt M, Kopyto M, Birkel H. Improving resilience of the healthcare supply chain in a pandemic: Evidence from Europe during the COVID-19 crisis. *Journal of Purchasing and Supply Management*.

**Acknowledgements**  
Regards to New York University for offering this opportunity and allocating the necessary tools. Thank you to the Tandon Undergraduate Summer Research Program faculty and our supervisor, Dr. Cassandra Thiel for guiding us through this paper and supporting our research.

Poster presentation at NYU Tandon.



Waste audit post-cataract surgery at NYU Langone Health.

**MARYAM AL DARMAKI; ALANOOD ALAMEERI; NADINE KABBANI; MARIANA LUGO CELEDON; RIJA NADEEM**

**COACHES:** NAWAF ALSULAIM AND KACPER JARCO

**RESEARCH LOCATION:** VIENNA, AUSTRIA

**WILLEM C. VIS INTERNATIONAL COMMERCIAL ARBITRATION MOOT (VIS MOOT)**

The Willem C. Vis International Commercial Arbitration Moot or Vis Moot is an international moot competition. Since 1994, it has been held annually in Vienna, Austria, attracting more than 300 law schools from all around the world and spurring the creation of more than 20 pre-moots each year before the actual rounds are held in Vienna. It is the largest arbitration moot competition, and second-largest moot overall, in the world. A sister moot, known as the Willem C. Vis (East) Moot, is held in Hong Kong just before the rounds in Vienna. It was established in 2003 and attracts around 150 teams every year, making it the second largest commercial arbitration moot. It uses the same moot problem as the Vis Moot, as does the various pre-moot friendlies.

The objective of both Vis moots is to foster study in the area of international commercial arbitration and encourage the resolution of business disputes by arbitration. The problem for the moot is always based on an international sales transaction subjected to the United Nations Convention on Contracts for the International Sale of Goods (referred to commonly as the CISG) and also involves procedural issues of arbitration such as jurisdiction and powers of an arbitral tribunal. The moot consists of submitting written memoranda for both claimant and respondent before the oral phase of the competition.



The NYUAD Vis Moot Team with Prof. Dr. Stefan Kröll and Dr. Christopher Kee - directors of the Vis Moot competition.



Photos from the Vis Moot event.



Photos from the Vis Moot event.



**LUKELO LUOGA**

**MAJOR:** COMPUTER ENGINEERING

**FACULTY SUPERVISOR:** KAAAN OZBAY

**RESEARCH LOCATION:** NYU TANDON SCHOOL OF ENGINEERING; NEW YORK, USA

**ENHANCING EQUITABLE PEDESTRIAN SAFETY IN SMART CITIES: A DIGITAL TWIN APPROACH WITH ADAPTIVE SIGNAL CONTROL FOR PEDESTRIANS WITH MOBILITY AIDS**

Enhancing pedestrian safety and accessibility in smart cities is a crucial goal for modern transportation innovations. However, current pedestrian signal controls often lack optimization for individuals with disabilities and older adults, highlighting the urgent need for adaptive and equitable solutions. My research project aimed to address this issue by developing a digital twin, utilizing the 2D traffic simulator SUMO and the 3D simulator CARLA, alongside a vision-based adaptive signal control system. The primary focus was enhancing pedestrian safety, particularly for those utilizing mobility aids. To achieve this, I built a beta version of a digital twin, enabling real-time vehicle and pedestrian input exchange between SUMO and the CARLA simulator. This integration facilitated dynamic and precise simulations of real-world traffic scenarios involving both vehicles and pedestrians. Additionally, I implemented an object detection model powered by cutting-edge computer vision techniques within CARLA, ensuring efficient pedestrian detection, with a specific emphasis on individuals using mobility aids. The insights from the detection model play a crucial role in shaping the Python-based adaptive signal system to cater to the unique needs of pedestrians with mobility aids. The project demonstrated the effectiveness of the adaptive control system in the digital twin model, promoting equitable crossing times for pedestrians with mobility aids.

**Enhancing Equitable Pedestrian Safety in Smart Cities: A Digital Twin Approach with Adaptive Signal Control for Pedestrians with Mobility Aids**  
 Lukelo Luoga,<sup>1</sup> Kaan Ozbay,<sup>2</sup>  
1. NYU Abu Dhabi Computer Engineering (2024); 2. Professor & Director, C2SMARTER Center, Department of Civil and Urban Engineering, Tandon School of Engineering, New York University

**ABSTRACT**  
 Urban transportation innovations aim to enhance pedestrian safety and accessibility, yet the lack of optimization in current signal controls for pedestrians with disabilities and older adults emphasizes the urgent need for adaptive and equitable solutions [1]. This research aims to address this issue by developing a digital twin, utilizing the 2D traffic simulator SUMO and the 3D simulator CARLA, alongside a vision-based adaptive signal control system. The research implements an object detection model powered by cutting-edge computer vision techniques within CARLA, ensuring efficient pedestrian detection. The detection results are then integrated with the Python-based adaptive signal system to cater to the unique needs of pedestrians with mobility aids (e.g., longer crossing time). The project demonstrates the adaptive control system's effectiveness in the digital twin model, promoting equitable and safer crossing times for all pedestrians.

**CARLA-SUMO CO-SIMULATION FRAMEWORK**  
 The co-simulation framework was successfully implemented, incorporating the 3D map of Flatbush Avenue in New York City. To create this map, the recommended software, RoadRunner, was utilized to generate maps compatible with CARLA.

**PEDESTRIAN DETECTION**  
 Using an RGB camera in CARLA, data images from a specific region are input into YoloV8 and StrongSort models to detect and track pedestrians with mobility aids. If detected and crossing time is insufficient, the system extends the green light adaptively based on an average crossing time for that group.

**ADAPTIVE TRAFFIC SIGNAL SYSTEM**

**CONCLUSION AND FUTURE WORK**

- The adaptive signal system efficiently detects pedestrians with mobility aids and promptly adjusts crossing time to accommodate their specific needs.
- Future work includes integrating in-vehicle pedestrian detection for improved detection accuracy.
- Establishing communication between multiple traffic signals to create a more connected adaptive signal system ecosystem.
- Implementing the system in the real world to test its efficiency and effectiveness in practical scenarios.

**ACKNOWLEDGEMENT**  
 The authors thank NYU Tandon School of Engineering's Office of Undergraduate Academics and C2SMARTER Center at NYU.

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 [2] Checklist for assessing the accessibility of transportation and Mobility. (n.d.). <http://www.nadtc.org/wp-content/uploads/NADTC-Checklist-for-Assessing-the-Accessibility-of-Transportation-and-Mobility.pdf>  
 [3] Kailash, A. S., Sneha, B., Anshelvi, M., Dhivya, M., Karthika, R., Prathu, E. (2023). Deep learning based detection of mobility AIDs using yoloV8. 2023 3rd International Conference on Artificial Intelligence and Signal Processing (AISP). <https://doi.org/10.1109/aisp57993.2023.10134845>

The project research poster.



**SUNGHO YOON**

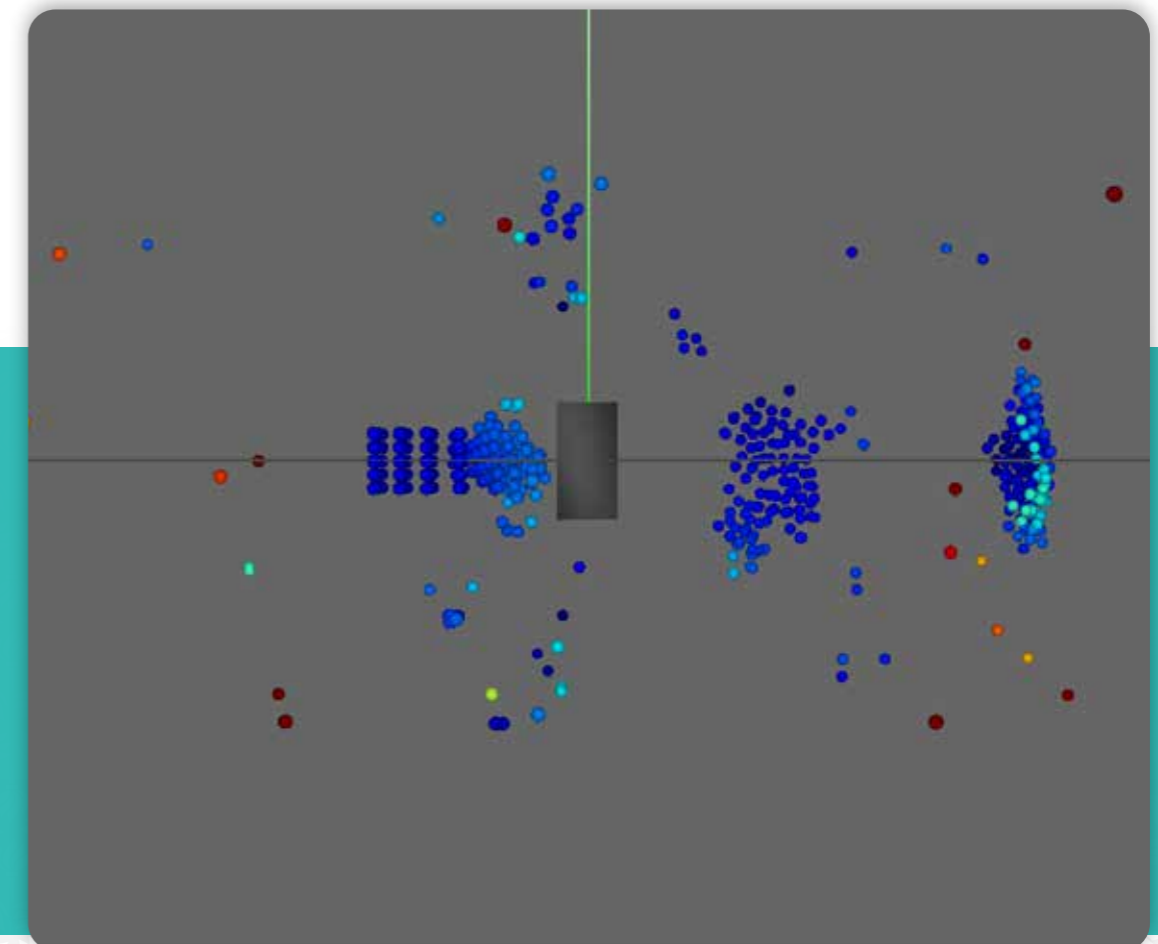
**MAJOR:** ENGINEERING

**FACULTY SUPERVISOR:** CHEN FENG

**RESEARCH LOCATION:** NYU TANDON SCHOOL OF ENGINEERING; NEW YORK, USA

**MOBILE 3D PRINTING**

The Mobile 3D Printing (M3DP) project aimed to provide a simulation tool of a mobile 3D printing robot generating the 3D printing material. I conducted thorough research on finding candidates for robotics (rigid-bodies) simulation and fluid engines. Two combinations were found and tested: (Gazebo+FluidLab) and (Isaac Sim+SPLiSHSPLaSH). The former was the replication of the previous research done by former AI4CE lab members in 2019. As the program environment had been updated, I had to adjust some of the previous research materials to the new environment of Gazebo11 and ROS Noetic. For the latter, I collaborated with my colleagues to construct the new simulation framework of combining Isaac Sim and SPLiSHSPLaSH in Python API. I completed updating the previous simulation tools to the current software versions and constructing the ROS node system governing Isaac Sim, SPLiSHSPLaSH, and Paraview. Although actual mobile 3D printing was not simulated, I found out that the novel framework was able to handle the generation of fluid particles at the designated position and rendered as 3D simulation.



Simulation of the Viscous Fluid Particles from a Sample Ejector in SPLiSHSPLaSH.



**SWOSTIK PATI**

**MAJOR:** COMPUTER SCIENCE AND INTERACTIVE MEDIA

**FACULTY SUPERVISOR:** S. FAROKH ATASHZAR

**RESEARCH LOCATION:** NYU TANDON SCHOOL OF ENGINEERING; NEW YORK, USA

**SMART WEARABLE SENSING AND SOFT ROBOTICS**

The field of robotics has proven to be revolutionary and immensely versatile, with modern life as we know it reliant upon its innovations, and few aspects of our lives remain wholly untouched by its reach. With applications ranging from automation in manufacturing and agriculture to marine and space exploration, another rapidly developing and expanding area with more direct contact in our lives is medicine and healthcare, whereby existing robots can assist with surgery, rehabilitation, patient prosthetics, and much more. This research project focused specifically on potential applications such as medical monitoring and rehabilitation, aiming to decode muscle functionality with a wearable solution in an innovative approach in soft robotics.

I worked with a team of students to design, create, and develop a frame/mount to collect and interpret hand-tracking data from a camera source. We worked on a system to render 3D hand models in real-time based on this collected data as well as data from other external sources such as sensors, and we also worked on a smart wearable wristband equipped with accelerometers to detect hand movements. With the collected data, our methodology involved training a machine learning model to predict hand gestures in real-time, focusing particularly on data collected from the carpus region. We postulate that with a fully trained model, we will be able to predict hand gestures solely using accelerometer data from the smart wristband, demonstrating the possibility of decoding muscle functionality without relying on additional external sensors or cameras.



**KALKIDAN AYALEW**

**MAJOR:** ECONOMICS

**FACULTY SUPERVISOR:** MORGAN HARDY

**RESEARCH LOCATION:** ADDIS ABABA, ETHIOPIA

**THE IMPACT OF BELIEFS ON MIGRATION PREFERENCES: EXPERIMENTAL EVIDENCE FROM ETHIOPIA**

The aim of this project was to provide causal evidence on how migration preferences are influenced by beliefs about the benefits of migrating for individuals and households, as well as the formality of migration channels. The study aimed to shed light on the challenges and trade-offs that jobseekers in Ethiopia face when considering migration, and to provide valuable insights into the factors that influence their migration decisions. To achieve this, the study intended to conduct a survey experiment that aimed to contribute to the empirical literature in economics.



**HAGAR AMER**

**MAJOR:** BUSINESS, ORGANIZATIONS, AND SOCIETY

**FACULTY SUPERVISOR:** ERNESTO REUBEN

**RESEARCH LOCATION:** MINISTRY OF FINANCE, CAIRO, EGYPT

**COP27 AND THE ROAD TO GREENER FISCAL POLICIES**

I had the opportunity to work as an Economic Research Intern at the Ministry of Finance in Cairo, Egypt, My main focus was researching and analyzing green economic policies implemented by key government bodies, particularly with regard to the Ministry of Finance's commitment to green fiscal policies following Egypt's Presidency of COP27. I prepared comprehensive reports, stakeholder maps, white papers, and periodical trade reports. Additionally, I developed government engagement strategies for various sectors, including TMT, FMCGs, Healthcare, Defense, Fintech, and Oil and Gas. I also conducted macro-economic and policy-related research to provide valuable insights to the Minister and his team for use during ministerial meetings. I received extensive training on a wide range of topics, including Egyptian, GCC, and international customs regulations, foreign trade agreements, client management, proposal writing, arabic business writing, government relations, regulation analysis, and import/export regulations. One of my notable accomplishments was revamping and presenting a narrative for the current investors' presentation, which allowed me to apply my training and research findings to a practical project.

*This experience was both enriching and fulfilling, as it provided me with valuable skills and insights into economic research, government relations, and policy analysis.*

### Smart Wearable Sensing & Soft Robotics

Wentao Chen, Yun Hao Dong, Salman Elgamil, Yaghyesh Ghimire, Swostik Pati

MERIIT Lab, NYU Tandon Undergraduate Summer Research Program

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**Abstract**

This research project focuses on specific applications of the field of robotics in areas such as medical monitoring and rehabilitation, particularly aiming to decode muscle functionality with a wearable solution in an innovative approach in soft robotics. We worked to design, create, and develop a frame/mount to collect and interpret hand-tracking data from a camera source, a system to render 3D hand models in real-time based on this collected data, and a smart wearable wristband equipped with accelerometers to detect hand movements.

**Background**

The field of robotics has proven to be incredibly revolutionary and immensely versatile, with modern life as we know it unable to exist without its innovations and few aspects of our lives able to remain wholly untouched by its reach. With applications ranging from automation in manufacturing and agriculture to marine and space exploration, another rapidly developing and expanding area with more direct contact in our lives is medicine and healthcare, with currently existing and additional potential future robots that are able to assist with surgery, rehabilitation, patient prosthetics, and much more, which is the focus of this project.

**Process**

Understanding and extracting the data from the Ultraleap served as a key starting point of our investigation. To establish an optimal data collection setting, we needed to create a stable platform for arms to rest at a position relative to the Ultraleap device. We fabricated multiple prototypes using cardboard. Based on our preliminary findings, we then advanced to a more robust design, employing wood for the primary structure, 3D printed arm rests, and a mount to securely the Ultraleap device.

**Results**

This research project successfully developed a hand tracking system and a design for a tendon movement data collection system, integrating the Ultraleap device, Unity, and OpenCV python library. The system provided accurate hand tracking by rendering the tracked hands within the Unity environment and also in OpenCV-based camera. A custom frame, composed of 3D printed components and wood, ensured uniform data collection with minimal interference during hand movements. We also developed a blueprint of a smart wristband equipped with an Arduino Nano Microcontroller and three accelerometers in the carpus area mounted over a PCB to capture precise tendon movement while various hand gestures are being made.

Figures 1, 2. Ultraleap's hand tracking capabilities

Figure 3. Rendering our hands in Unity

Figure 4. Hand tracking frame

Figure 5. PCB Design Prototype

**Future Work**

Our next step is to have the wristband with functional wiring schematic and PCB design manufactured. It will be synced with our frame and hand rendering tools for data collection, and then ultimately pair with a machine learning model to predict hand gestures in real-time, focusing particularly on data collected from the carpus region. We postulate that with a fully trained model, we will be able to predict hand gestures solely using accelerometer data from the smart wristband, demonstrating an ability to decode muscle functionality without relying on additional external sensors or cameras.

**Acknowledgements**

We extend our deepest gratitude to our project advisor, Professor S. Farokh Atashzar, whose supervision and mentorship have been invaluable throughout the entirety of this project. We would also like to acknowledge the dedicated support and guidance from the research mentors - Sarmad Mehrdad, Erin Hu, Mohammedi Roowala, and Joycephine Li.

Poster presentation at NYU Tandon.



**MALAK MANSOUR**

**MAJOR:** ELECTRICAL ENGINEERING

**FACULTY SUPERVISORS:** SHIVENDRA PANWAR AND FRAIDA FUND

**RESEARCH LOCATION:** NYU TANDON SCHOOL OF ENGINEERING; NEW YORK, USA

**LEARNING BY REPRODUCING A FOUNDATIONAL RESULT IN COMPUTER NETWORKS**

I worked on reproducing research in computer networks. The purpose of this was to validate a foundational result and create educational material for students. I used the original research paper to know what parameters and values I should set to reproduce the plot from the first environment in the paper. As I reproduced results, I would always validate them. This validation process allowed me to discover methodological issues along the way that I couldn't have anticipated without reproducing the results. After discovering them, I could fix them, make note of them in a list, and repeat the experiment. At the end, I created a student README guide on GitHub that summarized the steps that I took to run the experiment on the FABRIC testbed, validate the results, and discover methodological issues. As I fixed the issues, I could see my plot improving over multiple trials and matching that of the original paper.

*I gained a multitude of technical and soft skills from the research program including presentation, problem solving, research, data analysis, and organization skills. I've worked on all these skills in other courses before but I particularly felt them improving. I also created a poster and presented it at the culminating event with 20 other program participants to approximately 100 participants and non-scholars who attended the event.*



Malak and the summer research team.



**VALENTINA JUAREZ ORTIZ**

**MAJOR:** MECHANICAL ENGINEERING

**FACULTY SUPERVISORS:** GILLES LUBINEAU AND YAHYA KARA

**RESEARCH LOCATION:** KING ABDULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY; THUWAL, SAUDI ARABIA

**BIO-INSPIRED MICROSTRUCTURES OF DISCONTINUOUS CARBON FIBER COMPOSITE MATERIALS FOR ENHANCED MECHANICAL PROPERTIES**

Composite materials have gained increasing prominence across various industries, from aerospace and civil engineering to subsea applications, due to their exceptional properties, including high specific strength and stiffness compared to traditional metals and alloys. However, their utility is often hindered by their susceptibility to sudden failure. To enhance their reliability for applications requiring high safety standards, it would be advantageous to induce a more gradual failure in these materials.

My research project focused on designing a bio-inspired microstructure aimed at enhancing the mechanical properties of composite materials. This involved creating structures that mimic natural designs, introducing strategic cuts in the materials. Such modifications have proven effective in delaying failure. However, these introduced discontinuities can also lead to a reduction in the initial strength for which composite materials are preferred.

Consequently, a trade-off exists between strength and toughness, and the central question revolves around determining the optimal microstructure design that maximizes energy dissipation. The primary objective of this project, therefore, is to identify the ideal bio-inspired microstructure for implementation in CFRP-PEKK composites. I had the privilege of overseeing the entire manufacturing process of the samples. Subsequently, I conducted comprehensive tensile tests on these samples and analyzed the resulting data.

*This research internship offered me a holistic and informative learning experience.*



Experiments in progress at the NYUAD lab.



**ASHOK TIMSINA**

**MAJOR:** ELECTRICAL ENGINEERING

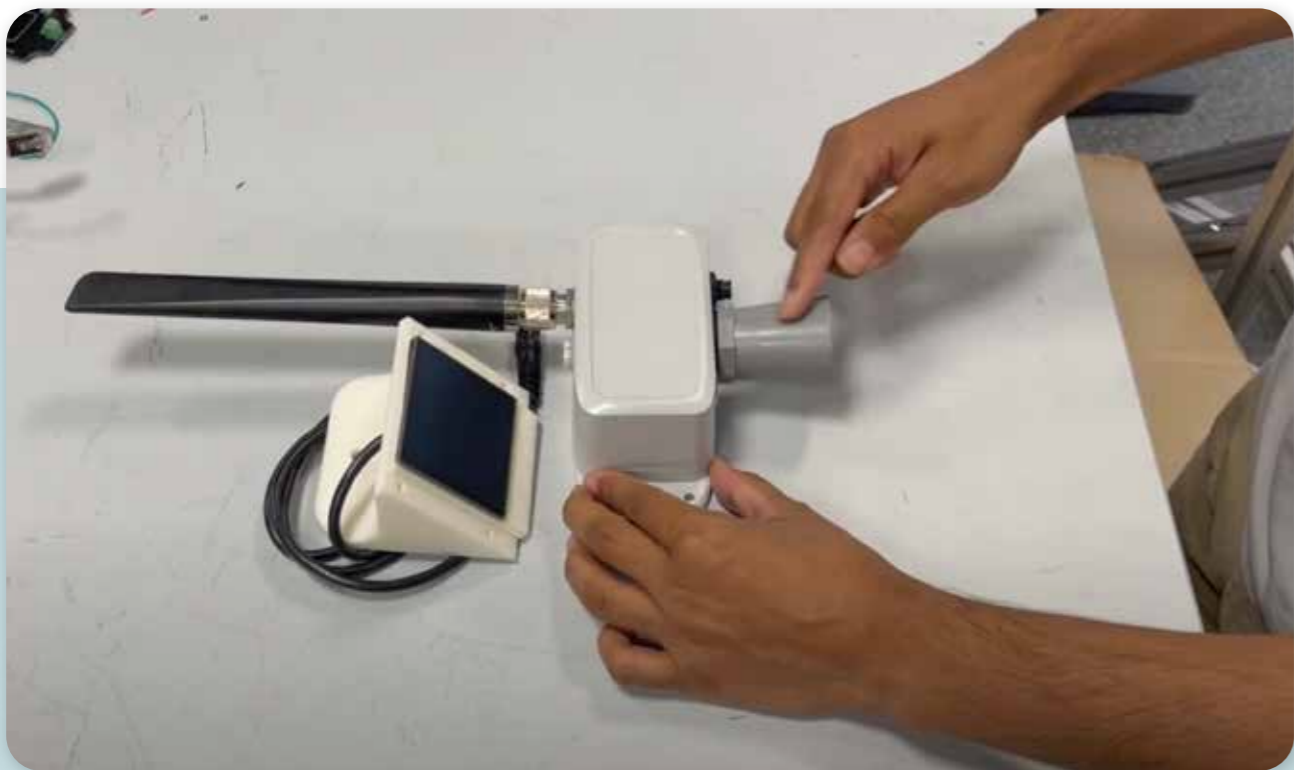
**FACULTY SUPERVISOR:** ANDREA SILVERMAN

**RESEARCH LOCATION:** NYU TANDON SCHOOL OF ENGINEERING; NEW YORK, USA

**FLOODNET**

FloodNet is a collaborative project that combines the efforts of academic institutions, government organizations, and community advocacy groups to address urban flooding in New York City. It involves deploying a network of low-cost and low-power flood-level sensors to collect quantitative flood-level data. The team aims to deploy over 500 flood sensors in a span of three years. I worked in the team as a data analyst to analyze data coming from the sensors to detect sensors which had failed or could possibly fail in the near future. One of my major findings during my work at Floodnet was that battery voltage is not the major reason for failure for most issues in the network. Additionally, I analyzed data related to the network status of the sensor network to find possible correlations with the failure. I also worked to create a dashboard and an alerting system which will alert if any sensor in the network fails or is approaching failure.

*It was a rewarding experience to be involved in a research project that can make a positive impact on addressing a real-world issue encountered by people.*



Ashok points out the various parts of the FloodNet sensor, which is used to measure street-level floods in real-time.



**FATIMA REBH**

**MAJOR:** BIOENGINEERING

**FACULTY SUPERVISOR:** LUCA BRAGA

**RESEARCH LOCATION:** INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY; TRIESTE, ITALY

**DISCERNING THE EFFECT OF RIBOFLAVIN, PROGLUMIDE, AMINOSALICYLIC ACID, AND GABAPENTIN ON THE SENSITIVITY OF PLEURAL MESOTHELIOMA CELLS TO CISPLATIN TREATMENT**

Pleural Mesothelioma is an aggressive type of cancer that particularly debilitates the lungs due to asbestos exposure. Its poor response to chemotherapy contributes to an extremely low five-year survival rate, just shy of 10%. Today, the most common and effective chemotherapy drug for the treatment of pleural mesothelioma is Cisplatin; however, it remains subpar in terms of improving response rates while keeping the side effects at a minimum.

Combinatorial treatment involving cisplatin and other drugs has shown promise in improving the response rates of patients with pleural mesothelioma. Accordingly, we conducted a thorough literature review of current FDA-approved drugs that have been successfully used in combination with other forms of chemotherapy. We then used high-throughput screening to test hundreds of drugs on primary mesothelioma cell lines and narrowed the selection down to four drugs – riboflavin, Proglumide, aminosalicic acid, and Gabapentin – based on their interaction with the cells.

I was responsible for determining the IC50, the optimal dose of Cisplatin needed to reduce the viability of mesothelioma cells by 50%. I then worked on discerning the combinatorial effect of Cisplatin, at its IC50, and the four drugs, at different concentrations (20 μL, 10 μL, 5 μL, 2.5 μL, 1.25 μL, 0.625 μL), on primary cells.

To determine the drugs that succeeded in sensitizing the cells to Cisplatin treatment, I tested and analyzed the expression of different markers involved in cancer stemness, chemotherapy resistance, and senescence. Our results indicate the success of riboflavin in improving the efficiency of Cisplatin treatment across several mesothelioma patients.

Using results obtained from whole genome sequencing, I performed bioinformatics analysis and protein modeling to characterize the mutations found in different patients and their impact on physiological responses to drug treatment. Mutations in CYP2D6 were found to be the most powerful in altering responses to different drugs. As our next step, we aim to test the efficiency of the aforementioned drugs, in combination with Cisplatin.

*I was able to take what I learned at NYUAD and apply it in hands-on research. It's been great being in a place that fosters learning and promotes collaborative research.*



**MORENIKEJI ADEDAYO**

**MAJOR:** BIOLOGY

**FACULTY SUPERVISOR:** DHIRAJ KUMAR

**RESEARCH LOCATION:** INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY; NEW DELHI, INDIA

**HOST-PATHOGEN INTERACTIONS OF PATHOGENIC MYCOBACTERIUM TUBERCULOSIS (MTB)**

Two different Mtb genes (Rv0288 and Rv3849), were selected based on in-silico studies done previously in the lab, for cloning and expression in prokaryotic and eukaryotic expression vectors pNiT3xHA and pBiFCVN173 respectively. I designed convergent primers for each gene and protocols for each reaction step. The plasmid DNA of confirmed pNiT constructs were electroporated into competent Mycobacterium smegmatis cells and placed under different induction conditions. These samples were processed downstream to separate each sample into secretory and cytoplasmic protein fractions. For the confirmed pBiFC constructs, the plasmids were transfected into HEK-293T cells via various chemical methods and the protein content and expression yielded from each method was analyzed.

Using the supernatant and pellet protein isolates of M. smegmatis cells containing various Mtb genes, I performed several SDS-PAGE, western blots, and agarose gel analyses to confirm the presence of these genes in the supernatant and pellet protein isolates.

The findings from this project will serve as proof of concept that certain Mtb genes are secreted into the host environment. In addition, the protocols and primers that I designed will be used to successfully clone other Mtb genes into bacteria and mammalian expression systems.

*I refined my wet lab skills and enhanced the knowledge and work ethic gained from my Foundations of Science lab sessions. I also met amazing research scientists and mentors who I intend to keep in contact with. Being able to live and work with several Ph.D. students was also a great insight into the grad school lifestyle, a path I intend to pursue in the future.*



**TOMIRIS DOSKHOZHINA**

**MAJOR:** BIOLOGY

**FACULTY SUPERVISORS:** SERENA ZACCHIGNA AND GIULIO CIUCCI

**RESEARCH LOCATION:** INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY; TRIESTE, ITALY

**INVESTIGATING THE EFFECT OF TUNABLE MECHANICAL LOADING ON THE PROLIFERATION OF CANCER CELLS IN ENGINEERED HEART TISSUE (EHT)**

I worked on a project related to cancer biology and tissue engineering. Employing neonatal cardiomyocytes, I engineered cardiac tissue as an in-vitro model with spontaneous contractile capabilities. Within the context of tissue casting, I introduced lung carcinoma, melanoma, and colorectal cancer cells into this construct, aiming to gain insights into their growth dynamics.

To modulate mechanical loading within the tissue, I utilized metal braces inserted into silicon posts, thus augmenting mechanical strain, and alternatively, I eliminated calcium from the medium to reduce mechanical loading. Additionally, I performed siRNA transfection on cancer cells to downregulate the nesprin protein, subsequently investigating its impact on their responsiveness to mechanical loading.

Preliminary findings indicated that melanoma cells exhibited the highest proliferative capacity within the cardiac tissue, aligning with their known metastatic potential. Further experiments are needed to establish comparative trends with other types of cancer cells.

*This experience enhanced my laboratory proficiency and fostered a scientific mindset, emphasizing meticulous experiment planning in line with existing literature. I want to further explore the influence of physical forces on disease development during my Capstone project and graduate studies.*



Preparing medium for cells in a biosafety hood.



ICGEB at Trieste, Italy.



**RAHUL SHRESTHA**

**MAJOR:** BIOLOGY

**FACULTY SUPERVISOR:** LAWRENCE BANKS

**RESEARCH LOCATION:** INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY; TRIESTE, ITALY

**INVESTIGATING THE LINK BETWEEN CD109 AND HPVE7**

HPV is one of the major causative agents of cervical cancer, which accounts for 500,000 new cases of cancer and over 250,000 cancer deaths per year. As the virus transmission rate continues to grow, containing it and finding recovery modules is a current public health priority. Preliminary evidence has established that the development of HPV-induced malignancies requires the activity of two viral oncoproteins, E6 and E7. Research has shown that E6 and E7 are ideal potential targets for therapeutic research in HPV-induced cancer.

My work involved investigating the association of HPVE7 and membrane proteins. My project focused on the link between CD109 (a membrane protein) and HPVE7. I used different cell lines such as HeLa, SiHa, CaSki, HaCat, and Hek 293 to modulate the experiments. I acquired several experimental techniques such as Western Blot, DNA proliferation, Transfection, SiRNA, Cell seeding, PCR, and Genomic DNA extraction.

*I am incredibly grateful to have been a part of this esteemed lab and to have had such dedicated lab members. This experience has not only piqued my interest in Molecular Biology but also nurtured my decision to pursue a Ph.D. program upon graduation.*



Rahul with the lab members of Tumor Virology Lab, ICGEB Trieste.



**SAFEEYA AL AWADHI**

**MAJOR:** BIOLOGY

**FACULTY SUPERVISOR:** EMANUELE BURATTI

**RESEARCH LOCATION:** INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY; TRIESTE, ITALY

**THE INVESTIGATION OF RNA BINDING PROTEINS/STRUCTURE AND THEIR INFLUENCE ON TRANSLATION AND ALTERNATIVE SPLICING PROCESSES**

The aim of this research was to advance our knowledge of the pathophysiology of neurodegenerative diseases and the role of RNA binding proteins in these diseases. The objective of this study was to investigate the role of RNA binding proteins in the regulation of translation and alternative splicing processes and their potential impact on neurodegenerative diseases. The main focus of the research project was to determine the expression levels of RNA binding proteins and their impact on translation and alternative splicing processes in different sample types. The results of the study were used to shed light on the pathophysiology of neurodegenerative diseases and contribute to our understanding of the potential role of RNA binding proteins in these diseases.



**CONFIDENCE EZEMBA**

**MAJOR:** BIOLOGY

**FACULTY SUPERVISOR:** GIANNINO DEL SAL

**RESEARCH LOCATION:** INTERNATIONAL CENTRE FOR GENETIC ENGINEERING AND BIOTECHNOLOGY; TRIESTE, ITALY

**CANCER CELL SIGNALLING**

Tumors are dynamic environments that undergo evolutionary changes, including genetic and epigenetic alterations in cancer cells and interactions with the tumor microenvironment (TME). These interactions are crucial for promoting tumor growth and the spread of cancer cells to other parts of the body. The communication between cancer cells and TME involves both physical factors such as extracellular matrix stiffness, and biochemical cues that affect various levels of cellular function, including metabolism, gene expression, and epigenetics. These cues influence key signaling pathways that determine cell fate and response to therapy. By understanding how the tumour microenvironment work and evolve, resistance to chemotherapy can be further understood and more effective treatment methods for cancer can be developed.





**MILUTIN MILOJKOVIĆ**

**MAJOR:** BIOENGINEERING

**FACULTY SUPERVISOR:** SIMONETTA DI PIPPO

**RESEARCH LOCATION:** SPACE ECONOMY EVOLUTIO LAB, SDA BOCCONI SCHOOL OF MANAGEMENT; MILAN, ITALY

**SPACE ECONOMY EVOLUTION LABORATORY:  
“SPACE FOR EARTH” AND “SPACE FOR SPACE”**

The project aimed to diffuse the space economy phenomenon in the academic journals of space, economics, business, and policy. The objective involved extensive research and an analysis of multiple underlying theories, culminating in the production of scholarly works that contribute significantly to the current body of knowledge. Secondly, the project sought to develop innovations and produce scientific papers that address topics of increasing importance for humanity. These topics have the potential to significantly impact space travel and the economy, as well as the future of humans beyond Earth. By exploring these crucial issues, the project aimed to provide invaluable insights that will contribute to the betterment of society as a whole. The results of this scientific research will be presented at various professional conferences and workshops. The project will be presented will be at the 74th International Astronautical Congress in Baku. Such engagements enable the dissemination of the project’s findings and ideas to a broader audience, facilitating meaningful discussion and debate on the future of space exploration and the space economy.

*My internship at SDA Bocconi was an enriching experience that allowed me to delve into the realm of multidisciplinary research at the highest academic level. Engaging in projects such as SEEData and contributing to scientific papers on Commercial Space Stations and Space Debris afforded me the opportunity to be an active participant during the complete research article creation process. Furthermore, my time in Milan provided a conducive environment for independent research, enabling me to cultivate a diverse perspective and confidently approach intricate challenges encountered in advanced research endeavors.*



**PHUC NGUYEN AND SNEHEEL SARANGI**

**MAJOR:** COMPUTER SCIENCE

**FACULTY SUPERVISOR:** CHEN FENG

**RESEARCH LOCATION:** NYU TANDON SCHOOL OF ENGINEERING; NEW YORK, USA.

**VIDEO VPR VS. IMAGE VPR**

We have undertaken the design, implementation, and thorough evaluation of innovative algorithms within the realm of Visual Place Recognition, with a specific focus on addressing the challenge of Image and Video Retrieval for identical locations. Drawing inspiration from cutting-edge techniques like Convolutional Neural Networks, NetVLAD, SeqNet, and SeqMatchNet, we have crafted and rigorously tested a series of novel algorithms.

The prime objective of these algorithms is to enhance the precision and efficiency of Visual Place Recognition, facilitating the accurate retrieval of images and videos pertaining to specific locales. Leveraging the insights and methodologies of prominent state-of-the-art approaches, we have meticulously engineered these algorithms to overcome the intricate challenges associated with recognizing and retrieving location-specific visual data.

Through a meticulous process of development and experimentation, we have assessed the performance of each algorithm against stringent benchmarks, aiming to ascertain their efficacy in real-world scenarios. This research contributes not only to the field of Visual Place Recognition but also aligns with the broader landscape of AI-driven image and video-retrieval applications. Ultimately, this work advances the state of the art by presenting novel solutions grounded in the fusion of established methodologies and innovative algorithmic design.



**PAVLY HALIM**

**MAJOR:** COMPUTER SCIENCE

**FACULTY SUPERVISOR:** JUNTAO CHEN

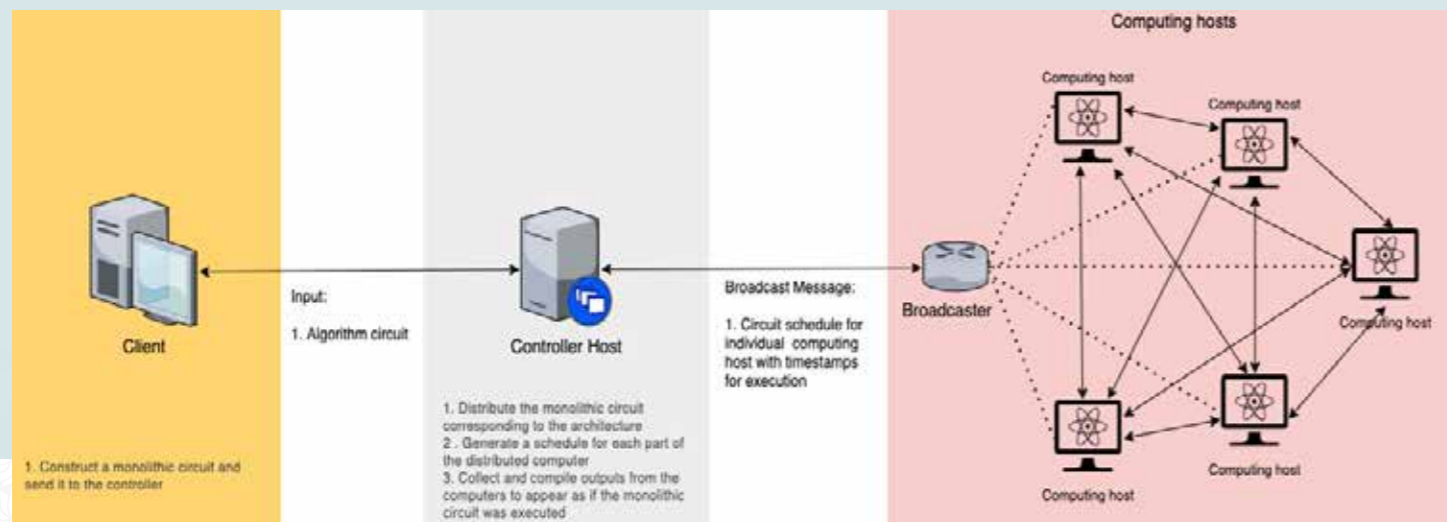
**RESEARCH LOCATION:** FORDHAM UNIVERSITY, NEW YORK, USA

**EXPLORING DISTRIBUTED QUANTUM SYSTEMS AND QUANTUM AI: AN APPLICATION OF THE INTERLIN-Q SIMULATOR**

I explored distributed quantum computing and the innovative capabilities of the Interlin-q simulator. This tool distinguishes itself by its adeptness in simulating the master-slave centralized-control dynamic, thus facilitating the real-time execution of quantum algorithms in a distributed framework. The crux revolves around understanding the process through which Interlin-q transposes conventional monolithic circuits to multifaceted distributed architectures, aiming to discern its broader ramifications for the Quantum Machine Learning sector.

My research trajectory was defined by a series of probing questions, which predominantly focus on evaluating the operational efficiency of the master-slave centralized-control paradigm and extrapolating the inherent advantages afforded by Interlin-q's real-time visualization capacities. An intensive summer immersion in Quantum Neural Networks and Quantum Algorithms has given me a foundational vantage point, illuminating the transformative potentialities latent within distributed quantum computing in monolithic versus distributed configurations.

*Exploring the quantum landscape this summer felt like navigating the subway system of New York City—complex, interconnected, and full of endless possibilities. Each algorithm cracked was a new stop discovered.*



Simulated Architecture for Distributed Quantum Computing & Network Control: DiAdamo, S., Ghibaudi, M., & Cruise, J. (2021). Distributed Quantum Computing and Network Control for Accelerated VQE. ArXiv. <https://doi.org/10.1109/TQE.2021.3057908>.



**SOYUJ BASNET**

**MAJOR:** COMPUTER SCIENCE

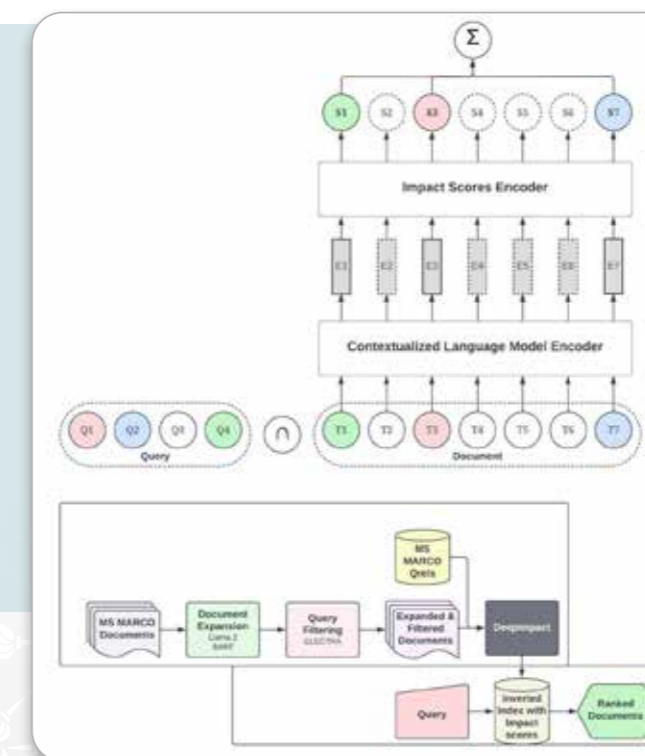
**FACULTY SUPERVISOR:** TORSTEN SUEL

**RESEARCH LOCATION:** NYU TANDON SCHOOL OF ENGINEERING; NEW YORK, USA

**IMPROVING LEARNED INDEX STRUCTURES**

Traditional search engines have relied heavily on complex textual matching algorithms and frequency-based ranking functions like BM25 for information retrieval. Even though they are computationally efficient, they suffer from the vocabulary mismatch problem where semantically relevant user queries do not syntactically match the keywords indexed for the documents. With the advent of transformers, search engines have started using large language models like BERT to leverage the context of the queries rather than relying solely on syntactic matching. Although this significantly boosts the accuracy of search results, it comes with a high computational cost. One approach to balance the accuracy and efficiency at the initial stages of reranking is to use neural networks to automatically derive better inverted index structures that approximate transformer-based ranking.

Our research project built upon DeepImpact (by Mallia et al.), which learns relevance scores for terms in a document by maximizing score difference between relevant and non-relevant passages for given queries. To solve a vocabulary mismatch, DeepImpact utilizes an expansion model trained to predict relevant queries for a given passage. In addition, we used a newer approach that filters out non-relevant predicted queries as autoregressive LLMs are prone to hallucination. We also fine-tuned the more recent LLaMa 2 model for expansion instead of using T5. Our results showed improvements in Mean Reciprocal Ratio (MRR@10) although Recall remained the same. Furthermore, we explored a novel approach of analyzing the attention layers of the transformer to identify meaningful token pairs and derive index structures for pairwise terms.



Architecture of the DeepImpact model.



**DANISH KHAN**

**MAJOR:** PHYSICS

**FACULTY SUPERVISOR:** ADRIANO DI GIOVANNI

**RESEARCH LOCATION:** GRAN SASSO SCIENCE INSTITUTE; L'AQUILA, ITALY

**TEST AND COMMISSIONING OF THE PROTOTYPE OF THE ZIRE PAYLOAD OF THE NUSES SPACE MISSION**

NUSES is a new space mission that aimed to test innovative observational and technological approaches related to the study of low-energy cosmic and gamma rays, high-energy astrophysical neutrinos, Sun-Earth environment, space weather and magnetosphere-ionosphere-lithosphere coupling (MILC). The satellite hosted two payloads, named Terzina and Zire . Zire performed measurements of electrons, protons and light nuclei from a few up to hundreds of maximum extractable value (MeV), also tested new tools for the detection of cosmic MeV photons and monitoring of MILC signals. TERZINA observed the Cherenkov Light produced by EAS generated by cosmic ray primaries at very high energies, and monitored the light emissions from the Earth limb in the near UV and visible ranges at the ns time scale, thus testing the observational concept of detecting Earth-skimming astrophysical high energy neutrinos. The main objectives of my project were to calibrate and test the Silicon Photomultipliers used in the prototype, test the representative chain of electronics, and optimize the prototype configuration for the October test beam at CERN SPS.



**GABRIEL VERLEY**

**MAJOR:** MATHEMATICS

**FACULTY SUPERVISOR:** JEFFREY MARTINEZ

**RESEARCH LOCATION:** ANDERSEN AIR FORCE BASE; YIGO, GUAM, USA

**36<sup>TH</sup> MEDICAL GROUP SHADOW PROGRAM**

The primary objective of this research opportunity was to gain a comprehensive understanding of the field of medicine, with a specific emphasis on military medicine. The study focused particularly on military healthcare and its adaptations in situations with limited resources. A thorough analysis of existing practices, protocols, and the current state of military medicine was conducted.

This encompassed observing interactions between healthcare providers and patients, acquiring examination techniques, receiving training on diagnostic decision-making, and understanding outpatient procedures and treatment planning. Additionally, the research delved into the nuanced aspects of military practices, exploring how individuals without formal medical training can contribute in the event of medical disasters.



**SAMYAM LAMICHHANE**

**MAJOR:** COMPUTER SCIENCE

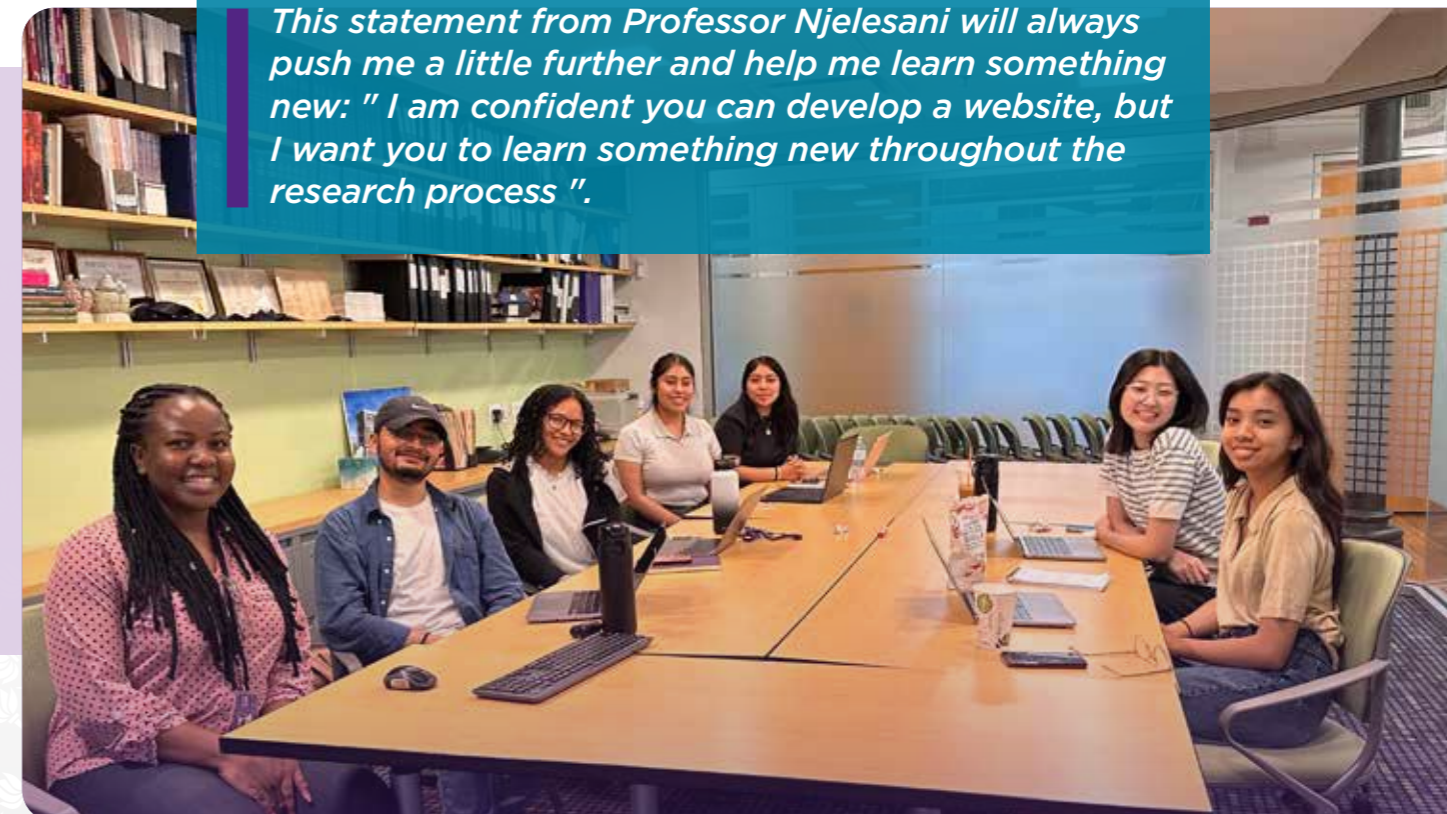
**FACULTY SUPERVISOR:** JANET NJELESANI

**RESEARCH LOCATION:** NYU STEINHARDT; NEW YORK, USA

**GLOBAL DISABILITY-BASED VIOLENCE KNOWLEDGE MOBILIZATION, YCARE MODULE INTERVENTION**

Throughout the research duration, I primarily worked on the web development project. My roles involved designing a website from scratch with a particular focus on accessibility. With the help of Dr. Njelesani, I was able to meet Fatma Al Jassim, a disability advocate and the first Emirati to become internationally certified in the field of Professional Accessibility, with her suggestions, I integrated different accessibility features and developed a website that is accessible for people with disabilities. I used the Bootstrap framework for front-end development, and using the findings from previous research projects on website development, I was able to increase the accessibility to 86%, while also maintaining scores of 92% and 100% for 'Best Practice' and 'Search Engine Optimization' respectively.

My research experience consisted of conducting interviews to collect demographic data, intervention characteristics, inner and outer settings and self-efficacy data from healthcare professionals for the YCare module. I briefly contributed to the creation of a codebook for data analysis, performed an initial thematic analysis on the interview transcripts and participated in graphics designing for different projects. I assisted in the said responsibilities, and I look forward to participating in further web development roles in the future.



*This statement from Professor Njelesani will always push me a little further and help me learn something new: " I am confident you can develop a website, but I want you to learn something new throughout the research process ".*

Samyam and the summer research team.



**BIANCA MANDAPAT**

**MAJOR:** SOCIAL RESEARCH AND PUBLIC POLICY

**FACULTY SUPERVISOR:** JANET NJELESANI

**RESEARCH LOCATION:** NYU STEINHARDT; NEW YORK, USA

**ADAPTING AN INTERVENTION TO SUPPORT YOUNG CAREGIVERS OF CANCER SURVIVORS**

Over the summer, my main focus was leading the interview component for Dr. Njelesani’s study on how health providers can best support the young caregivers of cancer survivors. While children of cancer patients provide various forms of care to their ill loved ones, they remain one of the least supported caregiving groups. Thus, the project aimed to understand the ways professionals in cancer care are currently providing assistance to young carers and how such can be improved.

My role involved creating interview guides, recruiting participants, and conducting interviews with various allied health professionals, ranging from speech-language pathologists to physical therapists to hospital social workers. We also began the initial coding and analysis of the gathered data. In collaboration with the research team at the University of Washington in St. Louis, the interview findings will be put towards adapting an intervention specific to the cancer context based on the pre-existing YCare program, a multidisciplinary intervention that is used to support caregivers in the neurological disease setting. Similar to YCare, the project hopes to provide skills training and support networks tailored to fit a younger demographic of carers.



**MANE HARUTYUNYAN**

**MAJOR:** ECONOMICS

**FACULTY SUPERVISORS:** PETER BEARMAN AND AMY WEISSENBACH

**RESEARCH LOCATION:** COLUMBIA UNIVERSITY; NEW YORK, USA

**BUFFETTS’ LETTERS PROJECT**

I worked on a project that aimed to create and analyze a database from about 10,000 handwritten and typed letters written to Warren Buffett and his sister, Doris. The letters represent real-life narratives and personal stories that ask for financial, medical, or educational assistance and provide a fascinating source for understanding American poverty and the inefficiencies of the fragile welfare state in its inability to cover people’s basic needs. As the archive was built on letters written between 2006 and 2016, the database could be used to understand how the Global Financial crisis affected the way people narrate stories and talk about hardships and whether increased healthcare support by the state, such as the Affordable Care Act, affected people’s need for financial assistance from non-governmental sources and charitable institutions.

As part of the team, I worked on cleaning and organizing the textual and printed data, created a timeline of Warren and Doris Buffetts’ media news appearances, and analyzed the specific news triggers that might have incentivized people to write to the Buffetts. This work aimed to contribute towards understanding how people’s narrative is being structured, if there is a specific prompt that they are responding to, and how the financial crisis affects this.



*More than the knowledge acquired and the skills developed through this project, I gained a new appreciation for qualitative research in its quest to highlight lived experiences and individual stories. While significance is often measured in numbers and statistics, I have learned that whether it is one or ninety-nine, it still counts.*

[NYU's Department of Occupational Therapy.](#)

*As this was my first formal experience in academic research, I gained valuable insights about the life of a typical academic researcher. For instance, as a researcher, the pathway towards getting an outcome is not exactly linear and I should be open to exploration and a diverse way of interpretation with the material. As the work involves mental pressure and constant interaction with complex ideas, I learned to recognize and value the necessity of taking short breaks to recharge and maintain stable mental and physical health since this can be the basis for success.*



[Mane at the research center.](#)



**AHMAD KIYANI**

**MAJOR:** POLITICAL SCIENCE

**FACULTY SUPERVISOR:** GIULIANA PARDELLI

**EFFECT OF TOURISM ON FEMALE FINANCIAL EMANCIPATION IN NORTHERN PAKISTAN**

This social science research was a crucial component in crafting my Capstone proposal. I set out to work for one and a half months in the remote mountainous region of Gilgit Baltistan in Northern Pakistan, surveying 13 different localities. I worked with two local translators/coordinators who helped me navigate the local region and culture. Speaking in Urdu, English, Shina, Balti and Bushaski, between the 3 of us we managed to reach our target sample size of 400 responses from the Hunza-Nagar region.

We aimed to observe the different factors at play that led females in the region to have some of the highest indicators of emancipation, which include financial emancipation and political emancipation among others. We wanted to examine whether tourists flocking to the region for mountaineering, paragliding, skiing or cultural expeditions affected the local female population and encouraged them to start their own businesses. We wanted to find out whether the China-Pakistan Economic Corridor and its significant infrastructure projects also played a role in the emancipation of local women. Our findings suggested that tourism has indeed had a positive impact on key indicators of emancipation in the region.

*I will be using the data gathered from this survey in my Capstone thesis and intend to publish it in the future. This was one of the most "life-altering" experiences I have ever embarked on. Along with the challenges we faced, it was wonderful to learn about new cultures and traditions, and let go of stereotypes I might have unintentionally held. I got to learn how to be a team leader and coordinator, and managed to work with a variety of individuals from policemen to motorists. Learning to deal with people from all walks of life is crucial for social research of any kind. The kind of empathy this sort of research instills in you is truly remarkable.*



Survey activities in Gulmit, Hunza-Nagar.



Project Translator/Surveyor and Coordinator.



"Chacha" our transporter from the research project.



The Survey Team (left to right): Ahmad Kiyani, Tamami Kaneko, Ishrat Karim, Didar Shah.

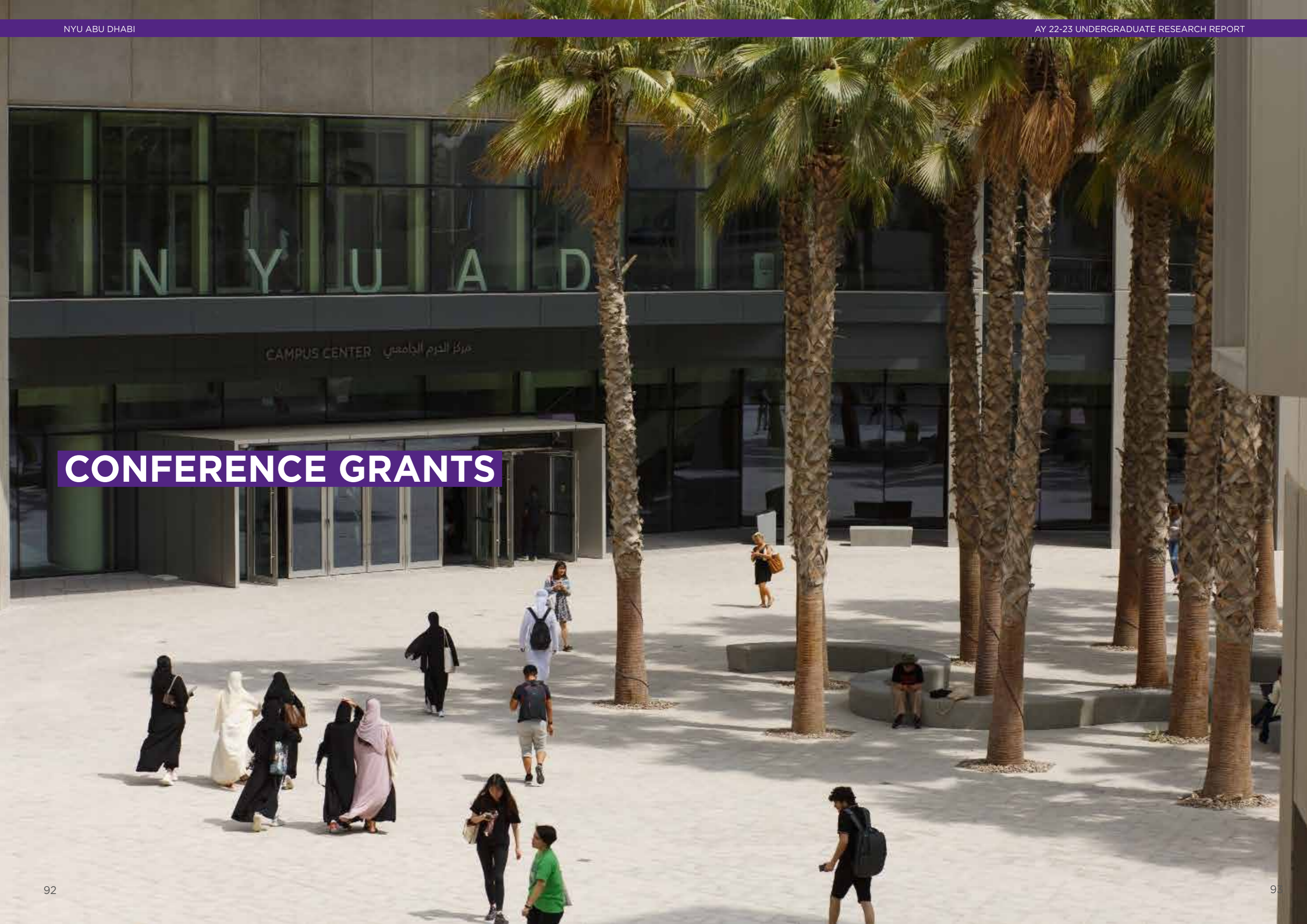


Attabad Lake, Hunza-Negar.



Surveying in Gojal.

# CONFERENCE GRANTS





**SEKOU JABATEH**

**MAJOR:** POLITICAL SCIENCE

**FACULTY SUPERVISOR:** JOAN BARCELO SOLER

**CONFERENCE NAME:** THE AMERICAN POLITICAL SCIENCE ASSOCIATION'S (APSA) 2022 ANNUAL MEETING AND EXHIBITION

**BUILDING COOPERATION ACROSS ETHNIC GROUPS WITH INTERPERSONAL MONETARY TRANSFERS: A FIELD EXPERIMENT IN POST-WAR LIBERIA**

The erosion of relationships between ethnic groups in war-torn societies carries significant repercussions, escalating from simple outgroup avoidance to outright physical violence. There is an urgent need for policies addressing these dynamics. We introduced an innovative approach based on the principle of positive reciprocity as a crucial foundation for intergroup cooperation. We argue that ethnic conflicts diminish mutual trust, heightening suspicions and amplifying prejudice and discrimination. We hypothesized that targeting individuals' perceptions about the cooperative tendencies of outgroup members can rebuild trust in postwar settings.

To validate this, we piloted a field experimental intervention in post-conflict Liberia, employing interpersonal monetary transfers between individuals of different ethnicities. Before the intervention, participants displayed strong prejudice against outgroup members. Participants initially exhibited significant prejudice against outgroup members. Once informed of their donor's ethnicity, those funded by non-coethnic donors showed notably less prejudice than their counterparts backed by coethnic donors, an impact observed even a year later.

Preliminary results from the dictator game similarly revealed the treatment group's more equitable fund distribution. Importantly, the treatment group also expected reduced prejudice and more balanced fund allocation from outgroup members, underscoring the importance of expected reciprocity in shaping interethnic relations. These findings underscore the potential of interpersonal transfers in bridging ethnic divides, pointing towards a promising avenue for post-conflict reconciliation efforts..



Sekou presenting at APSA.



**NGOC HOANG**

**MAJOR:** COMPUTER SCIENCE

**FACULTY SUPERVISOR:** DJELLEL DIFALLAH

**CONFERENCE NAME:** 2022 IEEE MIT UNDERGRADUATE RESEARCH TECHNOLOGY CONFERENCE

**A VIETNAMESE NAMED-ENTITY RECOGNITION SYSTEM FOR COVID-19 ARTICLES**

The research project proposed a named-entity recognition system for the specific domain of Vietnamese COVID-19 news articles. By incorporating manually-selected and domain-specific features into a simple deep learning architecture, the system can identify a wide range of custom-named entities relevant in the context of COVID-19 and future epidemics. Using high dimensional embedding vectors in combination with part-of-speech tags and additional features, the system achieves an F score of about 90.41%, surpassing or coming close to that of other models that are more complicated or pre-trained and fine-tuned.



The virtual presentation delivered in the Machine Learning/Artificial Intelligence track at the conference.



**DIMITRIOS MASTROGIANNIS**

**MAJOR:** ELECTRICAL ENGINEERING

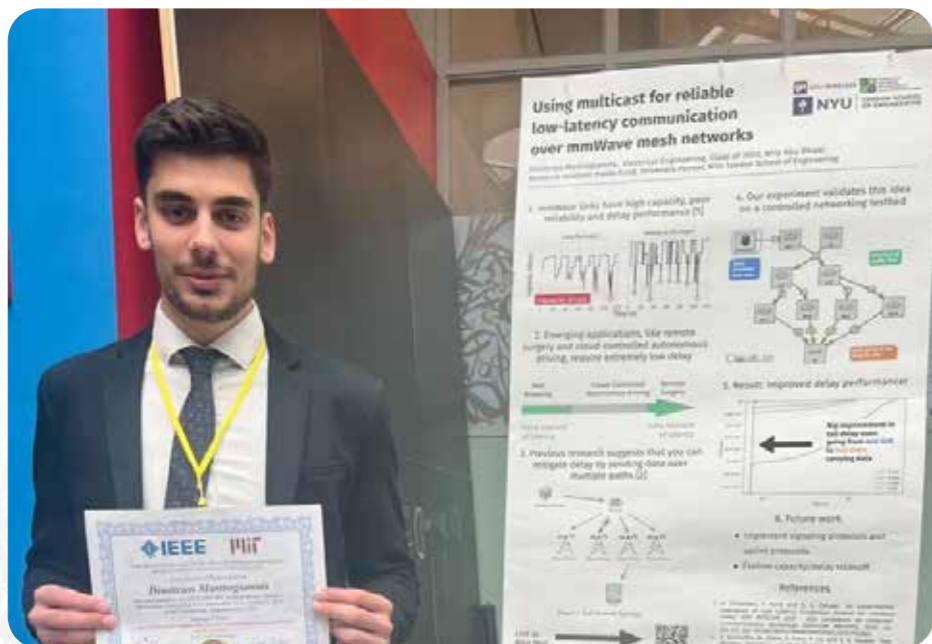
**FACULTY SUPERVISOR:** ANTHONY TZES

**CONFERENCE NAME:** 2022 IEEE MIT UNDERGRADUATE RESEARCH TECHNOLOGY CONFERENCE

**USING MULTICAST FOR RELIABLE LOW-LATENCY COMMUNICATION OVER MMWAVE MESH NETWORKS**

Redundancy - sending multiple copies of data across different network paths - has the potential to mitigate poor reliability and delay performance in mesh networks. However, this has not been fully explored because mesh networks were traditionally subject to tight capacity constraints that made redundant transmissions less practical. With the recent availability of mmWave links that have very high capacity but poor reliability, the potential of this approach should be revisited. If high-capacity mmWave links can deliver improved reliability and delay performance, this can enable new applications like remote surgery and cloud-controlled autonomous driving. To address this, we developed a protocol for one-to-one data delivery with redundancy using multicast protocols, and evaluated it in a testbed environment that is representative of a mmWave mesh network. The results of this research will inform further protocol design and development for reliable low-latency communication over mmWave links.

*As I reflect on my time at the conference, I am filled with a sense of gratitude and accomplishment. It was truly a privilege to be a part of this prestigious event, where I had the opportunity to network with top professors and researchers, as well as showcase my own research in front of a knowledgeable audience. The chance to exchange ideas, share perspectives, and learn about the latest developments in the industry was truly invaluable.*



Dimitrios presents his poster at the 2022 IEEE MIT Undergraduate Research Technology Conference.



**DAVIT JINTCHARADZE**

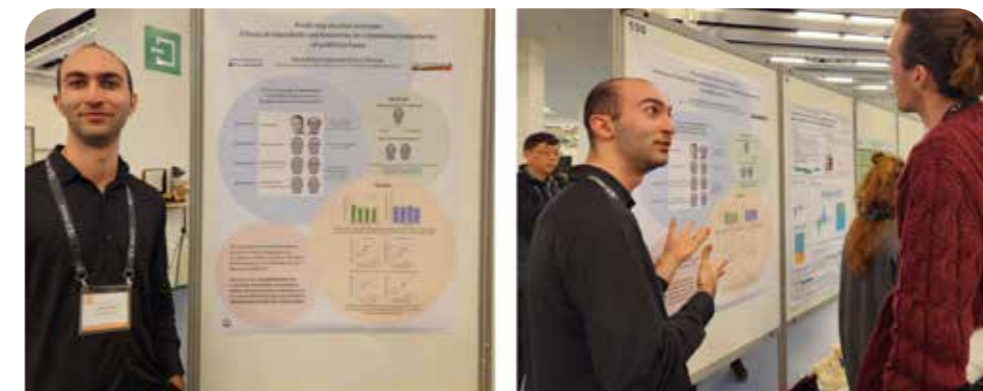
**MAJOR:** PSYCHOLOGY

**FACULTY SUPERVISOR:** OLIVIA CHEUNG

**CONFERENCE NAME:** INTERNATIONAL CONVENTION OF PSYCHOLOGICAL SCIENCE

**EFFECTS OF MASCULINITY VS. FEMININITY ON COMPETENCE JUDGEMENT OF POLITICIAN FACES AND ELECTION OUTCOME PREDICTION**

The goal of this study was to directly investigate the role of political candidates' facial features on perceived competence and election outcome prediction, specifically by the direct manipulation of facial features applied to real-world politicians' faces. Using images of the opposing candidates in real-world elections, we used the original photographs of the candidates, which included additional facial or non-facial features, and images of the politicians with only facial features extracted. More importantly, we manipulated the facial features by increasing either masculinity or femininity. By isolating and manipulating the facial features, this study provided direct evidence that facial features alone were used by observers to interpret other individuals' personality traits or leadership ability. These findings are critical in constructing hypotheses on how different types of visual and non-visual information may be utilized for choosing leaders.



Davit presents his poster at the International Convention of Psychological Conference in Brussels, Belgium.





**SUDIT SAHOO**

**MAJOR:** ARAB CROSSROADS STUDIES

**FACULTY SUPERVISOR:** JUSTIN STEARNS

**CONFERENCE NAME:** MIDDLE EAST STUDIES ASSOCIATION UNDERGRADUATE RESEARCH WORKSHOP

**ETHNOGRAPHY PROJECT ON MAPPILA MUSLIMS OF KERALA, INDIA**

My project explored the Mappila muslim community’s historical origins by looking beyond national and imperialist imagination to fully encapsulate their dual Arab-Malayali attributes. I argued that Mappila identity is based on their transoceanic roots, maintained through myths, genealogy, migration, remnants of historical maritime trade, movies, social media platforms and cultural elements including language, oral history, and folk music. My project underscored how this historically cosmopolitan group, across generations and on both sides of the Arabian Sea, engages with its identity and how the emergence of post-colonial nation-states and external migration affects it. Through interviews, my project underlined the complex realities of identity formation of a community with transoceanic roots in constant flux.



**BRIAN CHESNEY QUARTEY**

**MAJOR:** BIOENGINEERING

**FACULTY SUPERVISOR:** JEREMY TEO

**CONFERENCE NAME:** 18<sup>TH</sup> INTERNATIONAL SYMPOSIUM ON COMPUTER METHODS IN BIOMECHANICS AND BIOMEDICAL ENGINEERING

**AUTOMATED LABEL-FREE CELL PHENOTYPING FOR THE DYNAMIC STUDY OF IMMUNE CANCER CELL INTERACTIONS**

Tumor microenvironment comprises a mass of heterogeneous cell types including immune cells along with cancer cells, and live imaging is essential to studying and understanding the interactions of these different cell types. Hence, an automated framework to distinguish the various cell types is necessary. Using fluorescent imaging to identify cells poses unique challenges, as dyes have been shown to be potentially cytotoxic, limiting long-term study of cells. In this project, we utilized Detectron2, a next-generation object detection and instance segmentation library, to develop a computational framework for studying dynamic interactions of immune-cancer cells using bright-field live imaging. The workflow for automated dataset generation, allowed us to overcome the challenge of generating large quantity and quality training datasets for our image segmentation model. Overall, this computational framework eliminates the tedious processes and challenges that come with cell staining, allowing for long-term and real-time study of immune-cancer cell interactions.



**JOSEPH HONG**

**MAJOR:** COMPUTER SCIENCE

**FACULTY SUPERVISORS:** YASIR ZAKI AND MICHAEL ANG

**CONFERENCE NAME:** ARS ELECTRONICA’S CAMPUS EXHIBITION

**THE OASIS**

The Oasis is a set of mechanical lotus flowers that interact with light in order to challenge the presumption of a lifeless, barren desert. The flowers are designed to be static artworks, buried in the crests of sand dunes. As the sun descends below the horizon, the flowers come to life, blooming as they cast a soft light onto the sand below and transforming the space around them. Even in a place as seemingly desolate as the desert, there is still life though it “blooms” to life at night, when the temperature is more suitable for movement. This installation represents that life, and the blue hue it casts upon the sand (the “oasis”) is an ode to the lakes that once dotted the deserts of Abu Dhabi.

*It was an amazing experience to have an opportunity to exhibit our project, The Oasis, at Ars Electronica’s Campus Exhibition. I met so many artists, made friends with members of the Founding Lab, and was inspired and encouraged by the installations of the Prix Ars Electronica Exhibition to continue creating at the crossroad between arts and technology. As a Computer Science major, I never thought that I would find myself in such a unique position or that I would enjoy being there. Then I thought maybe, just maybe, I too, could be an artist.*



The Oasis’ at Ars Electronica’s Campus Exhibition.



**WING KWAN HANNAH CHU**

**MAJOR:** PSYCHOLOGY

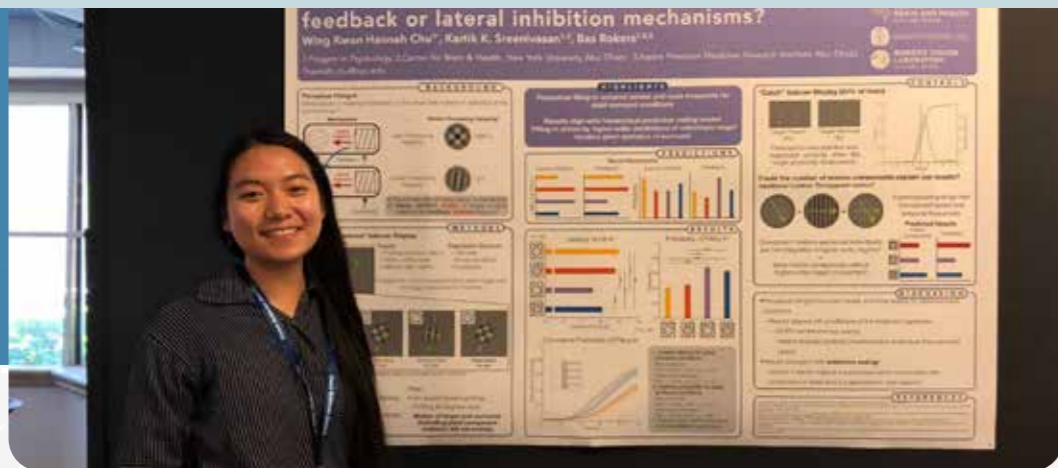
**FACULTY SUPERVISORS:** KARTIK SREENIVASAN AND BAS ROKERS

**CONFERENCE NAME:** VISION SCIENCES SOCIETY

**ARE ARTIFICIAL MOTION SCOTOMAS DRIVEN BY CORTICAL FEEDBACK OR LATERAL INHIBITION MECHANISMS?**

Perceptual filling-in is a common and useful process that occurs when visual information is missing or interpreted as missing. It is important for normal pattern, surface, and motion perception yet, the neural mechanisms that compensate for the missing information remain unclear. Two competing hypotheses may account for filling-in: 1), lateral inhibition in a single cortical region, whereby neighboring cells suppress the local area of missing information or 2), feedback signals from higher-order visual regions override the sensory representation. Current evidence is insufficient to conclusively support either hypothesis. We sought to better understand the mechanism of perceptual filling-in using artificial motion scotomas. Artificial scotomas are experimentally-induced blind spots caused by viewing a peripheral target that is surrounded by full field of texture or structured motion. After a few seconds, the target is suppressed and filled-in with a percept interpolated based on the surround. We leveraged knowledge of the motion processing hierarchy where component (gratings) motion signals are integrated in V1, whereas pattern (plaid) motion signals are integrated in hMT+ to test the time of filling-in onset. Participants reported when the target first filled-in (filling-in latency) in four conditions differing between the type of motion of the target and the surround: Plaid Target-Plaid Surround, Grating Target-Plaid Surround, Plaid Target-Grating Surround and Grating Target-Grating Surround. Under a lateral inhibition hypothesis, we expected shortest latency in conditions where the target and surround motion were the same (e.g., Grating Target-Grating Surround). A feedback mechanism would result in shorter latency for conditions with plaid surrounds. We found that the latency was shortest in plaid surround conditions and longer in grating surround conditions. These results suggests that perceptual filling-in is driven by feedback signals from higher-order visual regions rather than later inhibition, and that generating such percepts involve interactions between multiple visual subregions.

*This experience fuelled my desire to pursue a career in research with hopes to one day contribute to the field and present again at this and other conferences.*



Hannah presents her poster at the Vision Sciences Society 2023 conference in Florida.



**AYSHA HAMKARI**

**MAJOR:** PSYCHOLOGY

**FACULTY SUPERVISORS:** KARTIK SREENIVASAN AND DAVID MELCHER

**CONFERENCE NAME:** VISION SCIENCES SOCIETY

**VWM IMPAIRS VISUAL DETECTION: A FUNCTION OF SHARED ATTENTIONAL OR SENSORY RESOURCES**

The sensory recruitment hypothesis posits that the same cortical areas used for visual perception were also used for maintaining visual working memory (VWM). Support for this idea came from evidence that information stored in VWM can influence perception. To test whether there is competition for sensory processing resources between perception and VWM, we measured the sensitivity of detecting a near-threshold flash during the delay period of an oculomotor delayed response task.

We compared detection performance for participants (N=30) under three conditions: (1) an oculomotor delayed matched-to-sample task, in which participants prepared to make a saccade to a remembered target location, (2) a delayed nonmatched-to-sample task, in which they made a saccade to a new target that was not part of the memory set, and (3) a detection-only condition in which participants ignored the VWM display and only focused on detecting the flash. The visual input was matched across conditions up to the point of the oculomotor response. We found that detection varied significantly between the three conditions. Participants had a significantly lower sensitivity ( $d'$ ) for the non matched condition, when a sensory code was maintained, compared to the matched condition where a motor code was maintained. Highest sensitivity was found when the VWM stimuli were ignored (condition 3). This pattern of results suggested that maintaining a sensory code in VWM influences basic visual processing, potentially due to the recruitment of sensory processing areas in the active maintenance of visual memory representations.



**GITHMI RABEL**

**MAJOR:** ECONOMICS AND SOCIAL RESEARCH AND PUBLIC POLICY

**FACULTY SUPERVISOR:** ANJU MARY PAUL

**CONFERENCE NAME:** CITIZENSHIP AND MIGRATION IN ASIA INTERNATIONAL CONFERENCE

**WHEN CITIZENSHIP IS OFF THE TABLE: THE COMFORTABLE TRANSIENCE OF HIGH-SKILLED INDIAN WOMEN MIGRANTS IN THE UAE**

There is a general understanding in migration studies that high-skilled migrants have the security of permanent settlement and citizenship. While this is true of Western countries, there are many countries in Asia and the Middle East, including the UAE, where citizenship remains an impossibility for high-skilled migrants. My research project explored the differentiated and mixed post-migration mobilities of highly skilled female migrants from India in the UAE. I explored how these women navigate the lack of pathways to citizenship in the UAE. Based on data gathered from 31 highly-skilled female migrants from India, we found that they mostly lived a life of comfort and transience, with many of them wishing to stretch their time in the UAE as much as possible instead of considering onward migration to the West or return migration to India. This research highlights the need to study non-Western migration pathways, since there is an emerging class of migrants from non-Western countries who do not wish to forgo their lifestyle and class benefits in countries such as the UAE in exchange for the security of citizenship or permanent residence in the West.



# RESEARCH FELLOWSHIP PROGRAM



**AARON MARCUS-WILLERS**

**FACULTY SUPERVISORS:** MATTEO MARCIANO AND DAVID WRISLEY

### AN ECO-ACOUSTIC SURVEY OF ABU DHABI

This research project explored the impacts of anthropogenic noise pollution on avian biodiversity in the Abu Dhabi mangroves. Using autonomous sound recorders deployed within the mangroves in varying proximity to newly developed infrastructure, acoustic data was collected over the course of several months. Over the course of the survey, over one thousand hours of recordings were collected and analyzed using bioacoustic analysis software.

Through cross-referencing recorded vocalizations with local ornithologists, over 20 distinct species of resident and migratory birds were identified by their calls. Verified identifications were used to train the software to automatically identify and group vocalizations in each batch of recordings. Additionally, a range of acoustic indices were derived from the collected data to illustrate patterns such as noise pollution levels and diversity of bioacoustic signals in daily and weekly cycles, and more broadly across the months of recording.

Distinct patterns were found in species abundance and diversity, as well as the selected acoustic indices suggesting both physical and acoustic impacts from the new infrastructure on the avian population of the mangroves.

This project was exploratory, testing widely used eco-acoustic methodologies in the largely underrepresented Gulf Region and creating a robust body of acoustic data of the vital and highly diverse mangrove ecosystem.



**RIKO MORISAWA**

**FACULTY SUPERVISORS:** HANNAH BRUECKNER AND FATIAH D. TOURAY

### TRANSFORMATIVE MOMENTS AT NYUAD

This research investigated the transformative moments that undergraduate students and faculty have at their time in NYUAD, focusing especially on moments that made individuals reevaluate their pre-existing beliefs and/or prejudices. The findings of this research reveal that many students and faculty have experienced life-changing transformative moments during their time at NYUAD. From in-class transformations to off-campus during study away, transformative moments do not seem to have a skewed presence in a single space. Instead, they take place where conversations are opened up and difficult discussions are had. These conversations could take place in classrooms, facilitated by professors, in speaker sessions, or in personal relationships.



**HAZEM LASHEN**

**FACULTY SUPERVISOR:** MUHAMMAD SHAFIQUE

### SELF SUPERVISED LEARNING AND DOMAIN ADAPTATION

I worked on several tasks which included conducting a literature review to learn about SOTA methods in self-supervised learning, proposed several modifications to existing self-supervised learning methods, and I ran multiple baseline experiments to compare with concurrent work. With Professor Ozgur's lab, I developed and published a work detailing the use of graph neural networks for trojan detection in integrated circuits. While with Professor Shamout's lab, I developed and successfully submitted a paper on the efficacy of machine learning methods for deterioration prediction in the United Arab Emirates compared to current methods.

The poster features a portrait of Aaron Marcus-Willers and includes the following text:
 

- NYU ABU DHABI logo and CITIES logo.
- CITIES Fellowship Presentation
- PASSIVE ACOUSTIC MONITORING TO ASSESS THE EFFECTS OF URBAN DEVELOPMENT ON ABU DHABI'S AVIAN BIODIVERSITY**
- TUESDAY, MAY 9, 5 PM - 6 PM, NYUAD, A6 - 015
- Aaron Marcus-Willers, CITIES Post-Graduation Research Fellow
- QR code
- Quote: *In the course of this project, I expanded my experiences in field recording, and gained skills in avian identification, conducting long-term field research, and data analysis.*
- Small bio: Aaron Marcus-Willers is a Post-Graduation Research Fellow with the CITIES Center for Interacting Urban Networks. Aaron completed his Bachelor's degree in Music at NYU Abu Dhabi in 2022. Aaron focused on recording and music technology during his undergraduate studies.



**KARNO DASGUPTA**

FACULTY SUPERVISOR: AIKATERINI ARFARA

**BEING IN TIME: AESTHESES OF THE ANTHROPOCENE**

My project was an open-ended research experience at the intersection of art history, performance studies, and literary studies. Using the title as a thematic container, I wrote multiple papers on a range of interrelated subjects, including aesthetics, policy, comparative racialization, and Anthropocene discourse. Aspects of the project involved critical explorations of the IPCC Assessments (1990-2023), habitat shifts caused by climate change, the works of Ursula Le Guin and Jamaica Kincaid, gestures and graphs, and the philosophical potential of tenderness in inter-community solidarity. These papers were presented at a number of conferences, ranging from the American Comparative Literature Association Annual Meeting in Chicago, to the Cornell University EGSO's Conference in Ithaca, to the International Consortium of Critical Theory Programs' Conference in Seoul. Additionally, I wrote a research paper titled "This Flesh of Time: A Phenomenology of Hiroshi Sugimoto's 'Dioramas'", which examined the relationship between photography, movement, and phenomenology, and is currently being revised for submission to journals in my fields of interest.

*The post-graduation Research Fellowship is an unparalleled opportunity for researchers, especially in the Arts and Humanities, to both broaden the scope and deepen the nature of their critical investigations. The fellowship allowed me to work across disciplines, converse with various scholars, spend time refining my written projects, and most importantly: it gave me time to think with the dense, philosophical material that forms the basis of so much humanities research. Using the flexibility of the role, I could focus intensely on studying a set of themes (which I did not have the opportunity to adequately address as a student). The fellowship enabled me to take my papers to prestigious conferences across the world!*



**FANISI MBOZI**

FACULTY SUPERVISOR: JONATHAN ANDREW HARRIS

**WHEN DO VOTERS SEE FRAUD? EVALUATING THE ROLE OF POLL SUPERVISION ON PERCEPTIONS OF INTEGRITY**

Over the course of the year, I developed my Capstone project into a more substantive journal submission which received a review-and-resubmit (RnR). With direction from my advisor, I wrote an RnR response memo and resubmitted my article. The project examined factors shaping voters' evaluations of electoral integrity, focusing on voters' reactions to polling station information. I focused on one aspect of the polling station environment: the observer groups. How does the presence or absence of specific interest groups at a polling station shape voter evaluations of electoral integrity?



**IVANA DRABOVA**

FACULTY SUPERVISOR: JORDAN NORRIS

**SUSTAINABLE CONSUMER PREFERENCE**

Do wealthier consumers buy more sustainable products? I conducted a cross-country analysis of the role of income in shaping sustainable consumer dietary preferences. Using world trade data, I categorized agricultural commodities into groups and assessed them on various sustainability metrics, such as greenhouse gas emissions and water use. I then investigated the relationship between countries' incomes and the environmental impact of the agricultural commodities they consume. Expanding my research beyond agriculture, I further examined the role of income in the green transition across various sectors, including manufacturing and services.



**MARKO BRNOVIC**

**FACULTY SUPERVISOR:** SERDAL KIRMIZIALTIN

**INDUCED ION CORRELATIONS LEAD TO DNA ATTRACTION IN MANGANESE**

I started the project with a question: Why is it that we can experimentally detect DNA condensation in manganese chloride solution, but not in magnesium chloride? Manganese and magnesium ions are very similar: they both have a +2 charge and they are chemically almost indistinguishable. I first simulated a set of parallel DNA in both solutions to check if the molecular dynamics (MD) simulation agrees with experiments. When I plotted the free energy as a function of interspacing distance between the DNA strands, I saw that in the case of manganese, there was a dip at a very small distance, whereas for magnesium it was larger. This meant that in manganese, it is favorable for DNA to be close, whereas for magnesium, the farther the better. Thus we got agreement between experiments and simulation.

I then observed how each of the ions interacts with the environment. I found that hydrated magnesium ions have a stronger hydration shell than that of manganese ions. Moreover, I found that manganese ions can lose water from the hydration shell in favor of binding to the DNA at some specific sites on the phosphate backbone. Since magnesium loses water less frequently, it binds to the large major groove binding sites more often. More manganese ions are able to bind to the negative phosphate backbone, and they locally renormalise the DNA charge and induce attraction to the parallel DNA strand. Magnesium does this more weakly, thus not supporting condensation. This was the answer to the question: the strength of the ion hydration shell can determine the strength of DNA-DNA attraction since losing water means ions can get closer to the DNA, and facilitate condensation. This project studied manganese and magnesium, but it has the potential to be generalized to a theory of divalent cation-induced DNA attraction.



**JAIME ANDRES FERNANDEZ URIBE**

**FACULTY SUPERVISORS:** SARAH PAUL AND MATTHEW SILVERSTEIN

**KNOWING WHAT'S GOOD:  
EXPLORING THE INTERSECTION OF ETHICS AND EPISTEMOLOGY**

My main manuscript proposed that the doxastic wronging thesis has been challenged by several authors in a way that can be generalized to a particular argumentative structure. I adopted the term "upstream debunking argument", and proposed that this argumentative strategy has led us astray. I analyzed one of the many instances in which this argumentative line has been deployed, namely concerning our control over our beliefs. I surveyed theories of moral responsibility and suggested a way in which they can be used to circumvent the corresponding "upstream debunking argument." Aside from that, I have explored and produced content on topics like singular propositions, perspectives, moral encroachment, negligence, the nature of wronging, and microaggressions. I am delighted to have been accepted to Cornell's PhD program in Philosophy!



**TSEDENIA DENEKE**

**FACULTY SUPERVISOR:** AASHISH JHA

**MULTIOMICS REVEALS ORAL MICROBIOME MEDIATED BIOLOGICAL MECHANISMS UNDERLYING OBESITY IN EMIRATIS**

Human microbiomes have been linked to cardiometabolic diseases but the specific contributions of the oral microbiome is markedly underexplored. This scarcity in research is particularly relevant in regions like the Middle East where these diseases are highly prevalent. In my research project, I used blood and urine markers, demographic and health data to determine prevalent medical conditions in 2,716 Emiratis enrolled in the UAE Healthy Future Study (UAEHFS). As a part of a team of researchers in the Genetic Heritage Group at NYU Abu Dhabi, I played a primary role in the extraction, preparation and sequencing of oral mouthwash samples from 669 of these participants. We then employed a multi-omics approach combining 16S analysis, metagenomics and metabolomics to reveal oral microbiome mediated biological mechanisms underlying obesity- the most prevalent disease in the cohort (30.4%). Both 16S rRNA gene sequencing analysis and strain-level metagenomic analysis revealed robust differences between oral microbiome composition of obese and non-obese participants. Furthermore, functional profiling revealed a large repertoire of differentially-enriched metabolic pathways in obesity-associated microbiomes. By further incorporating untargeted metabolomics, we uncovered metabolic alterations and identified metabolic signatures associated with obesity. Our study illuminates an unexplored connection between the composition and function of the oral microbiome and obesity, and lays a foundation for using oral microbiome markers as diagnostic tools for cardiometabolic conditions.



**NOORA SHUAIB**

FACULTY SUPERVISOR: NANCY W. GLEASON

**FACULTY AND STUDENT PERSPECTIVES OF CRITICAL PEDAGOGIES OF CARE IN HIGHER EDUCATION**

The project was a qualitative study of the use of caring and discomforting practices by faculty in the Core Curriculum program at NYUAD. By conducting 40 in-depth interviews with faculty and students and using study away survey answers, I studied both student and faculty perspectives on pedagogies used in the Core. The project began with a thorough literature review, in which I read through papers that focused on or were related to pedagogies of care and discomfort. As the study of pedagogies of discomfort is relatively new, I looked into case studies as well to form my literature review. Following the literature review, I recruited participants for interviews, While students were signing up for interviews, and faculty were responding to invites, I used the software MaxQDA to conduct a textual analysis of two semesters of NYUAD study away survey answers (2,000 answers) to the question: What is the core class that caused you to think most deeply and/or question assumptions or values you held? How did it achieve that? Following the interviews, I cleaned the automated transcriptions generated by the software Otter. I then manually coded all interviews and began the data analysis process in addition to finalizing our research paper.



Leading a workshop on the incorporation of pedagogies of care in STEM education at Khalifa University's 'Best Practices in Teaching and Learning Conference 2023'.



Presented with a presenter's gift at the Khalifa University 'Best Practices in Teaching and Learning Conference 2023.'



**YAMAN GARG**

**FACULTY SUPERVISORS:** KEMAL CELIK AND MASOUD GHANDEHARI

**GROUND TRUTH VALIDATION OF THE MICROCLIMATE MODEL OF NYUAD CAMPUS: AN ARID CITIES RESEARCH PROJECT**

I established a weather monitoring network on the NYUAD campus to validate the simulation results. Several campaigns of thermal measurement of the campus were also conducted. Four permanent outdoor weather stations spread across the NYUAD campus which are capable of measuring indoor and outdoor air temperature, humidity, wind speed, direction, solar radiation, and UV index were installed. The weather stations constantly upload data to the publicly-accessible weather underground (WU) network at 5-minute intervals. The stations will be maintained by CITIES in the future and data used for future projects.

جامعة نيويورك أبوظبي  
NYU | ABU DHABI

*CITIES Fellowship Presentation*

**GROUND TRUTH VALIDATION OF THE MICROCLIMATE MODEL OF NYUAD CAMPUS: AN ARID CITIES RESEARCH PROJECT**

**YAMAN GARG**  
CITIES Post-Graduation Research Fellow

**TUESDAY, APRIL 25**  
**5 PM - 6:30 PM**  
**NYUAD, A6 - 015**

**YAMAN GARG** is a Post-Graduation Research Fellow with the CITIES Center for Interacting Urban Networks. Yaman completed his Bachelor of Science degree in Civil Engineering at NYU Abu Dhabi in 2022. He also completed a minor in Urbanization, and his capstone work was focused on autonomous robotics for construction.



Snapshots from the CFD microclimate simulation of NYU Abu Dhabi Campus.



# CONGRATULATIONS!

To the following NYUAD students who were awarded a Post-Graduation Research Fellowship From September 1, 2023 to August 31, 2024.

NAME	FACULTY SUPERVISOR(S)	RESEARCH PROJECT TITLE
Yoonsik Chico Park	Katia Arfara	Temporariness: The Performativity of Change
		Communities, Networks and Spaces of Cultural Production and Consumption in the UAE
Aayush Karna	Sunil Kumar	Design Optimization and Performance Prediction of Tube-fin Heat Exchanger using Neural Networks
		Interpretable, Scalable and Generalizable Spatial-Temporal Graph Neural Networks for Traffic Flow Prediction
Wing Kwan Hannah Chu	Bas Rokers and Kartik Sreenivasan	The Neural Basis of Perceptual Filling-In Caused by Artificial Scotomas and Its Implication for Working Memory
		JavaScript-Aware Energy Optimization for Web Browsing in Heterogeneous Multi-Core Systems
Michael Xu	Sanjeev Goyal and Bedoor AIShebli	From Diverse Roommates to Diverse Social Networks: Evidence From A University Dorm Room Assignment Policy
		Building Intergroup Trust Through Personal Transfers: A Field Experiment in Post-War Liberia
Hilina Bayew	Melina Platas	Air Quality at NYUAD: Measuring the Effects of Information Provision on Knowledge, Behavior and Policy Preferences
Rita Fahmy	Aashish Jha	Community-Engaged Research Identifies Genetic Histories, Basis of Malaria Resistance, and Evolution of Shorter Stature in Lower-Altitude (<1400m) Himalayan Populations
Grace Shieh	Sarah Alzaabi and Fatiah D. Touray	Attitudes and Approaches of Accents in the Global Classroom
Chenyu Yi	Nancy Gleason	Exploring Integration of Generative AI at Gulf Liberal Arts University Context: A Case Study of ChatGPT at NYUAD
Freya Yao	Olivier Bochet and Bedoor AIShebli	Search and Matching with Informational Friction and Complementarity
Fabiola Chiminazzo Assumpcao	Dale Hudson	Encounter Museum

## WITH THANKS TO ALL FACULTY AND ACADEMIC STAFF WHO SUPERVISED NYU ABU DHABI UNDERGRADUATE RESEARCHERS IN ACADEMIC YEAR 2022-2023.

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