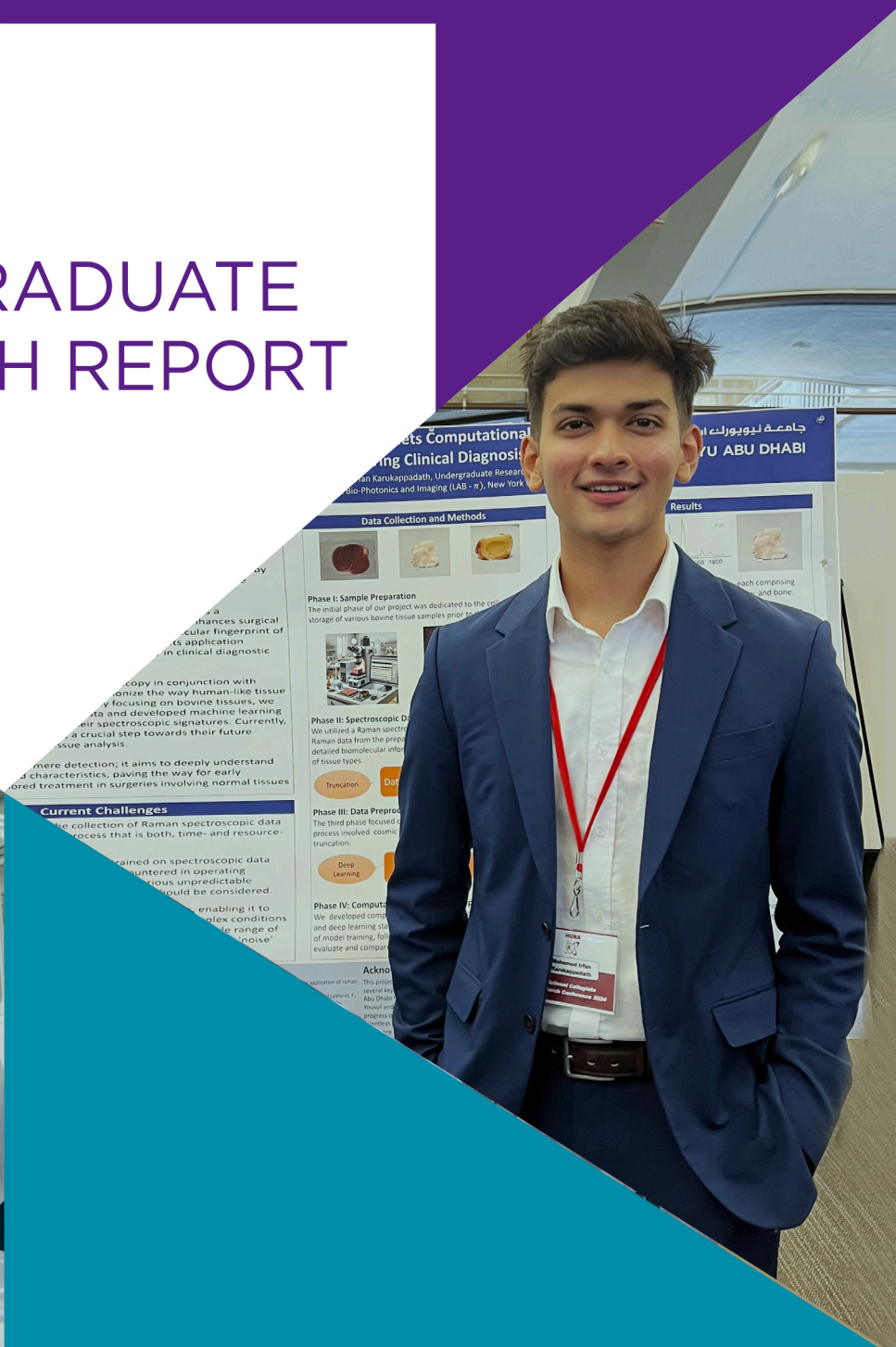
جامعة نيويورك أبوظبي

NYU ABU DHABI

AY 23-24
UNDERGRADUATE RESEARCH REPORT



AY 23-24 UNDERGRADUATE RESEARCH REPORT

OFFICE OF STUDENT RESEARCH

NYU ABU DHABI

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nyuad.nyu.edu/undergrad-research

At NYU Abu Dhabi, our students continually push the boundaries of inquiry, creativity, and innovation, contributing to a vibrant academic community that spans disciplines, cultures, and continents.

This report serves as a testament to some of the outstanding undergraduate research endeavors undertaken by NYUAD students during the academic year 2023-2024 and the subsequent summer of 2024. Their achievements remind us of the incredible potential of young minds empowered by curiosity and supported by a global academic network.

We thank the faculty and researchers who have dedicated their time, expertise, and mentorship to guiding NYUAD students in their research endeavors. Their unwavering commitment to fostering intellectual curiosity and academic rigor has been instrumental in shaping these students' experiences. By providing valuable insights, constructive feedback, and encouragement, they have not only advanced their research skills but also inspired their personal and professional growth.

Special recognition is extended 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.

Sincerely,

Erich Dietrich

Vice Provost, Office of Undergraduate Education

Farhana Goha

Head of Visiting Students Program and Student Research

CONTENTS

DATA ON STUDENT RESEARCH PROGRAMS

139
STUDENTS PARTICIPATED

SUMMER RESEARCH GRANTS

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

180
APPOINTED

SUMMER RESEARCH ASSISTANTSHIP PROGRAM

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

30
STUDENTS PARTICIPATED

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.

134
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.

38
GRANTS AWARDED

CONFERENCE PRESENTATIONS

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

736
POSITIONS

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.

64
STUDENTS AWARDED

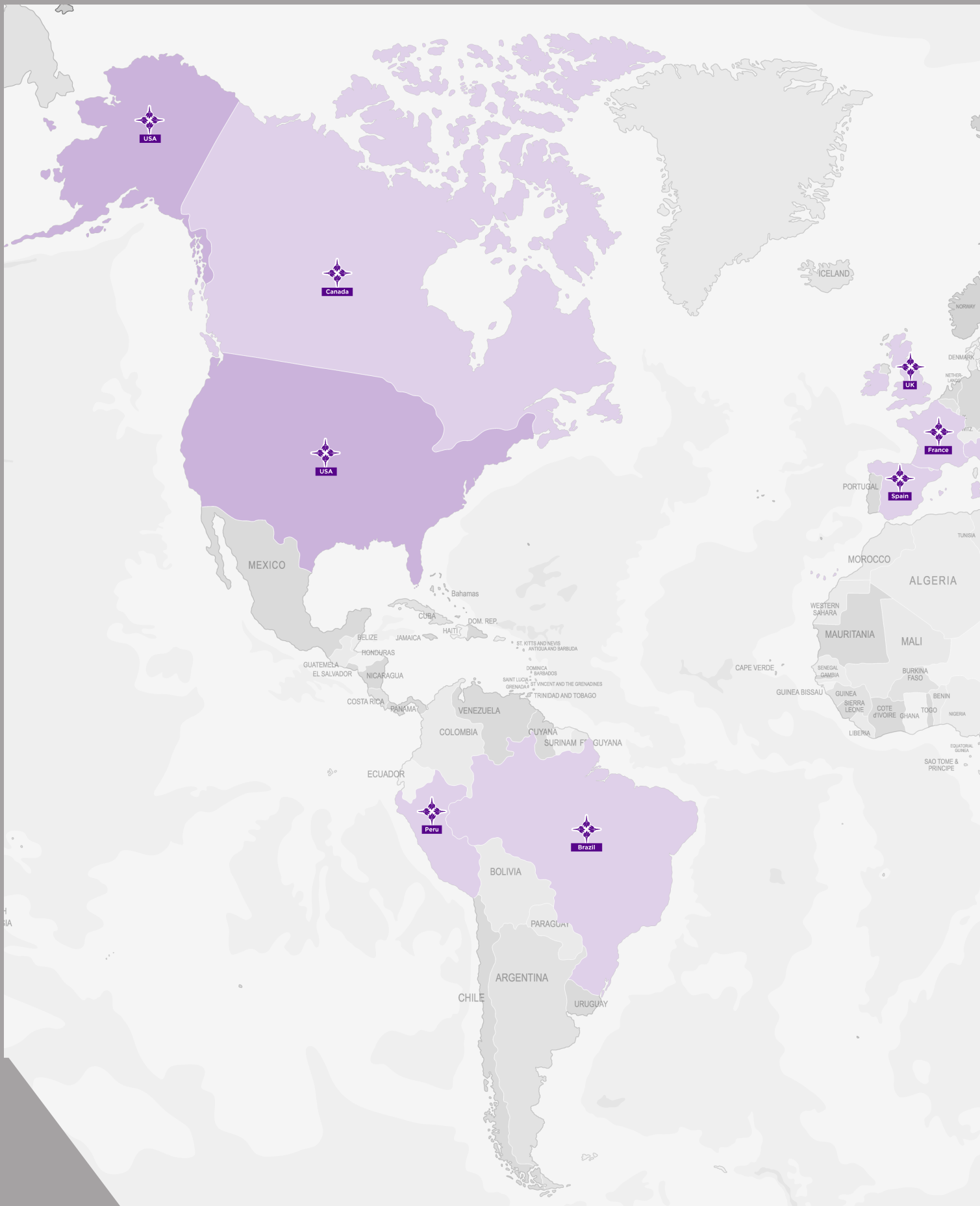
VISITING UNDERGRADUATE RESEARCH ASSISTANTSHIP AND ARTS APPRENTICESHIP AWARDS PROGRAM

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.

12
FELLOWS SELECTED

TAMAYYUZ RESEARCH FELLOWSHIP PROGRAM

Supports a select cohort of outstanding NYUAD graduating seniors, providing them with a one-year opportunity to conduct advanced and independent research at NYUAD.


USA
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MEXICO
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HAITI
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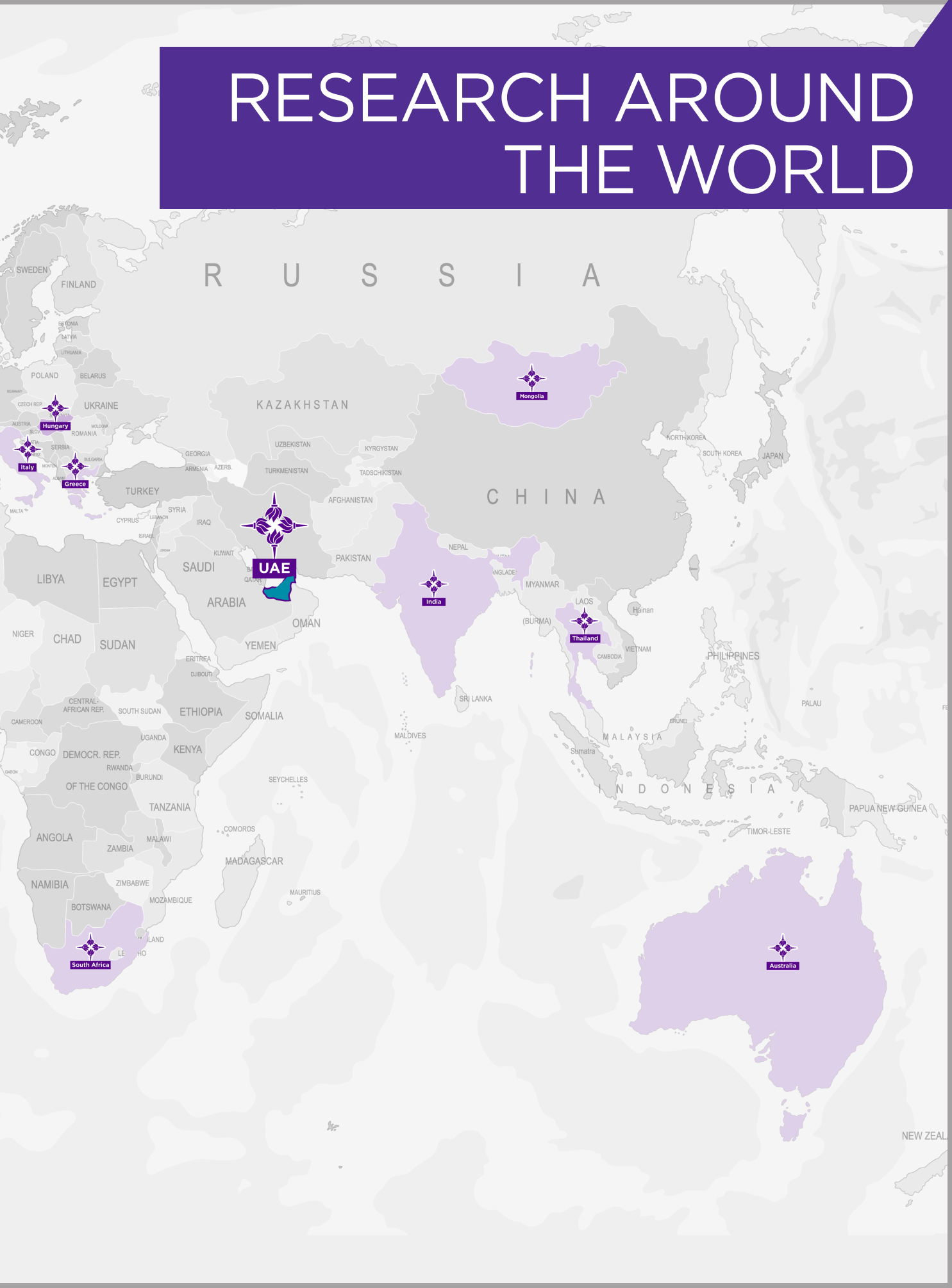
BELIZE
HONDURAS
GUATEMALA
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
VENEZUELA
COLOMBIA
GUYANA
SURINAM
ECUADOR
Peru
Brazil
BOLIVIA
PARAGUAY
ARGENTINA
CHILE
URUGUAY
ICELAND
NORWAY
DENMARK
UK
France
Spain
PORTUGAL
TUNISIA
MOROCCO
ALGERIA
WESTERN SAHARA
MAURITANIA
MALI
CAPE VERDE
SENEGAL
GAMBIA
BURKINA FASO
GUINEA BISSAU
GUINEA
BENIN
SIERRA LEONE
COTE d'IVOIRE
GHANA
TOGO
NIGERIA
LIBERIA
EQUATORIAL GUINEA
SAO TOME & PRINCIPE

RESEARCH AROUND THE WORLD



ERA BUDJAV,
TENUUN LKHAGVADORJ

Major
Biology

Faculty Supervisor
Youssef Idaghdour

Location: **NYU Abu Dhabi**

GENETIC AND MICROBIOME VARIATION ASSOCIATED WITH LIPIDS AND LIPID METABOLISM IN THE MONGOLIAN POPULATION

This research project aimed to unravel the complex interplay between genetics, microbiome, and lipid metabolism in the unique context of Mongolia's diverse population. By focusing on the stark dietary contrast between nomadic communities, known for their high dairy consumption, and urban populations with distinctly different eating habits, the study sought to illuminate how these lifestyle differences caused by urbanization impact metabolism, physiology, and immune function at a molecular level. Through a comprehensive analysis of genetic markers, lipidome profiles, and microbiome compositions, this investigation delved into the potential genetic and microbial influences on lipid metabolism, offering insights into how traditional dietary patterns shape human adaptation and health.

Samples from 200 Mongolian adults comprising four groups (urban, rural-to-urban migrants, and nomads from two different geographical locations) will be analyzed for genetic markers, microbiome compositions, and lipid profiles. By linking these findings to dietary patterns, the study aims to provide a comprehensive understanding of how lifestyle and diet impact metabolic pathways and genetic adaptations. Utilizing cutting-edge genomic technologies, the research team will perform genome-wide genotyping on over 800,000 genetic markers, with a particular focus on metabolism and lipid-related genes. Complementing this genetic analysis, the study will generate oral and gut microbiome data and conduct comprehensive lipidomics and metabolomics analyses. By comparing the prevalence of specific genetic variations between nomadic and urban populations and exploring correlations between genetic markers and dietary adaptation, especially in the context of dairy-rich diets, this collaborative effort between the Environmental Genomics Laboratory at New York University Abu Dhabi and the Mongolian National University of Medical Sciences promises to yield valuable insights into the molecular mechanisms underlying human dietary adaptation and its implications for health and disease susceptibility.

Meeting with the Minister of Health to discuss the project.

Students Era and Tenuun conducting lifestyle questionnaires from Mongolian nomads in Dundgovi Province.

Research Collaboration Poster.

The research team during the Dundgobi Province, Mongolia, fieldtrip.

Photo outside the Mongolian yurt with the local nomads.

Inside the yurt of one of the family nomads who participated in the study.

Students Era and Tenuun with Professor Youssef in the study field area in Mongolia.

Students collecting samples.

Photo inside the mongolian yurt.

BASIL OTIENO OGOLA,
IMAN LALANI

Major
Chemistry

Faculty Supervisor
Aleksander Rebane

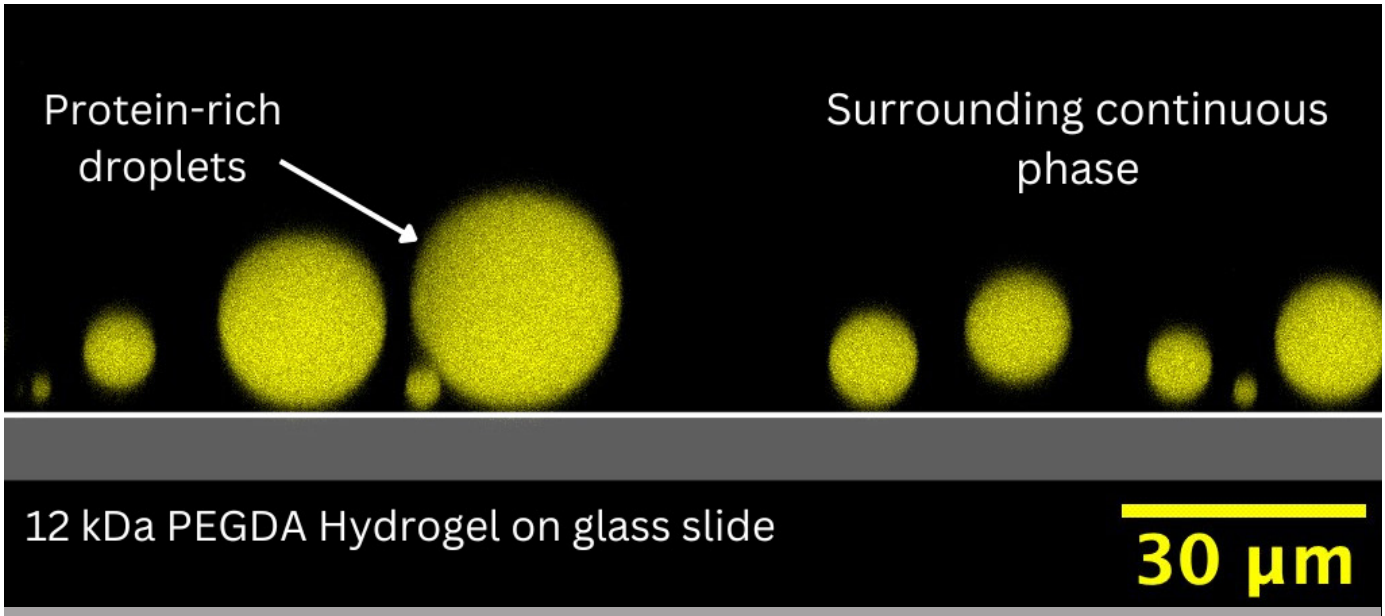
Location: **NYU Abu Dhabi**

UNDERSTANDING SUPER - REPELLANCE IN HYDROGEL BASED SURFACE COATINGS

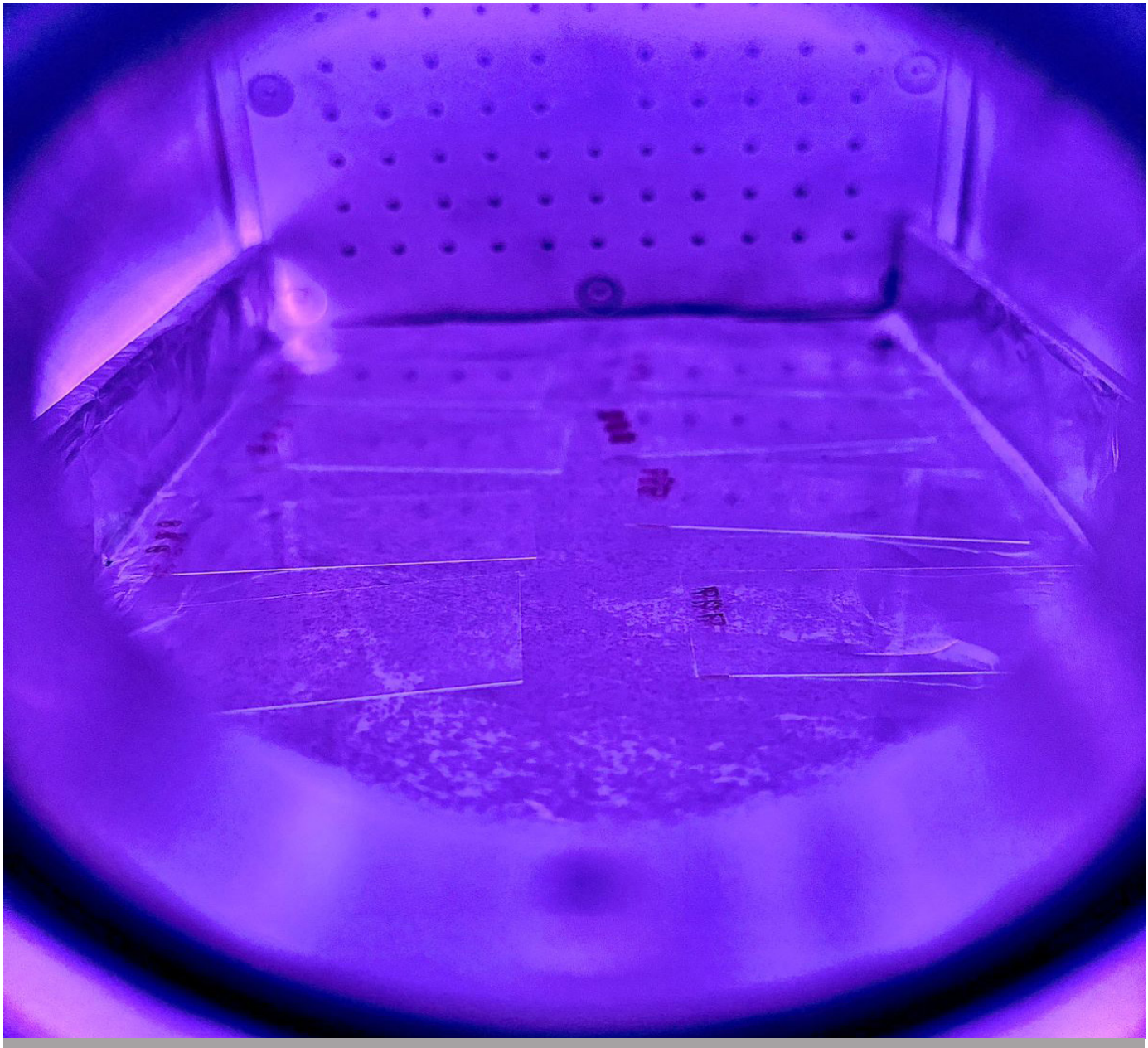
Aqueous solutions of macromolecules such as proteins and nucleic acids can undergo liquid-liquid phase separation (LLPS), forming microscopic liquid-like droplets suspended in solution, which are thought to be important for executing vital functions in living cells. However, these droplets tend to stick and spread on the walls of test tubes and microscope slides (called wetting), complicating their study in in vitro experiments.

As part of our project, we tried to understand how a novel surface treatment, which consists of coating the microscope slide with a high molecular weight (12 kDa) PEGDA hydrogel, stopped wetting of any droplet that appears via LLPS in water-based solutions. Lower molecular weights have shown poorer de-wetting performance, and our goal was to understand why the high molecular weight PEGDA hydrogel performs so well compared to low MW and other common surface treatments. We hypothesized that the high molecular weight of our PEGDA (MW 12 kDa) yields hydrogels with >90% water content, rendering them practically indiscernible from the surrounding solution from the point of view of the droplet, thereby reducing adhesion and wetting. To test this hypothesis, we measured the water content and wetting performance of PEGDA hydrogels of different MW. Surprisingly, we found only limited correlation between MW and water content, suggesting that it is in fact the microstructure of the high MW PEGDA hydrogel network that is key to its superior de-wetting performance.

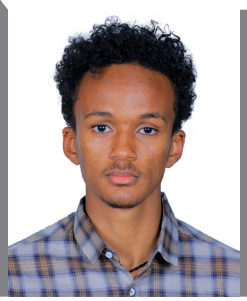
> **I am extremely grateful to have had the opportunity to assist in research during the summer. Spending more time in the lab has significantly boosted my confidence in my technical skills and deepened my understanding about how to answer scientific questions by testing hypotheses. I am now drawn towards looking at research as a long-term career path.**
>
> ***Iman Lalani***



The dewetting performance of Bovine Serum Albumin (BSA) droplets on a 12kD Polyethylene glycol diacrylate (PEGDA) hydrogel coating.



Fluorescently tagged protein droplets on the surface of a hydrogel, showing de-wetting.



YOHANNES MOREDA

Major
Economics

Faculty Supervisor
Christopher Paik

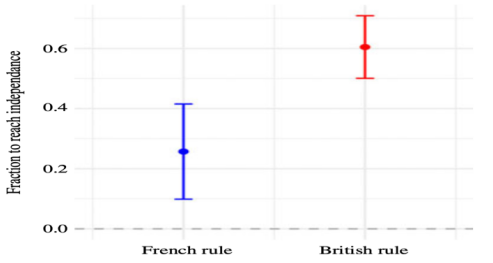
Location: **NYU Abu Dhabi**

STUDYING THE IMPACT OF VARYING COLONIAL ADMINISTRATIVE SYSTEMS ON THE POSTCOLONIAL TREATMENT OF COLLABORATORS

I investigated how different colonial administrative types—direct and indirect—influenced the integration of local collaborators and their treatment after independence. I compared the Japanese colonial administration, which was marked by direct rule and minimal involvement of local elites, with the British approach that utilized local elites more extensively under indirect rule.

I also studied the varying post-independence treatment of collaborators across different colonies under the same colonizer.

For example, in Korea and Taiwan, under Japanese rule, varying levels of elite integration and differing public perception led to distinct post-colonial outcomes for collaborators.

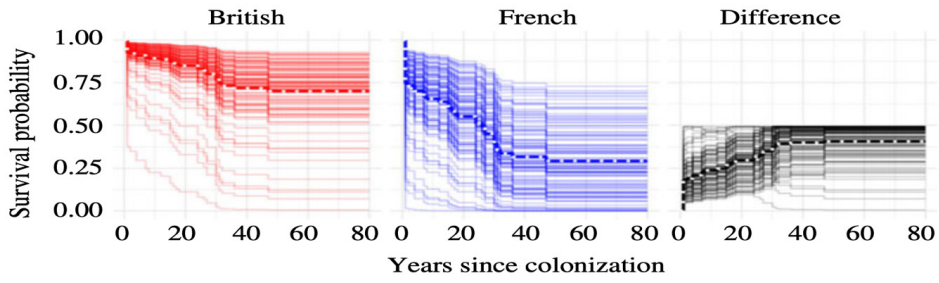


Note: Error bars denote 95% condence intervals from a linear regression without controls. For a full set of cross-sectional analyses, see Appendix A2.2.

FIGURE 4. *Fraction of colonized lines of succession to survive until the year of independence from colonial rule*

Müller-Crepon, C. (2020). Continuity or Change? (In) direct Rule in British and French Colonial Africa. International Organization, 74(4), 707–741. doi:10.1017/S0020818320000211, P.720.

Müller-Crepon, C. (2020). Continuity or Change? (In) direct Rule in British and French Colonial Africa. International Organization, 74(4), 707–741. doi:10.1017/S0020818320000211, P.722.



Notes: Based on Model 1 in Table 2, the Figure plots the predicted survival of every polity under British and French colonial rule. The third panel plots the polity-level dierence between these two predictions. Thin lines plot the polity-level predictions, bold lines plot the average across all predictions.

FIGURE 5. *Survival curves as predicted for all polities under either British or French rule*

RAHUL SHRESTHA

Major
Biology

Faculty Supervisor
Piergiorgio Percipalle

Location: **NYU Abu Dhabi**

INVESTIGATING THE ROLE OF NUCLEAR MYOSIN 1 (NM1) IN PROSTATE CANCER

I participated in a research project aimed at understanding the role of Nuclear Myosin 1 (NM1) in prostate cancer. This study explored the molecular mechanisms underlying NM1's involvement in regulating gene expression and its potential implications in tumorigenesis.

The project leveraged RNA-Seq data from previous experiments involving wild-type (WT) and NM1 knockout (KO) mouse embryonic fibroblasts (MEFs). The analysis began with quality control and clustering, which confirmed distinct variability between WT and KO groups. Differential gene expression analysis revealed thousands of upregulated and downregulated genes, highlighting pathways related to cell cycle regulation, DNA damage repair, and mRNA processing.

One of the most intriguing findings was the enrichment of the KEGG pathway for "prostate cancer" among the upregulated genes in NM1 KO MEFs. Further analysis identified PTEN, a well-known tumor suppressor gene, as significantly upregulated in NM1 KO cells. This finding was supported by data from the COSMIC database, where genes associated with the "prostate cancer" pathway showed distinct mutagenesis and expression patterns in human samples. Additionally, phenotypic differences were observed between NM1 WT and KO mice, including enlarged seminal vesicles in KO mice. These findings point toward a broader physiological role of NM1, particularly in reproductive organ development and cancer. Future plans for the study include validating seminal vesicle size differences, conducting RNA-Seq on prostate and seminal vesicle tissues, and identifying candidate genes linked to prostate cancer using existing literature and databases.

> **This research experience taught me the importance of integrating computational analysis with experimental biology to uncover molecular mechanisms, while emphasizing critical thinking and precision in interpreting complex datasets.**

ARYAM ALHOSANI

Major
Political Science

Faculty Supervisor
Gabriel Koehler-Derrick

Location: **NYU Abu Dhabi**

NATIONAL IDENTITY DYNAMICS: COMPARING EMIRATI NATIONALISM IN FREEHOLD AND NON-FREEHOLD AREAS

My research proposal was focused on the exploration of the impact of residential environments on the national identity of Emiratis. It aims to do so by comparing those living in freehold areas with those in non-freehold areas. As I worked on the preliminary stage of this project, I aimed to curate a research design that would provide a comprehensive understanding of how community dynamics and individual experiences shape the Emiratis' national identity.

By comparing the experiences of Emiratis in freehold areas with those in non-freehold areas, this research would seek to explore a facet of influences on national identity formation, thus encountering implications that are to be applied to a broader national context.

Using the 'My Land' application, run by the Department of Municipalities and Transport, in the UAE, has been extremely insightful in considering the planning of cities.

> **I was delighted to work with Professor Gabriel Koehler-Derrick, who mentored me by guiding me through extensive literature and provided me with unwavering support throughout the entire process of selecting a research topic for my mock Capstone proposal. I spent the summer formulating a reading list and reading around the topic of nationalism.**

ZAYED AL TAMIMI

Major
Computer Engineering

Faculty Supervisor
Ozgur Sinanoglu

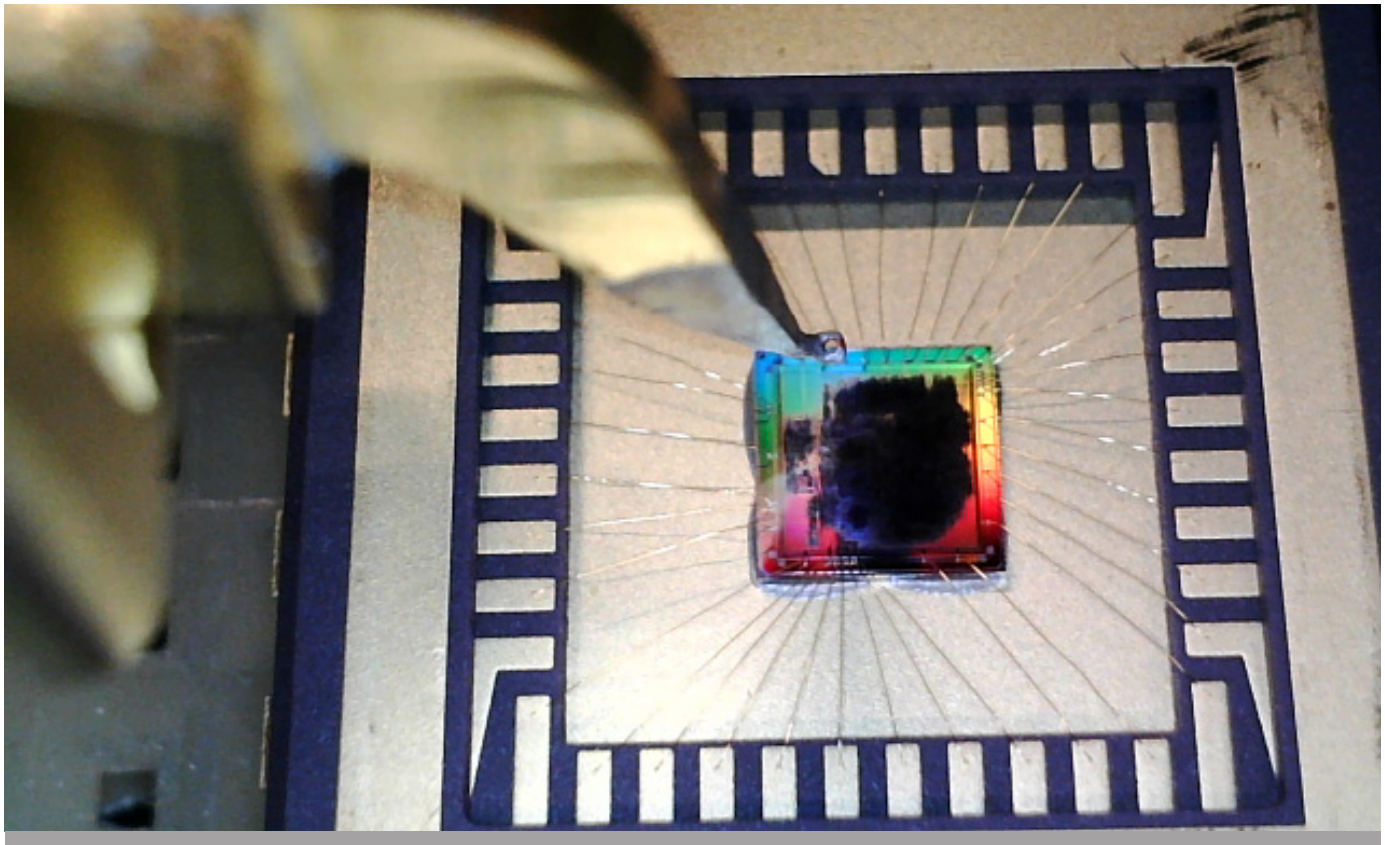
Location: **NYU Abu Dhabi**

A NOVEL ATTACK ON LOGIC LOCKING USING POWER SIDE-CHANNELS

Logic locking is a widely established method that allows Integrated Circuit (IC) designers to protect the integrity of their designs. The method revolves around adding key-like components within the original chip design. To get the chip to function appropriately, a key supplied by the IC designers composed of a unique sequence of input bits must be inserted into these additional components. In other words, without the key, which is held by the legitimate owners only, the IC remains protected from unauthorized copying and operation.

My research focused on creating novel algorithms for an advanced security evaluation of logic locking. We devised the algorithms in C++ to enable efficient processing on very large and complex search spaces.

The idea was to find a design similar to the original (unlocked) chip in terms of the type and assignment of gates within it. Carefully contrasting the power side-channel behavior of an unlocked (oracle) chip and a locked chip was a key principle.



Probing of a chip to leak secret data on it.

MOHAMMED MOUAD MELOUK

Major
Computer Engineering

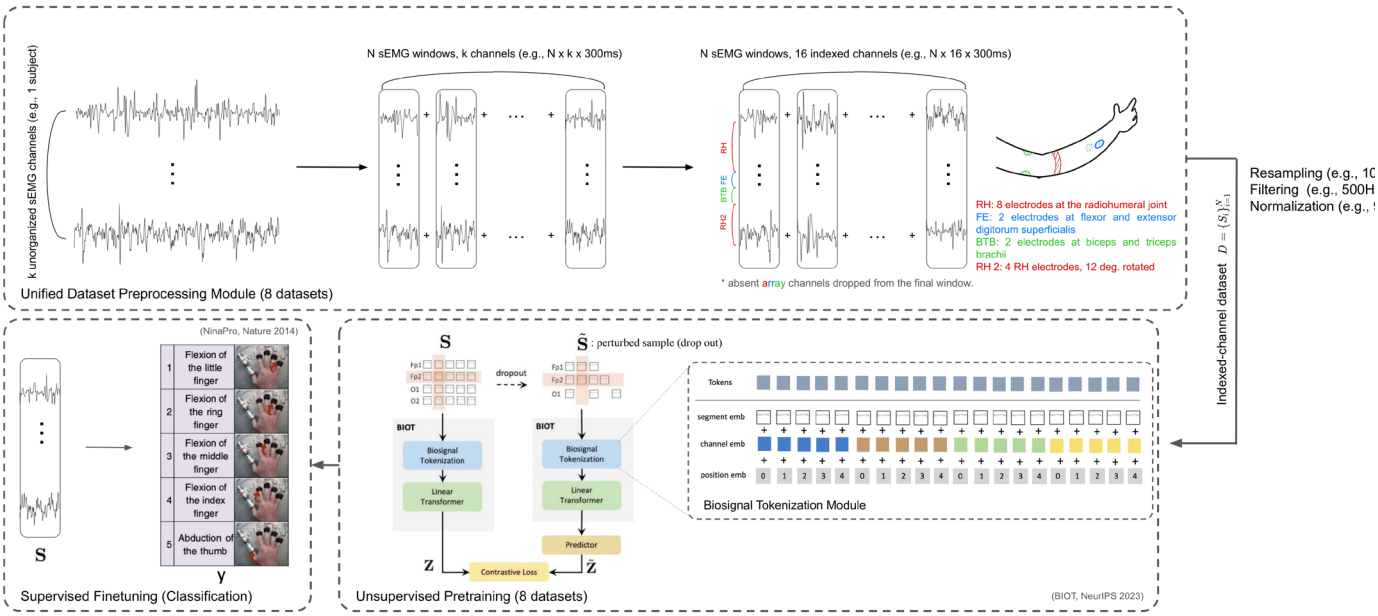
Faculty Supervisor
Tuka Alhanai

Location: **NYU Abu Dhabi**

BIOSIGNAL TRANSFORMER FOR EXOSKELETON AUGMENTATION

My project focused on adapting and training a Transformer model on a large dataset of sEMG signals, aiming to evaluate its applicability in prosthetics and orthotics. Under Professor Tuka's guidance, I successfully achieved state-of-the-art performance on a specific set of patient data. My next step is to refine this model for a broader sEMG dataset with varying signal and channel characteristics. This approach has demonstrated the potential to improve generalization and performance, which is crucial for real-world applications in prosthetic and orthotic limbs.

> **This experience was an intense and focused deep dive in data science and machine learning.**



Proposed framework for unified decoding of surface electromyography signals.

KHALIL KASHWANI

Major
Mathematics

Faculty Supervisor
Alberto Gandolfi

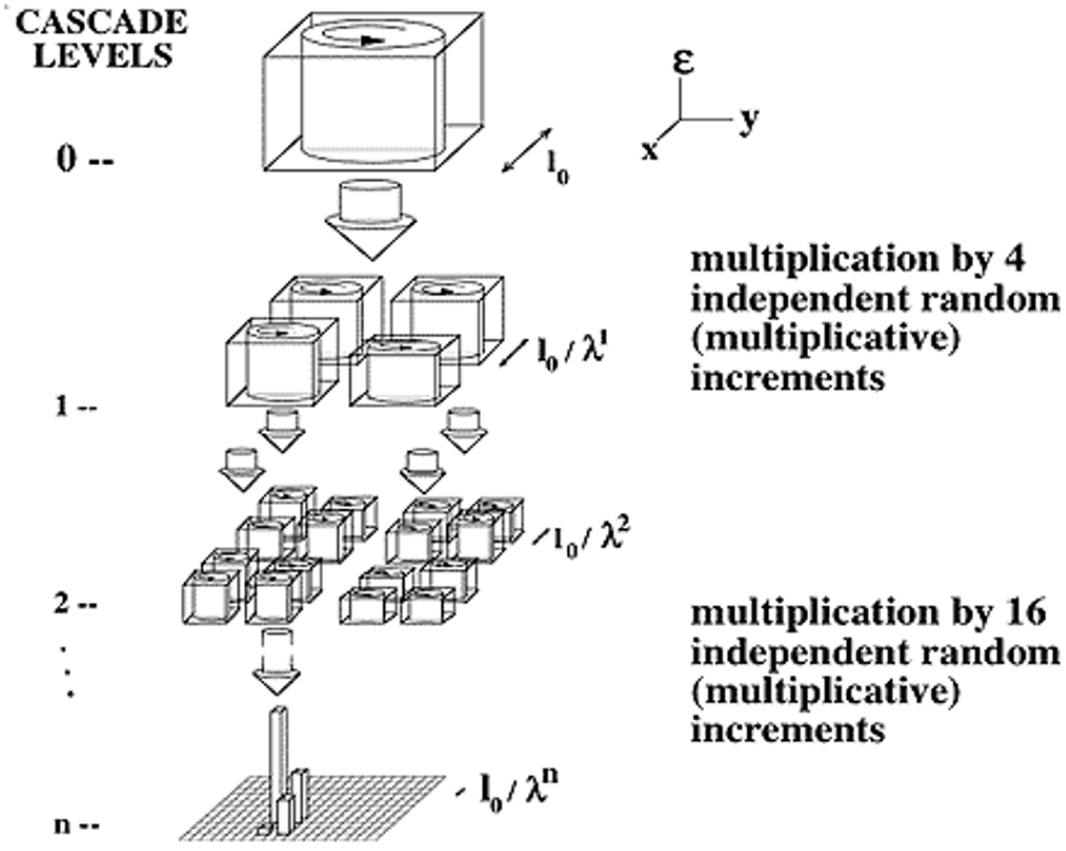
Location: **NYU Abu Dhabi**

THE EQUIVALENCE OF STABILITY CONDITIONS FOR MULTIPLICATIVE CASCADES AND GAUSSIAN MULTIPLICATIVE CHAOS

I began my research by studying an exponential random walk, attracted to zero or twice the distance, and identified "survival" conditions. I then extended this to random walks that branch into independent walkers along the way.

This second problem relates to multiplicative cascades (introduced by Mandelbrot), which are an example of Gaussian multiplicative chaos (GMC, developed by Kahane). Our goal is to advance this research by providing approximations to GMC in more general settings.

Since GMC is used in statistical mechanics, theoretical physics, and finance, these discrete approximations via multiplicative cascades could enhance the practical application of earlier works on cascades.



A visualization of a multiplicative cascade and its limiting behaviour.

SHERIFA YAKUBU

Major
Mechanical Engineering

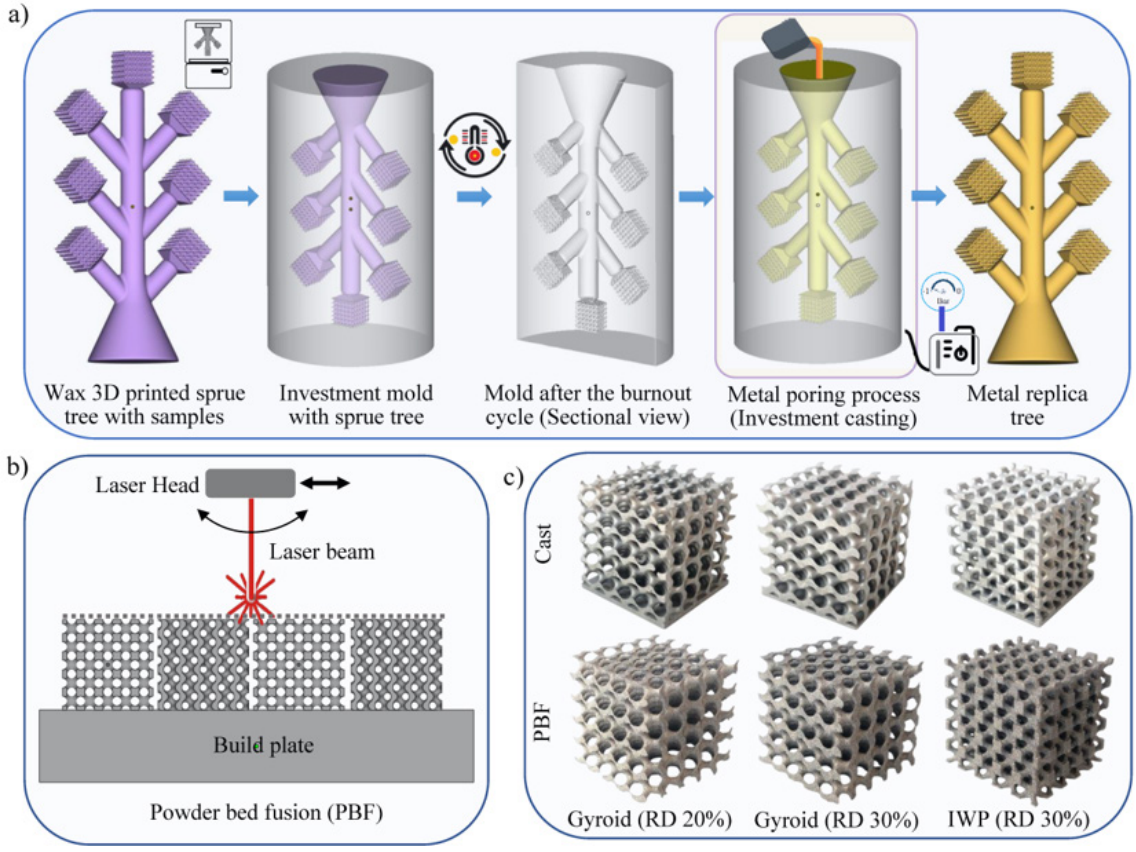
Faculty Supervisor
Nikolaos Karathanasopoulos

Location: **NYU Abu Dhabi**

INVESTIGATING THE MECHANICAL PROPERTIES OF METALLIC METAMATERIALS PRODUCED THROUGH INVESTMENT CASTING

The main project involved investigating the mechanical properties of the metamaterials we created using centrifugal casting, aiming to assess the advantages and disadvantages of this casting method compared to other additive manufacturing processes.

I worked on the entire process, from designing the metamaterials and operating the 3D printer to produce wax samples, to designing the trees to hold these samples, creating molds, and using furnaces to extract the wax, leaving behind a void replica of the samples. I observed the process of pouring the molten metal (aluminum) into the void under a vacuum, thereby creating investment cast metamaterials. I extracted the cast samples from the dry slurry and conducted SEM, microscopy, and mechanical testing post-processing steps.



Hybrid (investment casting) and Powder Bed Fusion (PBF) based manufacturing of architected advanced materials.

KRISTINA SISIAKOVA

Major
Economics

Faculty Supervisor
Torsten Figueiredo Walter

Location: **NYU Abu Dhabi**

ENDOGENOUS SAMPLE SELECTION

I contributed to a project investigating the impact of enumerator incentives on the quality of survey data, a critical element in social science research and policy formulation.

The study focused on how these incentives influence enumerators to selectively exclude high-effort respondents, which can result in biased data. Our research drew on data from over 180 Demographic and Health Surveys and Multiple Indicator Cluster Surveys across 73 countries, revealing that in many instances, survey samples were not truly representative of the population. This misrepresentation was linked to systematic omissions by enumerators who, motivated by effort costs, excluded certain individuals from the sample.

My responsibilities included gathering and cleaning survey data, analyzing patterns of non-random sample selection, and examining how these biases affect aggregate statistics like fertility rates. I also assisted in visualizing the data to illustrate the discrepancies and their broader implications for policy and research.

> **In one of my classes, I learned to write code for web scraping. During the summer research, I applied this skill in practice when we needed to quickly and efficiently gather large amounts of data.**

KIRUBEL SOLOMON TESFAYE,
YOUSSEF ANDRAWS

Major
Electrical Engineering

Faculty Supervisor
Mahmoud Rasras

Location: **NYU Abu Dhabi**

DELAY - BASED PHOTONIC RESERVOIR COMPUTING

Photonic Reservoir Computing (PRC) is a model that leverages the speed, parallelism, and inherent nonlinearity of photonics to perform complex computational tasks.

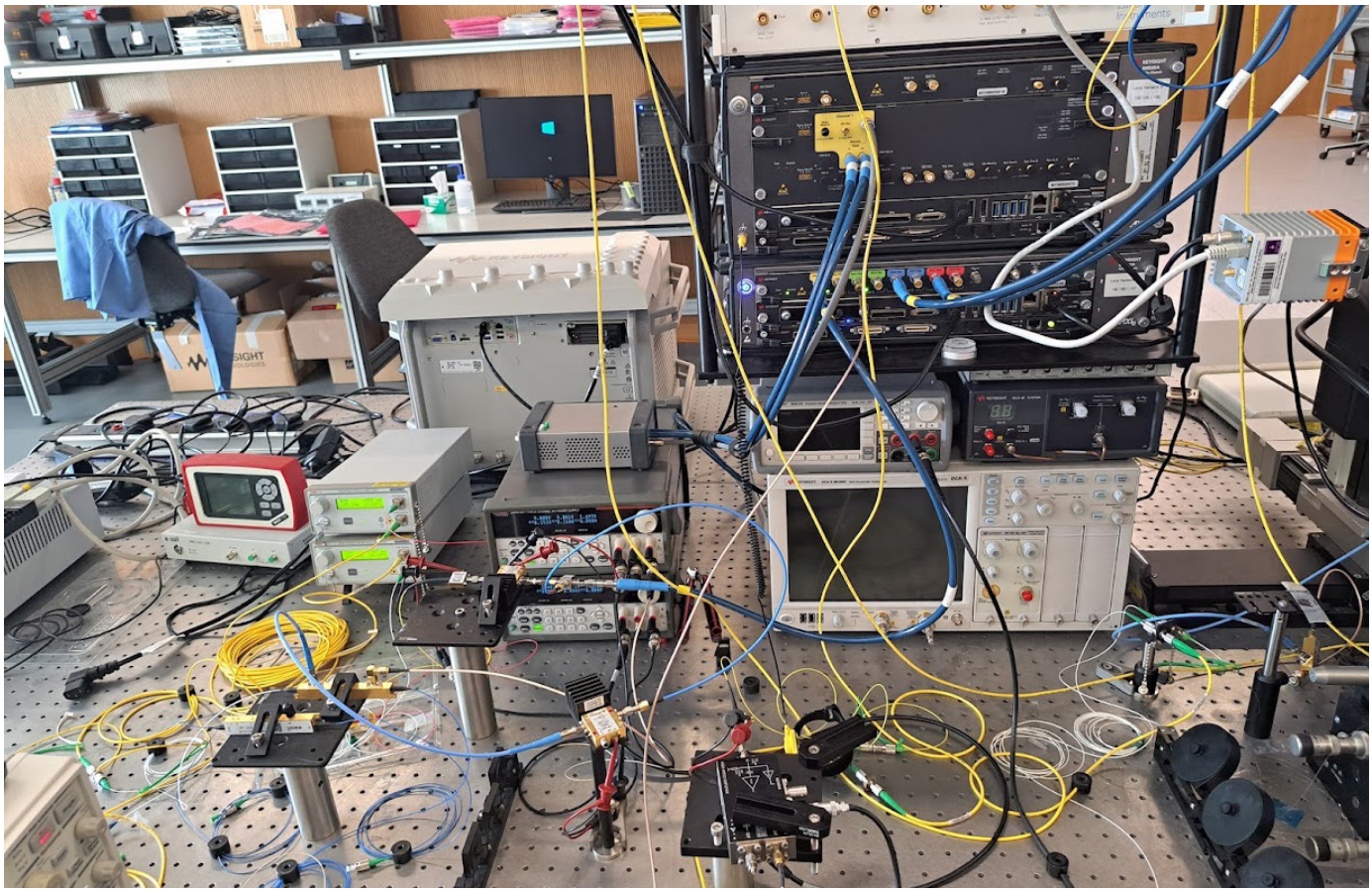
Developed and implemented since the 2010s, PRC utilizes a photonic network as a reservoir—a dynamic system where input signals are transformed into a nonlinear, high-dimensional space. The key advantage of PRC lies in its ability to process information at the speed of light, enabling ultrafast computation with low energy consumption. This makes it particularly well-suited for tasks such as real-time signal processing, pattern recognition, machine learning, and edge computing.

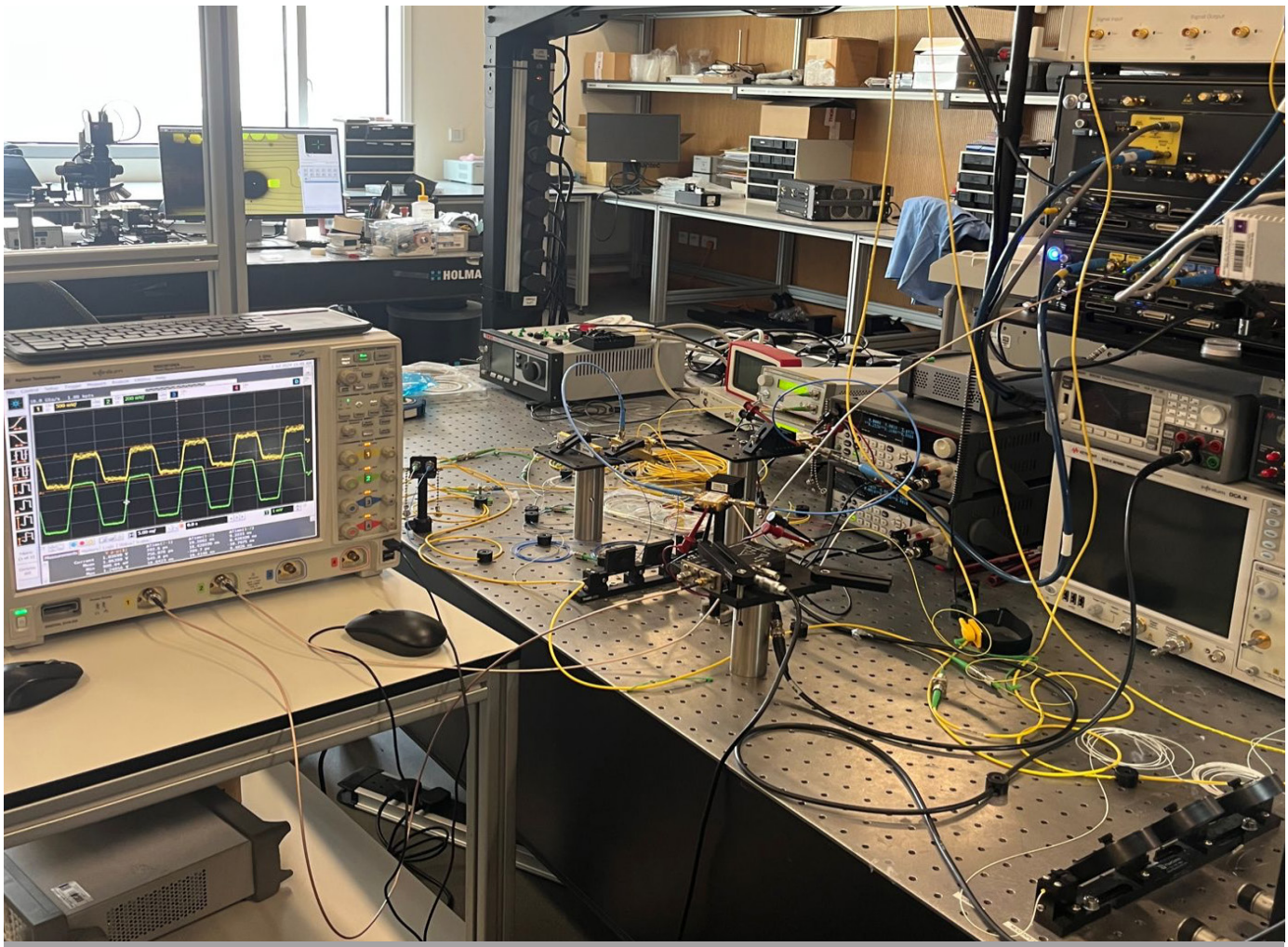
The implementation of a Photonic Reservoir Computer typically involves integrating optical components such as lasers, modulators, and photodetectors. Following a detailed background study, we decided to implement a delay-based photonic reservoir computer utilizing a Mach-Zehnder modulator as the source of nonlinearity, along with other optoelectronic devices.

The input data is fed into this network, where it undergoes complex transformations. The output is then read from specific nodes in the network and linearly combined to generate the final result.

Unlike traditional computing, PRC requires minimal training, as only the readout layer is optimized, making it computationally efficient. We implemented this reservoir in the Photonics Research Lab for the first time and applied it to nonlinear channel equalization.

> **We gained hands-on experience in turning theoretical concepts into practical applications by implementing a delay-based photonic reservoir computer, which proved essential in advancing real-world computing research.**
>
> ***Kirubel Solomon Tesfaye***





Photonic reservoir computing experimental setup.

ZEIN MUKHANOV

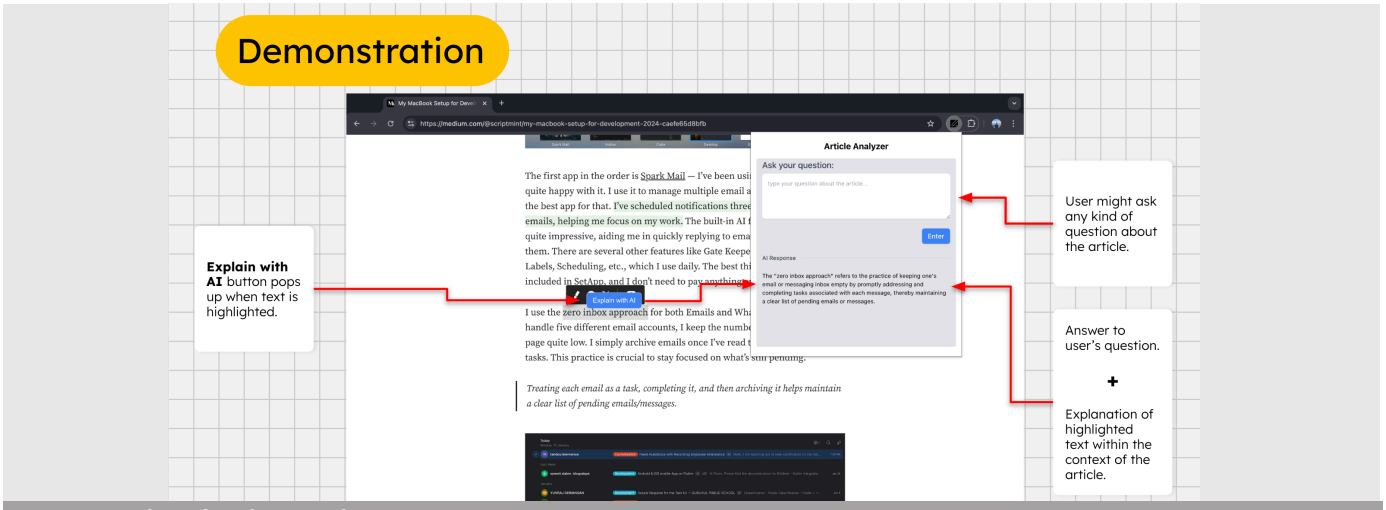
Major
Computer Science

Faculty Supervisor
Tuka Alhanai

Location: **NYU Abu Dhabi**

DEVELOPMENT OF A CONTEXT - AWARE WEB BROWSER LLM EXTENSION

I focused on developing a context-aware web browser extension that leverages the OpenAI language model to analyze and summarize online articles. The primary goal was to create a tool that could extract key elements from web pages—such as the title, author, main thread, article text, and comments (e.g., Medium, Substack, New York Times)—while avoiding unnecessary information that could overwhelm the model. I implemented this in a Chrome extension, aiming to enhance user experience by enabling users to interact more efficiently with web content.



Demonstration of Web Extension's Key Features.

This project significantly advanced my technical skills in front-end development and Chrome extensions, and laid the groundwork for future studies that will investigate the broader implications of integrating AI into everyday web experiences. The skills I've developed through this project align closely with my Capstone project, which focuses on developing a Mental Health Support Application.

MARIA WANI

Major
Political Science

Faculty Supervisor
Joan Barceló

Location: **NYU Abu Dhabi**

A META - ANALYSIS ON WHETHER EXPOSURE TO WARTIME VIOLENCE INCREASES RELIGIOSITY

I assisted with an analysis of the relationship between religiosity and wartime violence exposure from data based on approximately fifty different studies from around the world. I reviewed an overall effect on religiosity, and also disaggregated the studies into measures of religiosity, measures of violence exposure, and types of conflicts in order to test certain hypotheses. In addition, I reviewed intra-study heterogeneity in variables like age, gender and education level in order to look at potentially significant interaction effects.

> **I will be continuing this work project as a co-author, and we plan to have the manuscript submitted to a journal soon. While having taken a class in Rstudio before, I was not confident in my ability to clean, analyze and visualize data. Through this assistantship, I have grown much more comfortable in doing so, as not only was I given the chance to prove myself by taking on difficult tasks, but I was also given ample help any time I struggled. This allowed me to experiment on my code, learn new tips and tricks, and generally become more confident.**

MATAB MASHTA

Major
Business Organizations & Society

Faculty Supervisors
Ernesto Reuben and Monika Pompeo

Location: **NYU Abu Dhabi**

EARLY CHILDHOOD AUTHORITY PROJECT: EXAMINING NON-COGNITIVE SKILLS AMONG STUDENTS IN ABU DHABI SCHOOLS

I worked with the Center for Behavioral Institutional Design (CBID) on a project sponsored by the Early Childhood Authority (ECA) of Abu Dhabi to research and understand the non-cognitive skills in Abu Dhabi school students. I primarily conducted study sessions on students 5 - 7 years old to analyze their non-cognitive skills (specifically grit, competitiveness, and risk tolerance) and how such skills could be transmitted through parents. Throughout the summer, I visited 16 schools in which I helped set up the study sessions or lead the sessions myself. After that, I worked on digitalizing the data our team collected and creating a report for 6 different schools to summarize statistical results.

Separately, I also read through 20 papers and wrote a literature review about transmission, highlighting innovative research practices and findings in economic preferences and both cognitive and non-cognitive skills and providing a contextual background on the research in the context of the UAE and the MENA region.

> **This was a rewarding experience in many ways. Working with children taught me a lot about the importance of research in policy creation for future generations. Moreover, it provided me with understanding of the work the ECA of Abu Dhabi is involved in, and the care the UAE has for education.**

Conducting study sessions at schools in Abu Dhabi.

ROUDHAH AL MAZROUEI

Major
Art and Art History

Faculty Supervisor
Salwa Mikdadi

Location: **NYU Abu Dhabi**

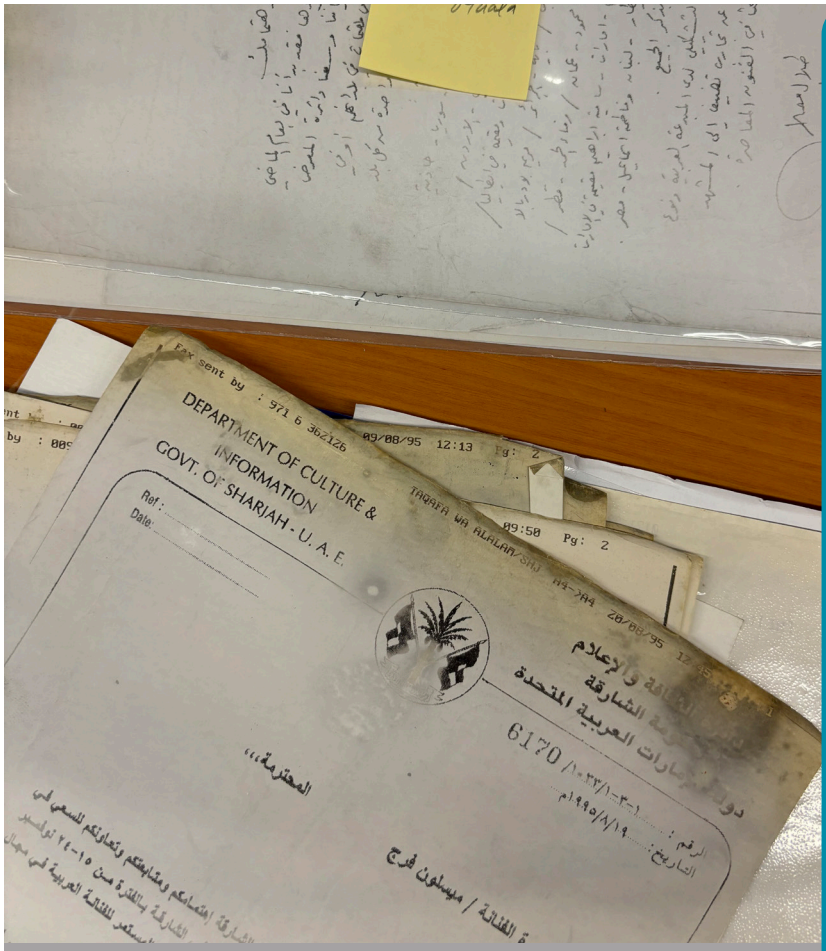
ARCHIVIST AT AL MAWRID CENTER

During my training, I had the privilege of working on the meticulous rehousing and sorting of Maysaloon Faraj's materials. This task required a high level of attention to detail and an understanding of archival best practices.

I also had the opportunity to transcribe a full symposium session conducted by Professor Terri Geis, which provided another layer of profound insights into the complexities of archiving and the narratives surrounding Arab art. The presentations during the symposium underscored the systemic exclusion of certain artists from mainstream art history and the efforts to rectify these omissions through archival research and curation.

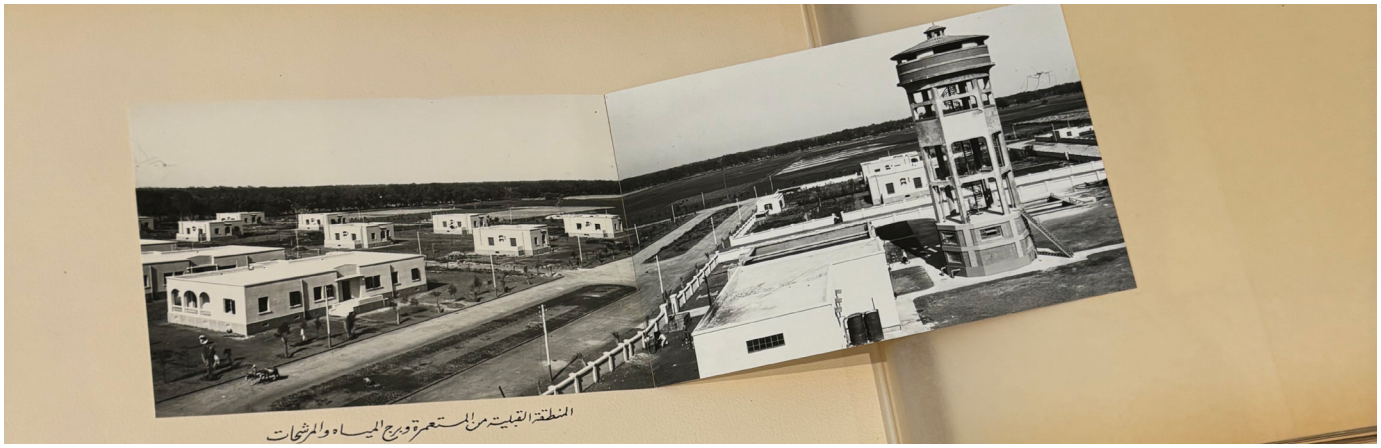
> **My training at Al Mawrid Center has been an enriching experience, enhancing my understanding of archival work and establishing the foundation for my research in postgraduate studies at the Royal College of Art.**

Photos from Maysaloun Faraj's collection.



Photos from Maysaloun Faraj's collection.

> Organizing the Al Mawrid Open House was a pivotal experience, bridging the institution's archival work with the public, through meticulous planning and a vision to present its mission and resources in an accessible and engaging manner.



Photos from Al Mawrid's collection.

TAMARA MASHNOUK

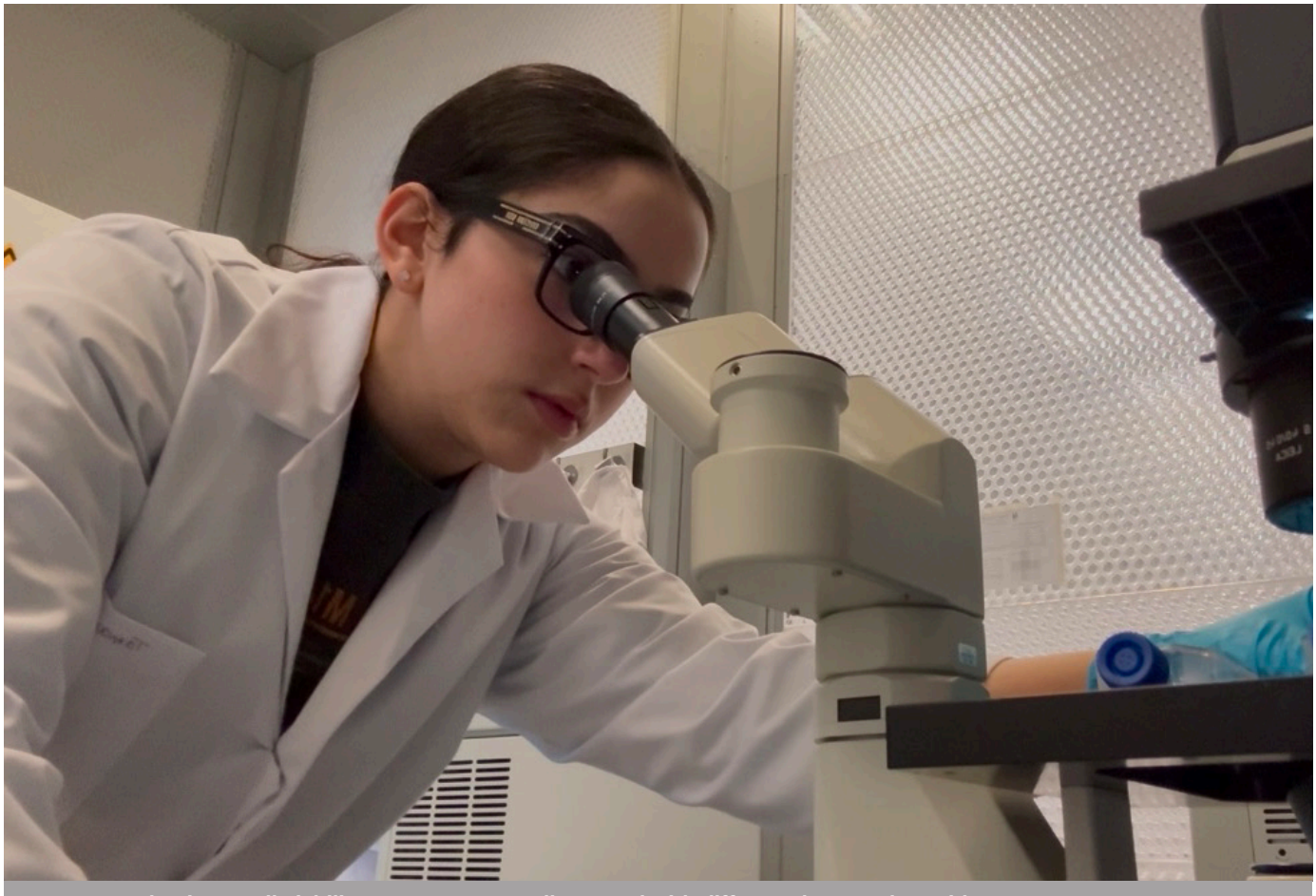
Major
Biology

Faculty Supervisor
Mazin Magzoub

Location: **NYU Abu Dhabi**

EFFECT OF MITOCHONDRIAL HEXOKINASE II KNOCKOUT VIA CELL-PENETRATING PEPTIDES ON AMYLOID β PHAGOCYTOSIS IN ALZHEIMER'S DISEASE

My project investigated the effect of a Hexokinase II-derived Cell Penetrating Peptide (CPP) on the rate of microglial phagocytosis of Amyloid beta plaques, which are the main pathological cause of Alzheimer's Disease. I spent the summer working on the HeLa cell line to establish a set of negative controls for my project, where I tested the CPP's efficacy at knocking out Hexokinase II from the mitochondrial membrane of HeLa cells, which yielded positive results.



Tamara conducting a cell viability assay on HeLa cells treated with different drugs and peptides.

WILL MEKVABIDZE
Major **Computer Engineering**

ATIQUZZAMAN BHUIYAN
Major **Mechanical Engineering**

Faculty Supervisor
Kemal Celik

Location: **NYU Abu Dhabi**

TIME-RESOLVED SYNCHROTRON MICRO-CT DATA ANALYSIS WITH MACHINE LEARNING-AIDED APPROACHES FOR MULTISCALE MATERIAL CHARACTERIZATION

We focused on the development of a deep learning-based approach for segmenting pores and cracks in CT images. Initially, we built a custom dataset class to handle the CT images and corresponding segmentation masks. This involved parsing XML files containing annotations in the CVAT format, where we extracted polygons and polylines to create segmentation masks. These masks were structured with multiple channels, each representing a different category, such as "crack" or "pore."

As the project progressed, we implemented a Fully Convolutional Network (FCN) model using PyTorch for image segmentation.

This involved careful study of existing literature, such as the FCN paper and related lectures on image segmentation, to ensure a thorough understanding of the underlying concepts. We experimented with different model architectures and hyperparameters to optimize performance.

> **Throughout the project, I utilized Colab for code sharing and collaboration. This project provided valuable insights into the intricacies of deep learning for medical image analysis and honed my skills in neural network implementation and dataset management.**
>
> ***Will Mekvabidze***

LAYAN ALKASAJI

Major
Bioengineering

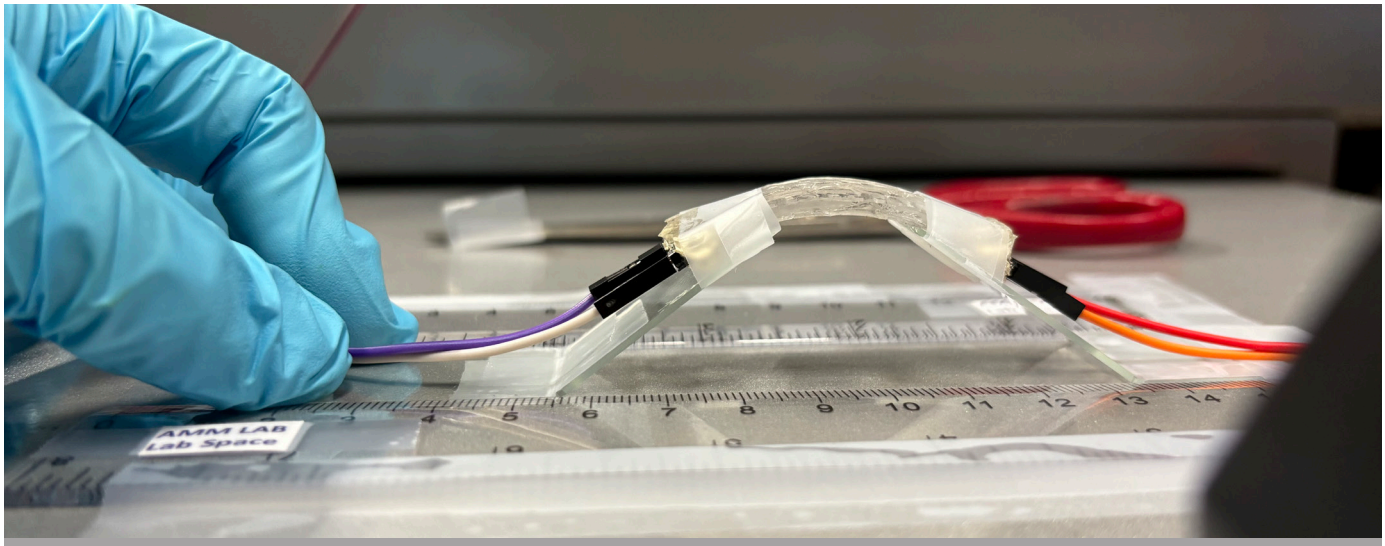
Faculty Supervisor
Mohammad Qasaimeh

Location: **NYU Abu Dhabi**

SOFT MICROFLUIDIC SENSORS FOR TACTILE SENSING IN MINIMALLY INVASIVE SURGERY

Tissue stiffness is a key indicator during surgery, helping surgeons differentiate between healthy and abnormal tissues. In minimally invasive surgeries, where precision is crucial, having a tool that accurately senses tissue stiffness is vital. This need drove my summer project, where I developed a cost-effective and easy-to-use tactile sensor for laparoscopic surgery. The goal was to enhance these procedures by providing surgeons with better feedback, improving precision and patient safety.

I created a sensor using a flexible material embedded with a liquid-filled microchannel, capable of detecting subtle changes in force and movement. After several iterations and rigorous testing, the sensor proved effective, offering enhanced feedback that could significantly improve surgical outcomes. This project highlighted the critical role of accessible technology in healthcare and fueled my passion for developing solutions that make a difference.



Experimental set-up for evaluating the bending performance of the sensor.

> **I will be continuing this project as part of the Engineering Honors Research Program, with the goal of further optimizing the sensor and integrating it into commercial laparoscopic tools.**

TARIRO GURUDZA

Major
Bioengineering

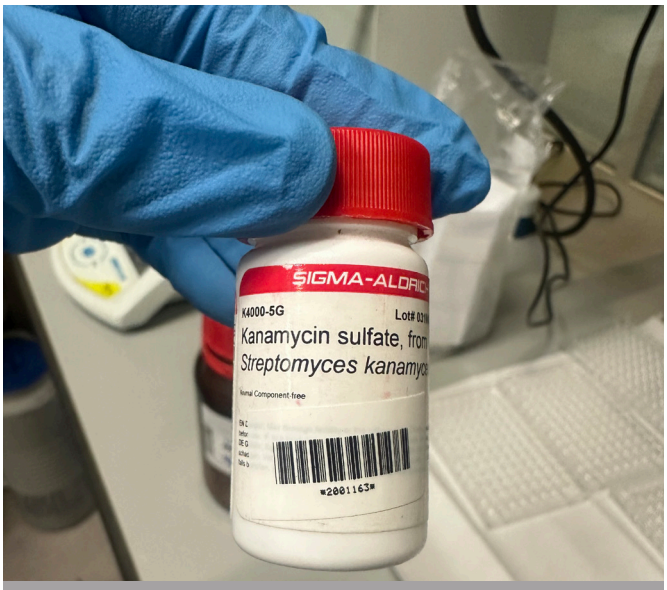
Faculty Supervisor
Wael Rabeh

Location: **NYU Abu Dhabi**

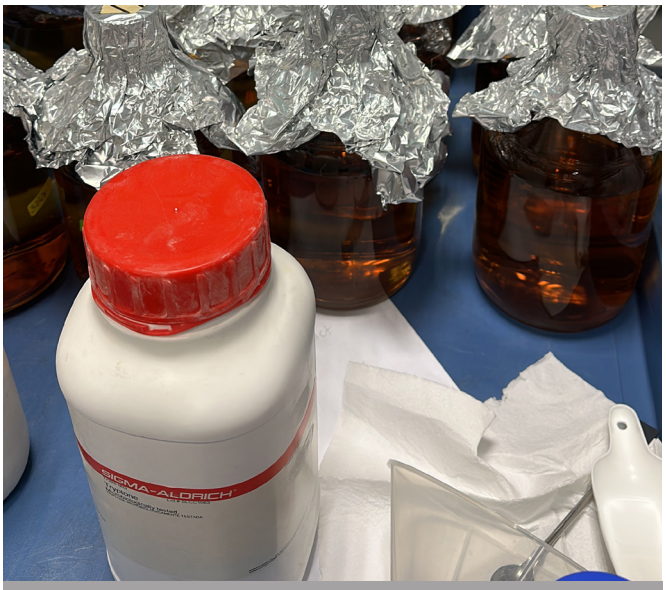
BIOCHEMICAL AND BIOPHYSICAL CHARACTERIZATION OF HEXOKINASE DOMAIN CONTAINING 1 (HKDC1) AND HEXOKINASE 3 (HK3)

My research with Professor Rabeh focused on the characterization of Hexokinase Domain Containing 1 (HKDC1), a newly identified and less understood member of the hexokinase family, which plays a crucial role in glucose metabolism.

Unlike HK1, HKDC1's role in pregnancy glucose tolerance and metabolic diseases remains largely unexplored. The research also explored HK3 in the same way as HKDC1. The study aimed to bridge this knowledge gap by examining the structural and functional similarities and differences between HKDC1 and HK1. To understand HK3 and HKDC1's biochemical properties, I used enzyme kinetics to analyze their catalytic activity, focusing on how HKDC1 and HK3 phosphorylate glucose to glucose-6-phosphate in the first step in glycolysis. This involved protein expression in E. coli, followed by affinity chromatography purification. Enzyme assays were conducted to monitor the production of glucose- 6-phosphate over time, providing insights into HK3 and HKDC1's efficiency compared to other hexokinases. Understanding HK3 and HKDC1's unique biochemical characteristics could reveal their broader role in glucose homeostasis and for HKDC1, its potential as a therapeutic target in diseases where glucose metabolism is disrupted, such as cancer.



Preparing antibiotics to create selective growth conditions for bacterial cultures used in protein expression.



Preparing growth medium to support bacterial growth for efficient protein production.

LUKE NGUYEN

Major
Film and New Media

Faculty Supervisor
Dale Hudson

Location: **France**

THE EFFECTIVE AND RELATABLE PORTRAYAL OF EMOTIONS IN 2D ANIMATED FILMS

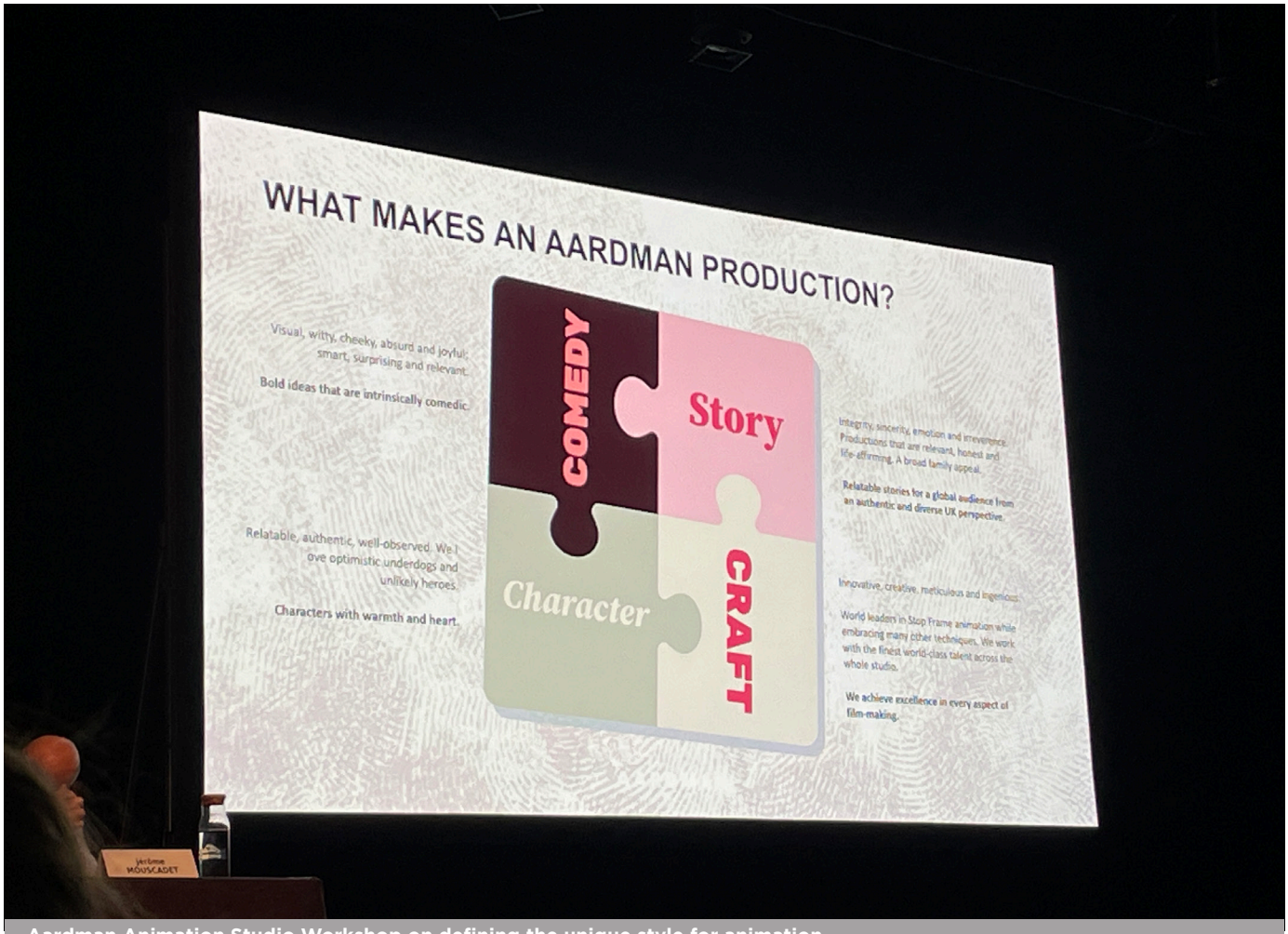
Animation is a powerful medium to explore complex emotions because it offers artistic freedom untethered to realism. My research explored a series of interrelated questions: How do independent and studio animators, writers, and directors effectively use 2D animation as a medium to depict or evoke emotional experiences in characters? What framework do they adopt while conceiving a story to tackle these complex emotions and which techniques or technology do they represent them? What methods do they adopt to research the complexities of the emotions they will portray in their films and to assess their own limitations?

The objectives were to examine how animators (1) effectively research the diverse, interconnected, and multi-layered psychological experiences, (2) determine the magnitude and complexity of the range of emotions the protagonist might have based on the story they want to tell, and (3) effectively reflect these complex emotions in a relatable manner in screenwriting.

> “This research will contribute to my existing animation projects that I have developed with my professors in my previous classes in terms of story and visual images. It will also contribute to my Capstone by laying the foundation for me to analyze stories as a driving force in an animated short.”

Final day visiting Mikros Animation Studio.

"Crafting Iconic Animation Character" - Panel Talk with Animation Directors and Writers on the process of writing characters.



Aardman Animation Studio Workshop on defining the unique style for animation.

BIVAS GHIMIRE

Major
Physics

Faculty Supervisor
Hisham Sati

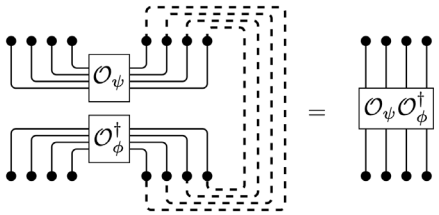
Location: **NYU Abu Dhabi**

TOPOLOGICAL PSEUDO ENTROPY

My research involved exploring topological pseudo entropy within the framework of Chern-Simons Theory. I studied the impact of local unitary action on pseudo entropy in multi-partite states. One of the investigations that I did was examining the configuration of states prepared on n-copies of boundaries, each with four Wilson lines representing fundamental representations of gauge group.

TOPOLOGICAL INTERPRETATION

The topological interpretation of the reduced transition matrix $\rho_A^{\psi|\phi}$ for a two-qubit system can be viewed as



where $\mathcal{O}_{\psi,\phi}$ are matrices corresponding to states ψ and ϕ respectively. Pseudo entropy generalizes entanglement entropy by characterizing the correlations between two quantum states $|\psi\rangle$ and $|\phi\rangle$ via the transition matrix $\rho_A^{\psi|\phi}$. Physically, it provides insight into the non-Hermitian connectivity of the reduced density matrix, capturing quantum overlaps between different states.

Topological interpretation of the reduced density matrix.

Within the two qubit states, I analyzed two different cases. Firstly, I considered topologically indistinguishable states that can be transformed into one another using braiding. Then, using literature I prepared the quantum state according to that topology. From there, I computed the pseudo entropy from one state to another and vice versa. Using analytical techniques I was able to write the pseudo entropy in terms of Riemann Zeta function. I used a similar process to find the pseudo entropy on three disjoint boundaries as well. Using similar analytic techniques, I evaluated the average pseudo entropy in the semiclassical limit and finite (rank). I also calculated the average entropies for finite (level) and the limit tends to infinity.

JENNIFER YUAN

Major
Physics

Faculty Supervisor
Ingyin Zaw

Location: **NYU Abu Dhabi**

DISENTANGLING STAR FORMATION (SF) AND ACTIVE GALACTIC NUCLEI (AGN) EMISSION IN NEARBY GALAXIES

Star formation (SF) is a crucial process in the life cycle of a galaxy and the evolution and structure of the Universe, which contributes to the emission across the electromagnetic spectrum.

To determine Star formation rate (SFR) with minimized systematic error, a multi-wavelength approach to SFR estimation is most promising. Active Galactic Nuclei (AGNs) are the most luminous continuum objects in the Universe powered by the accretion of matter onto a supermassive black hole at the center of the galaxy. AGNs can therefore be used to study how SMBHs interact with their surroundings and evolve alongside their host galaxies. Various parts of AGN contribute to the emission at various wavelengths, disentangling AGNs' relative contributions is critical for obtaining the true SFRs in active galaxies. Wavelength coverage in this project ranged from radio to optical. The final mission of this project was to apply our obtained correlation to another multiwavelength AGN catalog.

This allowed us to add SF information to the pre-existing catalog and provide a potential method to determine SFR, and SF and AGN emission contribution to other optical catalogs, and contribute to the completion of AGN catalogs.

PRIYANKA BALAMURALI

Major
Social Research and Public Policy

Faculty Supervisor
Luca Maria Pesando

Location: **Aravind Eye Hospital, India**

HOW CAN WE REIMAGINE HEALTHCARE BASED ON ARAVIND EYE HOSPITAL

I conducted research at the Aravind Eye Care System in India, exploring how their innovative healthcare model operates. They are a self-sufficient organisation achieving new heights in their mission to eradicate needless blindness.

After over a dozen interviews, visits to their eye camps, and interactions with the community, I understood how Aravind has been tailor-made to the people, culture, and economic context, playing a key role in their success. At their Madurai hospital, they treat 2,000 paying patients and 1,000 free patients every single day. On Sundays, they extend their outreach even further, setting up eye camps that serve an additional 200 patients who can't make it to the hospital.

A key factor in Aravind's success is their unique management strategy. They employ a large number of Mid-Level Ophthalmic Paramedical Staff (MLOPS), who are trained to conduct up to 75% of patient examinations. This reduces the burden on ophthalmologists, enabling them to focus on diagnosing and performing surgeries.

> **The founder of Aravind Eye Hospital has created a foundation where a patient has a right to demand healthcare at a zero-price point. When importing lenses was too expensive, he decided to manufacture them himself so healthcare remains affordable and accessible, and he set up eye camps and provided transport to those that couldn't access the main hospital. For each barrier, he radically changed the system to achieve his mission for the people. I find this attitude so inspiring and one that I want to hold closely as I navigate my career.**

Priyanka at the Aravind Eye Hospital in India.

AMINA ROTARI

Major
Arab Crossroads Studies

Faculty Supervisor
Erin Pettigrew

Location: **France**

THE ROLE OF EDUCATIONAL JOURNEYS AND THE FRENCH SCHOOL AS THE EMBODIMENT OF LAÏCITÉ IN SECOND - GENERATION FRENCH NORTH AFRICAN MIGRANTS' ARTICULATION OF IDENTITY AND TRAJECTORIES OF SOCIAL MOBILITY

In France, the educational system as it pertains to public schooling especially has long played a crucial role in the formation of a unified French identity. The enforcement of the narrative throughout one's school years that being French means being secular has a huge potential of alienating the generational immigrant population.

A problem that arises for specifically second-generation North African migrants in France is the difficulty of navigating a double identity. With this context in mind, I conducted an ethnographic research project in Paris in order to interrogate the validity of French Republican values such laïcité and mixité sociale, as well as the obstacles to social mobility in what pertains to university-level education for children of immigrants from the Maghreb. As part of my project, I interviewed people who shared their experiences having grown up in France, their thoughts on French politics and society when it comes to topics such as immigration, race, ethnicity and religion, as well as their plans for the future.

> **The most memorable aspect of the process has been the sheer diversity in perspectives and opinions I managed to learn from my respondents. They have greatly informed and shaped the direction of my research. I will be continuing this project as part of my Capstone.**

AVINASH GYAWALI

Major
Computer Science & Interative Media

Faculty Supervisor
Mark Billinghurst

Location: **University of South Australia**

ENHANCING COMMUNICATION IN MIXED REALITY REMOTE COLLABORATION THROUGH GAZE CUES AND LARGE LANGUAGE MODELS

I explored how virtual reality (VR) and artificial intelligence (AI) could enhance remote collaboration by improving communication through gaze cues. I focused on leveraging large language models (LLMs) to detect deictic language—phrases like "Can you look at that?"—and activate visual cues that directed the attention of another user within a mixed-reality environment. My goal was to streamline communication by reducing the need for traditional gestures or verbal explanations.

I developed a networked application in Unity and fine-tuned the LLama-8B model using QLoRA to increase its accuracy in recognizing relevant phrases. I also integrated OpenAI's Whisper model to convert speech to text, ensuring that the system could process conversations efficiently. By utilizing the Oculus Quest Pro's eye-tracking capabilities, I was able to render gaze lines that visually connected users to objects they were focusing on, creating a more immersive and intuitive collaborative experience.

The preliminary findings from this project suggested that combining LLMs with gaze cues could lead to more natural and efficient communication in remote settings. Although user studies were not yet conducted, the research provided valuable insights into enhancing task efficiency and interaction in mixed-reality environments.

AI-assisted remote collaboration in extended reality, where AI models run proactively in the background, facilitating user interaction in virtual reality.

SADAF HABIB

Major
Biology and Computer Science

Faculty Supervisor
Lara Donaldson

Location: **International Centre for Genetic Engineering and Biotechnology (ICGEB) South Africa**

CHALLENGES IN REGULATING THE AUXIN BIOSYNTHESIS GENE NITRILASE 2 (NIT2) BY TRANSCRIPTION FACTORS IN ARABIDOPSIS THALIANA

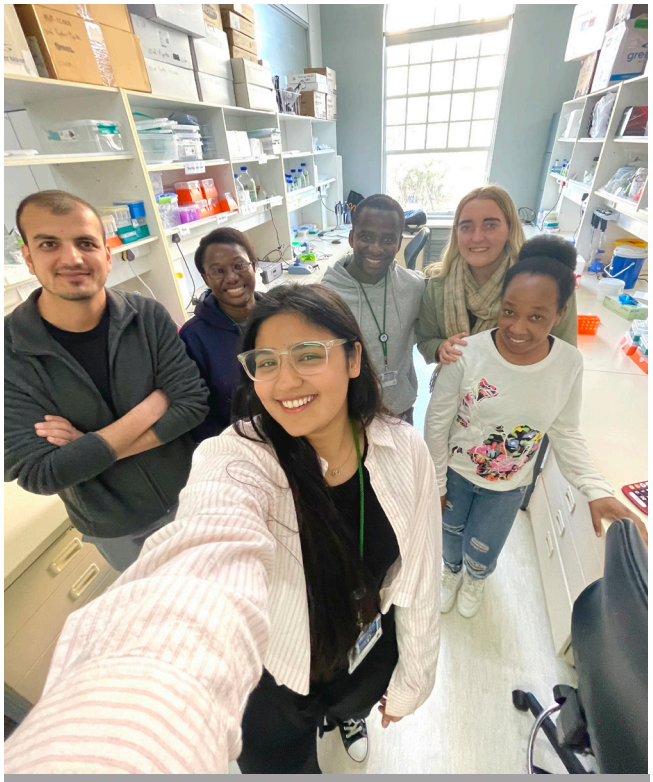
My research project focused on the regulation of the auxin biosynthesis gene Nitrilase 2 (Nit2). I specifically investigated how the transcription factor GLABRA2 (GL2) influences Nit2 expression, which is critical in auxin biosynthesis and impacts plant growth and development.

My primary task involved cloning the GL2 gene into plant expression vectors using recombinant DNA technology. This process required designing primers, amplifying the GL2 gene through PCR, and inserting it into an entry vector. I then performed a Gateway cloning reaction to transfer the gene into plant expression vectors for further experimentation. Once the cloning was successful, I conducted transient protoplast assays to assess how GL2 regulates Nit2. These assays allowed me to observe gene expression in plant cells without fully transforming the plant, offering a quicker and more controlled environment for studying transcription factor interactions.

Additionally, I harvested seeds from Arabidopsis thaliana plants to screen for homozygosity in different genetic lines, which helped in verifying the gene's inheritance patterns and its role in auxin biosynthesis.

> **My time at ICGEB helped me strengthen my molecular biology skills and build professional connections in the field. The experience has been invaluable in preparing me for my upcoming research endeavors.**

Pipetting for Gateway cloning of a transcription factor candidate.



With lab members at ICGEB.

Harvesting Arabidopsis for phenotypic analysis.

AALIA IMRAN

Major
Computer Engineering

Faculty Supervisor
Stefano Cacciatore

Location: **International Centre for Genetic Engineering and Biotechnology (ICGEB) Italy**

SPATIAL ANALYSIS OF GENE EXPRESSION IN CANCER USING ADVANCED BIOINFORMATICS TECHNIQUES

My research focused on spatial transcriptomics, a cutting-edge technology mapping gene expression while preserving tissue organization. Unlike traditional methods, which lose details about cellular environments, spatial transcriptomics retains tissue architecture, providing insights into how gene expression varies across regions. This is crucial for understanding diseases like cancer, where gene expression location impacts tumor behavior.

Using the Visium platform by 10x Genomics, which integrates histological imaging with gene expression data, I analyzed prostate and colorectal cancer tissues to uncover spatial gene expression patterns contributing to tumor growth. I developed a Python pipeline to process Visium data, creating annotation masks to mark regions such as inflammation or normal glands. For image segmentation, I applied machine learning models like Unet, UNI, and PathML to isolate these regions with precision. These technical skills allowed me to focus on specific areas of interest for further analysis.

Additionally, I used the SpatialData package to perform spatial queries and visualize gene expression within tissue structure. I processed large datasets, aligned microscopic images with gene expression data, and extracted detailed gene information. Tools like PCA and KODAMA graphs helped visualize spatial gene expression distributions, providing insights into tumor environments and cancer progression.

These methods showcased my skills in Python programming, machine learning, spatial analysis, and data visualization.

> **“I developed strong skills in Python programming, data processing, machine learning, and spatial analysis, as well as experience working with high-dimensional biological datasets and advanced visualization techniques. My work demonstrates my ability to combine computational tools with biological insights to address complex research questions.”**

Aalia at Cape Town's ICGEB lab.

BISHA SHAHID

Major
Biology

Faculty Supervisor
Stéphane Boissinot

Location: **NYU Abu Dhabi and Thailand**

COMPARATIVE ANALYSIS OF RED PALM WEEVIL POPULATIONS IN THAILAND AND THE UNITED ARAB EMIRATES: LINKING PHENOTYPIC AND GENOMIC VARIATION

The Red Palm Weevil (RPW; *Rhynchophorus ferrugineus*) is a pest affecting palm species across diverse climates and farming systems. RPW, which infests palm species in the Aceraceae family, such as date and coconut palms has become a significant agricultural threat in regions like the Arabian Gulf, North Africa, and the Mediterranean area. The rapid spread of the RPW has been facilitated by the development of palm monocultures and the trade of palm trees. The Gulf region is particularly affected and the RPW invasion has caused substantial economic loss for date palm farmers. It is believed that the RPW originated in South and Southeast Asia, where it occupies tropical environments, and recently invaded the MENA region and Europe, two areas with drastically different environmental conditions than in the native range. My research focused on understanding how this invasive species adapted to novel environments during its global dispersal.

To address this question, my research explored phenotypic variations that contribute to the RPW's adaptability with the goal of determining the genomic basis of adaptive variation.

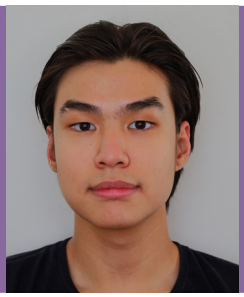
> **My time in Thailand immersed me in the country's rich culture and lifestyle while deepening my understanding of the cultural significance of this pest across various regions. Beyond technical proficiency, this project taught valuable lessons in experimental design and innovative problem-solving, providing a holistic understanding of the research process from sample collection to data interpretation.**

Lab members from the Boissinot Lab exploring the Sanctuary of Truth in Thailand during summer fieldwork, 2024.

Field sampling of weevils from Thailand.

Tissue extraction from weevil specimens collected from Pattaya and maintained in Bangkok for genetic analysis.

Animal Genomics and Bioresource Research Center at Kasetsart University, one of our primary research facilities in Thailand.



FATIMA FAROOQ, ABAY ORALOV

Major
Computer Engineering

Faculty Supervisor
Ramesh Karri

Location: **NYU New York**

BENCHMARKING LLMS FOR HARDWARE GENERATION

Large Language Models (LLMs) have found applications across various domains, including hardware design, where they enable agile design processes by generating Register-Transfer Level (RTL) code from natural-language instructions. However, current research primarily focuses on evaluating LLMs for accuracy in basic hardware designs, often using examples from the educational resource HDLBits. Some recent studies have extended this to RTL repositories, but they only test LLMs' ability to predict random lines within a module, rather than generating entire modules. Prior work does introduce new and comprehensive datasets but for the purpose of fine-tuning existing models, rather than for providing benchmarks for comprehensive evaluation of the capabilities of these models. Additionally, while prompt engineering has been extensively explored for software code generation, there is little to no work addressing its application in hardware design. Our work bridges this gap by first designing and evaluating various prompting frameworks for hardware design. Based on these evaluations, we selected the most effective frameworks to test LLMs on Verilog projects with real-world relevance across multiple different LLMs. We introduced a comprehensive benchmark that includes hierarchical Verilog projects commonly used in hardware design, such as the implementation of RISC-V and AXI protocol. This approach provides a more holistic evaluation of LLM capabilities in generating complex hardware designs.

NYU TANDON SCHOOL OF ENGINEERING

Benchmarking LLMs for Hardware Generation

Fatima Farooq,[1] Abay Oralov[2]

1. Computer Engineering, NYU Abu Dhabi 2. Computer Engineering, NYU Abu Dhabi

Abstract

Language Models (LLMs) have found applications in hardware design, where they **enable agile design processes** by generating Register-Transfer Level (RTL) code from natural language instructions. Our research presents a **comprehensive evaluation of LLMs** in generating complex hardware designs. We implemented and tested various **prompt frameworks** for Verilog code generation, assessing their effectiveness in producing high-quality designs. Additionally, we developed a **robust benchmark suite** comprising hierarchical Verilog projects that are widely used in hardware design. These benchmarks are deployable on the most effective frameworks, providing a **thorough assessment of LLMs' capabilities** in this domain,

Background

Current research in **benchmarking the LLMs is limited** for hardware design. Recent efforts, such as Verilog Eval[1] and RTLLM[2], have expanded this evaluation but **still rely heavily on an educational resource website, HDLBits**. While there has been work to develop more complex and comprehensive hardware design datasets, this work primarily focuses on fine-tuning LLMs rather than testing them on these datasets. RTL-Repo[3] aims to test LLMs on larger hardware projects but focuses on predicting random lines within a module instead of generating entire modules. Additionally, although effective prompting strategies have been suggested by previous papers, such as RTLLM[2], there has been **a lack of research on how different frameworks** used in software code generation **perform for hardware generation**. Our work aims to bridge these gaps in the use of LLMs for hardware design.

Methodology

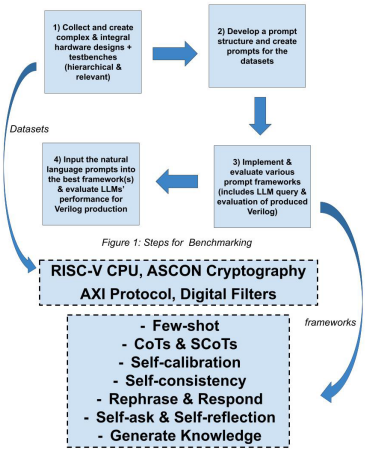


Figure 1: Steps for Benchmarking

Results

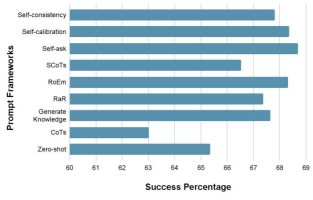


Figure 2: Average Percentage of Tests Passed Across Each Prompt Framework for ChatGPT4o on HDLBits Problem

Key Findings & Future work

- **Most frameworks outperform the standard zero-shot approach**– restructuring of the prompts often results in more accurate Verilog code production.
- **Self-ask** yielded the best results, **68.69%**. The self-ask method involves allowing the LLM to query any critical information necessary to implement Verilog modules.
- Next, we aim to **evaluate the prompt frameworks with additional various LLMs**
- We have **developed prompts** and are **creating test benches** for all modules in all datasets. Next step is to **integrate** these prompts and test benches **into the self-ask framework**

Works Cited

[1] M. Liu, N. Pinckney, Brucek Khailany, and H. Ren, "Invited Paper: VerilogEval: Evaluating Large Language Models for Verilog Code Generation," Oct. 2023, doi: https://doi.org/10.1109/iccad57390.2023.10323812.
[2] YY. Lu, S. Liu, Q. Zhang, and Z. Xie, "RTLLM: An Open-Source Benchmark for Design RTL Generation with Large Language Model," Jan. 2024, doi: https://doi.org/10.1109/asp-dac58780.2024.10473904.
[3] A. Allam and M. Shalan, "RTL-Repo: A Benchmark for Evaluating LLMs on Large-Scale RTL Design Projects," arXiv.org, May 27, 2024. https://arxiv.org/abs/2405.17378 (accessed Aug. 01, 2024).

Acknowledgements

We thank Professor Ramesh Karri and Jason Blocklove for their consistent guidance. We also thank NYU Tandon School of Engineering's Office of Undergraduate Academics for the research opportunity.

YUGOO LU

Major
Mathematics

Faculty Supervisor
Gabor Moussong

Location: **Hungary**

UNVEILING THE SECRET OF QUANTUM COMPUTING WITH TOPOLOGY

I spent the summer at the Budapest Semesters in Mathematics. As part of my research project, I acquired point-set topology, geometric topology, and algebraic topology, as well as worked on applications in topological quantum computing.

Topology can be roughly classified into three fields: point-set, geometric, and algebraic. Point-set topology includes the definition of a topological space, basis of a topology, homeomorphisms, topological invariants (connectedness, compactness, dimension). Geometric topology deals with geometric objects viewed as topological objects, and can be studied with surface diagrams and cut-and-paste techniques. Lastly, algebraic topology studies homotopy, homotopy equivalence, fundamental groups, homology, cohomology, and so on. These three subfields are all central fields of study in modern mathematics and are the foundation of other subjects in mathematics, too.

After acquiring topology, I looked at its application in topological quantum computing and raised interesting research questions. Firstly, I studied some axioms of topological quantum field theory. Then, I looked at how one of the representations of the braid group leads to the construction of a universal topological quantum computer. Finally, I looked at a differential geometric representation of the braid group, and studied if this representation leads to a construction on a universal topological quantum computer.

> “This summer research experience gave me a strong foundation in topology and has prepared me for my Capstone project in topological quantum computing.”

Receiving the Budapest Semesters in Mathematics certificate outside the school.

AMIRA MUSTAFINA

Major
Biology

Faculty Supervisors
Vittorio Venturi and Iris Bertani

Location: **International Centre for Genetic Engineering and Biotechnology (ICGEB) Italy**

REVITALIZING SOIL BIODIVERSITY THROUGH MICROBIOME TRANSPLANTATION

My summer research internship was a part of a bigger project aimed at restoring soil fertility by enhancing the microbiological biodiversity of degraded and exploited soils. The main aim was to transplant root microbiomes from healthy plants in new seed that will be sown into poor soil. This approach targets the restoration of soil structure, nutrient density, and carbon levels, thereby increasing soil resilience to environmental challenges and promoting sustainable agriculture. The project is focused on three core biological principles: the essential role of microorganisms in plant health, the advancements in modern DNA sequencing technologies, and the application of bioinoculants and biostimulants in agriculture. Microorganisms, particularly those in the rhizosphere, play a crucial role in nutrient cycling, plant growth, and soil health.

The primary method used in the project is microbiome transplantation, done using seed coating techniques and root exudate hydrolyzates. In addition, I've used advanced next-generation sequencing and biostatistics tools like R and Python to analyze microbial communities (bacteria, viruses, fungi). This technique allows for detailed profiling of microbial populations, enabling me to monitor changes in soil biodiversity and the success of the transplantations. My part of the research involved controlled laboratory experiments, and I performed DNA purification from rhizospheric samples to evaluate, with amplification and sequencing of 16S rRNA using Illumina methodology, their biodiversity. Barley, chosen for its economic and agricultural relevance, served as the model crop. In controlled conditions, various soil treatments were tested to optimize the microbiome transplantation process.

Amira and other NYUAD students at the International Centre for Genetic Engineering and Biotechnology lab.

SCARLETTE JIMÉNEZ

Major
Arab Crossroads Studies and Political Science

Faculty Supervisor
Justin Stearns

Location: **Peru and Brazil**

PRESERVING ARAB HERITAGE IN THE DIASPORA: A COMPARATIVE STUDY OF ARAB COMMUNITIES IN PERU AND BRAZIL

I conducted an ethnographic study examining how Arab communities in Peru and Brazil preserve their cultural heritage, focusing on second and third-generation migrants. As previous research has explored Arab migration to Latin America and the integration of these communities into their host societies, this study aimed to understand how ethnic ties shape identity formation in these specific diaspora contexts. I conducted fieldwork in Lima and São Paulo, where I interviewed individuals and gathered observational data from key cultural and religious institutions, such as the Palestinian Embassy in Peru and the Mosque of Brazil in São Paulo. Additionally, I consulted archival materials at the Club Union Arabe Palestino and the National Library in Peru.

> **By examining language, cuisine, religion, and festivities, this project offers insights into how diaspora communities navigate the preservation of their heritage while integrating into diverse sociocultural environments, contributing to broader discussions on migration and identity formation. This project, therefore, provides valuable insights into the complexities of identity and cultural preservation in diaspora contexts.**

AMEEN VADAKKEKARA

Major
Computer Engineering

Faculty Supervisor
Debdeep Mukhopadhyay

Location: **Indian Institute of Technology, Kharagpur**

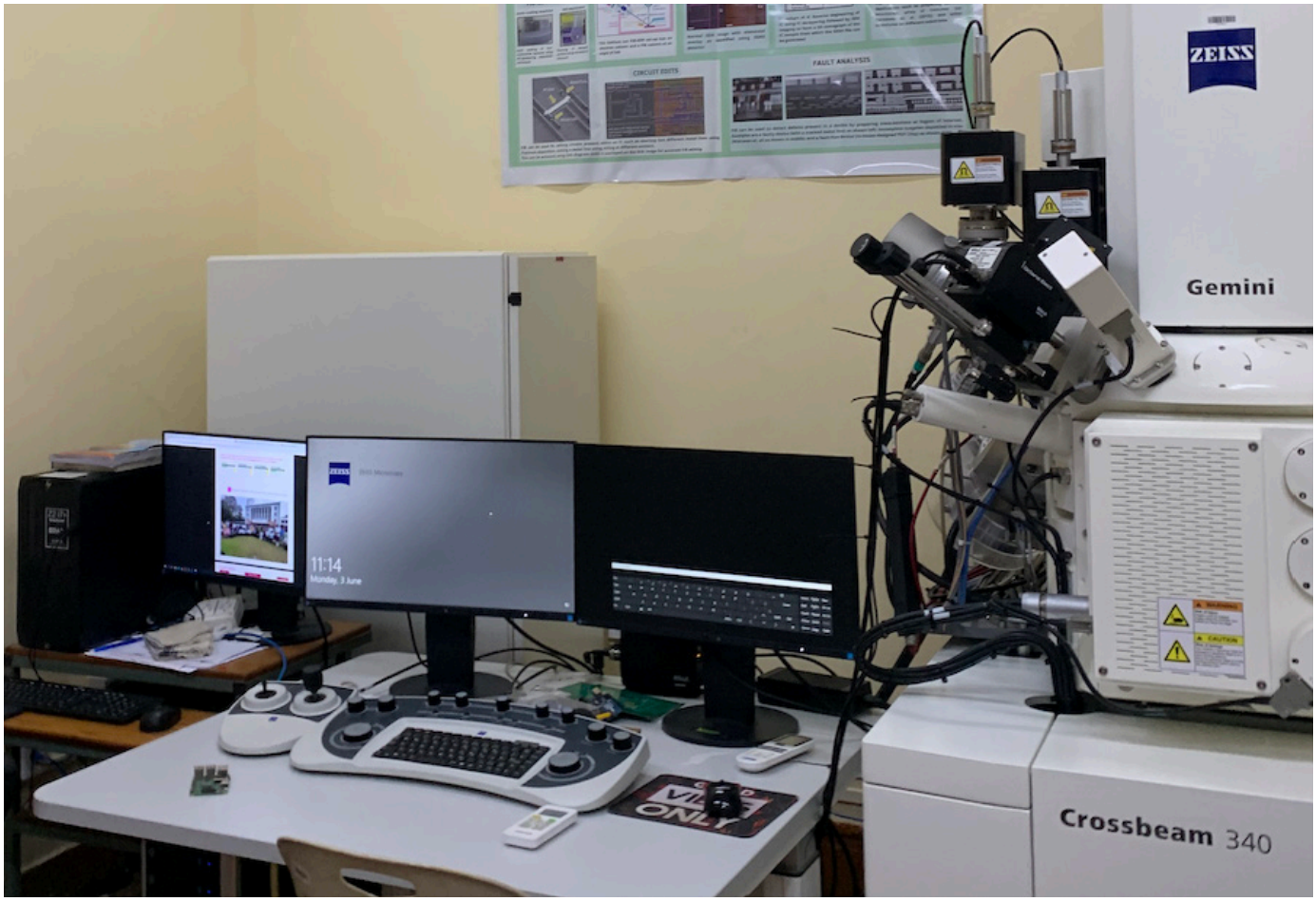
INVESTIGATING SOFTWARE-BASED POWER SIDE-CHANNEL ATTACKS ON CRYPTOSYSTEMS

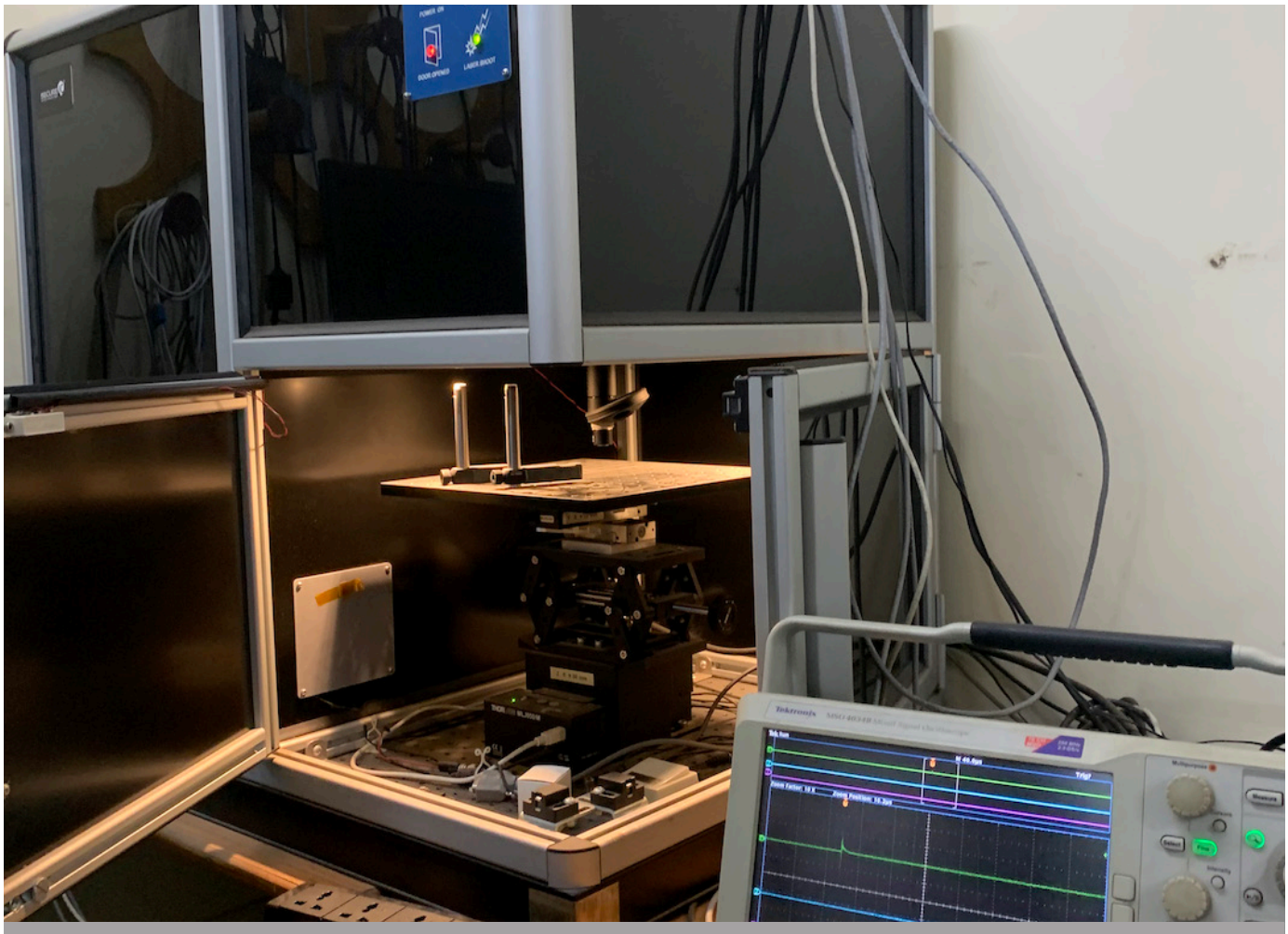
Microarchitectural attacks on cryptosystems are a critical area of study in hardware security, focusing on exploiting vulnerabilities within the microarchitecture of processors to compromise cryptographic operations. During my summer research internship at IIT Kharagpur, I investigated these attacks, specifically targeting software-based power side-channel attacks. These attacks exploit variations in power consumption during cryptographic operations to reveal sensitive information processed by cryptosystems.

My project involved analyzing how power consumption patterns could be used to uncover cryptographic keys and other confidential data. I employed measurement tools to monitor the power usage of cryptographic processes, such as encryption and decryption. By correlating these power measurements with data processing activities, I was able to identify patterns and variations indicative of potential information leakage.

One of the significant aspects of my research was the extraction of cryptographic keys through careful analysis of power consumption during scalar multiplication operations in Elliptic Curve Cryptography. I also compared vulnerabilities across different processor architectures, including Intel and Apple Silicon, to understand how various platforms handle cryptographic operations and to identify specific weaknesses.

> **The research highlighted the complexity of securing cryptosystems against power side-channel attacks and underscored the necessity for robust security measures. My findings emphasized the need for a comprehensive approach to address both hardware and software vulnerabilities, ultimately contributing to the development of more secure cryptographic systems.**





Workstations at Secured Embedded Architecture Laboratory.

GYEONGEUN NOH

Major
Chemistry

Faculty Supervisor
Lawrence Banks

Location: **ICGEB Italy**

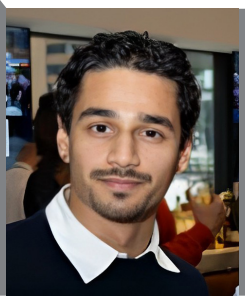
INVESTIGATING THE IMPACT OF P53 POLYMORPHISM ON E6-MEDIATED DEGRADATION IN HPV PATHOGENESIS

Human Papillomaviruses (HPVs) are a major cause of human tumours, with high-risk types 16 and 18 being particularly linked to cervical cancer, the fourth leading cause of cancer-related death in women. In the HPV life cycle, two viral oncoproteins, E6 and E7, play crucial roles by inducing the degradation of the p53 tumour suppressor protein. p53 is a key regulator of cell proliferation, and its inhibition or degradation by E6 disrupts the G2/M checkpoint in mitosis, preventing p53 from inducing growth arrest or apoptosis in infected cells. This disruption facilitates the survival and replication of HPV-infected cells.

Disrupting the interaction between E6 and p53 has been identified as a potential therapeutic strategy for combating HPV-driven tumorigenesis. This project focused on investigating the impact of the S47 and Y107W variants of the TP53 gene, prevalent in African-descent populations, on the degradation of p53 by the E6 oncoprotein in high-risk HPV types 16, 18 and 58. My experiments utilized various biochemical and molecular cell biology techniques, including plasmid purification, transfection of H1299 cells, SDS-PAGE, Western blotting, and immunofluorescence.

One of the most intriguing findings was from the western blot of transfected cells where the p53 isoforms showed reduced degradation by the E6 oncoprotein compared to the wild-type, at varying levels across different HPV types. By better understanding the mechanism and how the binding affinity between E6/E6AP and p53 is affected by these single nucleotide polymorphism, we can identify potential targets for therapeutic interventions aimed at inhibiting tumour progression in HPV-driven cancers.

> **“Meeting and interacting with leading scientists at the Arturo Falaschi Conference ICGEB DNA Tumour Virus Meeting was an amazing experience. Working alongside researchers and PhD students has been invaluable in building meaningful connections and gaining insights that will benefit my academic and professional journey.”**



JAIDEN MATHARU

Major
Legal Studies

Faculty Supervisor
Richard M. Hendler

Location: **NYU New York**

ENTREPRENEURIAL ECOSYSTEMS IN FOCUS: ANALYZING AND BRIDGING THE LEGAL AND REGULATORY DIVIDES BETWEEN THE UAE AND NEW YORK FOR EARLY-STAGE STARTUP ADVANCEMENT

This study's objective was to conduct a thorough comparison between the legal frameworks of the UAE and New York, pinpointing both unique challenges and common hurdles that early-stage startups encounter. By examining how differing legal and regulatory landscapes shape the entrepreneurial ecosystem, this research aimed to assess their impact on startup lifecycles from inception to expansion. The comparative analysis sought to identify areas for optimization within each legal system, proposing a series of legal reforms and best practices. These recommendations aim to leverage the strengths and address the weaknesses of both environments, providing lawmakers and regulatory bodies with actionable insights to foster a more supportive and efficient environment for early-stage startups. This endeavor not only contributes to the specific study regions but also enriches the global discourse on international business law and entrepreneurship.

> **My research not only allowed me to explore potential career paths and learn the nuances of the start-up scene in NYC, but helped foster a great community that I can rely on throughout my entrepreneurial pursuits.**

ABBAS RAZA

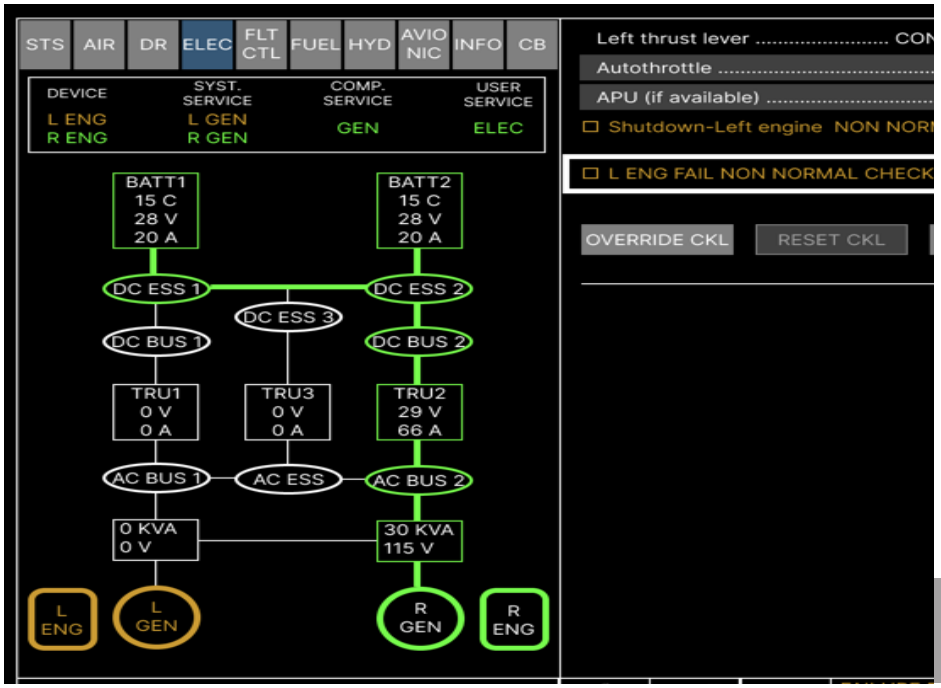
Major
Computer Engineering

Faculty Supervisor
Jeremy Cooperstock

Location: **McGill University, Canada**

COMPARING SPEECH AND NON-SPEECH INTERACTION PARADIGMS FOR PILOT-AUTOMATION INTERACTION

My primary role was to design and implement a speech interface for a single pilot to interact with during emergency procedures known as the "Automatic Failure Resolver" (AFR). The AFR is an autonomous system meant to replace the role of the monitoring pilot during emergency situations. It performs tasks such as reporting active alarms, assessing situations, and performing the checklist procedure that occurs on the flight during abnormal events. To investigate if this was a feasible solution, I simulated a flight scenario by implementing front and back-end software to use for a within-subjects study involving pilots to gauge the effects of the design. For much of this project, I worked with speech technologies, which exposed me to various AI paradigms including natural language processing. This project was part of a larger effort at the lab to ensure that the transition to SPO technologies does not increase the main pilot's workload by automating routine monitoring tasks, providing intuitive verbal interaction, and focusing on emergency procedures where workload is typically highest. By leveraging speech recognition and natural language processing technology, the AFR allows for efficient, human-like interaction that reduces the need for pilots to engage in the manual data entry procedure that occurs in a two-pilot aircraft.



Design of AFR User Interface on Figma.

VLADISLAV ZAPROMYOTOV

Major
Computer Engineering

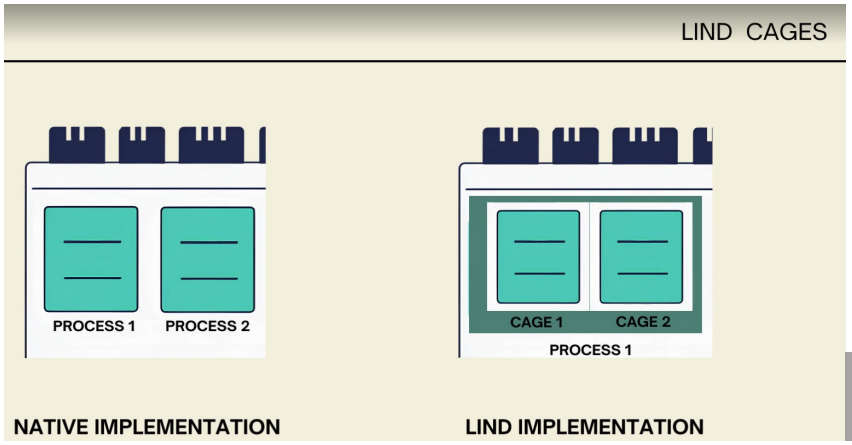
Faculty Supervisor
Justin Cappos

Location: **NYU New York**

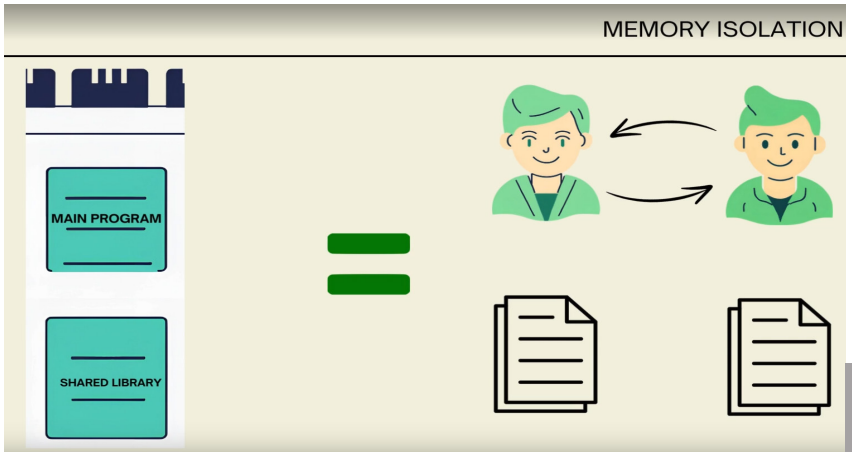
MEMORY ISOLATION INSIDE THE LIND SANDBOX

This project aimed to prevent libraries from accessing the main program's entire address space using the memory isolation principle via the Remote Procedure Call (RPC) mechanism inside the Lind sandbox based on the recent security incident, named "xz utils backdoor". Lind is a single-process sandbox that allows the safe execution of programs by providing a trusted subset of the POSIX API written in a memory-safety-oriented Rust language.

The first step was to separate OpenSSH and systemd into two different processes and establish a communication channel via RPC in the native system to prevent liblzma from ending up in the same address space as OpenSSH. This approach was expected to be considerably slower because of the performance overhead required to communicate the two processes. This is where the Lind sandbox came into play. Its concept of cages and more efficient IPC mechanism allowed us to run the two programs in complete isolation from each other while avoiding the performance overhead because the two programs were still running in the same process for the operating system.



RPC implementation inside the Lind sandbox using the concept of cages.



Memory isolation between the shared libraries and the main program.

ARUZHAN ZHAMALBEK, DILNAZ UTEMISSOVA

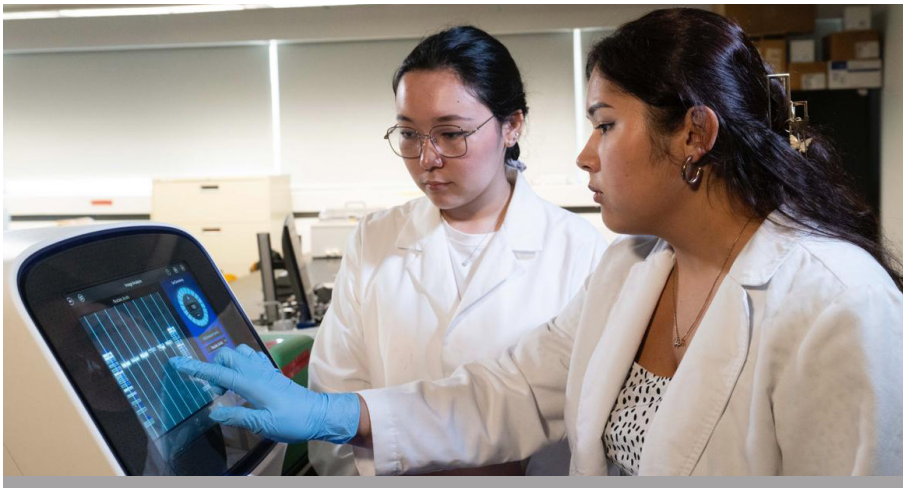
Major
Bioengineering

Faculty Supervisor
Nikita Grigoryev

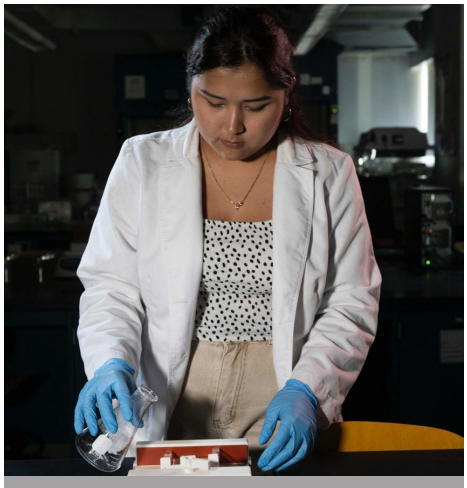
Location: **NYU New York**

CRISPR/CAS9-MEDIATED TAGGING OF TUBB3 WITH RED FLUORESCENT PROTEIN TO INVESTIGATE ITS ROLE IN CANCER CELL DYNAMICS

The TUBB3 gene, or Tubulin Beta-3 Chain, is crucial for the development of the central and peripheral nervous systems and serves as a marker of neuronal differentiation. Its elevated expression is associated with various cancers, particularly neurogenic tumors, highlighting its importance in cancer research. This study utilizes CRISPR/Cas9 genome editing technology to integrate a Red Fluorescent Protein (RFP) tag into the TUBB3 gene within cancer cell lines, enabling the visualization of TUBB3 gene activity and providing insights into its role in cancer progression. Guide RNAs targeting the TUBB3 coding region were designed and transfected into cancer cells along with donor DNA and Cas9 nuclease. The donor DNA was engineered to include a 2A self-cleaving peptide to preserve the natural folding and localization of the TUBB3 protein, maintaining its native function. The gene editing process utilized Homology-Directed Repair (HDR) and was followed by PCR amplification with custom-designed homology arm primers and Phusion™ Flash High Fidelity PCR Master Mix to ensure accuracy and minimize errors. The successful incorporation of the RFP tag was confirmed through fluorescence microscopy and genome sequencing. The Illumina DNA Prep Protocol and iSeq 00 platform were employed for high-throughput sequencing of the edited genomic regions, involving tagmentation, post-tagmentation cleanup, amplification, and library preparation. This research provides a novel method for tracking TUBB3 activity in cancer cells, offering valuable insights into its role in oncogenesis and establishing a foundation for developing targeted therapies.



Analyzing the results of Gel Electrophoresis.



Casting a gel to visualize PCR products.

CRISPR/Cas9-Mediated Tagging of TUBB3 with Red Fluorescent Protein to Investigate Its Role in Cancer Cell Dynamics

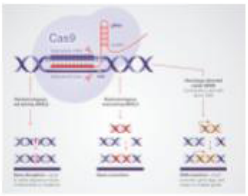
Aruzhan Zhamalbek[1], Dilnaz Utemissova[1], Dr. Nikita Grigoryev[2]
1. Bioengineering, NYU Abu Dhabi 2. Department of Chemical and Biomedical Engineering, NYU Tandon School of Engineering

Abstract

The TUBB3 gene, crucial for nervous system development, is linked to neurogenic tumors. This study uses CRISPR/Cas9 to edit TUBB3 by adding an RFP tag. Guide RNAs, donor DNA, and Cas9 nuclease were transfected into cancer cells, with a 2A peptide in the donor DNA preserving TUBB3's function. Homology-Directed Repair and PCR verified accuracy, and genome sequencing confirmed RFP integration. This approach offers a new way to visualize and study TUBB3's role in cancer progression.

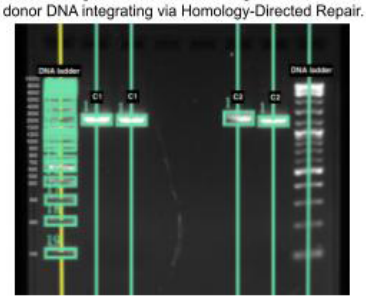
Background

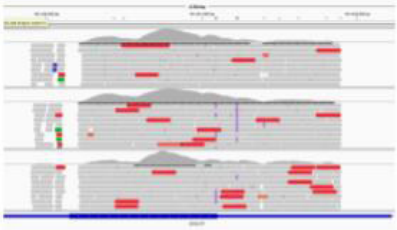
The TUBB3 gene encodes the Tubulin Beta-3 Chain, a critical protein in the development and function of the central and peripheral nervous systems. It plays a vital role in neuron differentiation and is commonly used as a neuronal marker. Elevated TUBB3 expression is associated with various cancers, particularly neurogenic tumors, making it significant in cancer research. This study aims to explore the role of TUBB3 in cancer by utilizing CRISPR/Cas9 technology to edit and tag the gene, enabling detailed functional analysis.



Methodology

2 sets of guide RNAs: C1 and C2 were designed to target specific regions within the TUBB3 gene, ensuring precise cutting by the Cas9 nuclease and minimizing off-target effects. PCR was used to amplify the TUBB3 gene regions surrounding the CRISPR cut sites, employing high-fidelity reagents for accurate DNA amplification. Gel electrophoresis was performed to verify the correct amplification of the TUBB3 gene fragments by separating and analyzing the DNA based on size. Cancer cells were transfected with the CRISPR/Cas9 components, including gRNAs, Cas9 nuclease, and donor DNA with the RFP tag, to enable genome editing. CRISPR/Cas9 technology was utilized to introduce an RFP tag into the TUBB3 gene, with Cas9 creating double-strand breaks and donor DNA integrating via Homology-Directed Repair.





Results

High-throughput sequencing using the Illumina iSeq 100 platform confirmed the successful integration of the RFP tag into the TUBB3 gene by analyzing the edited genomic regions.

Future Work

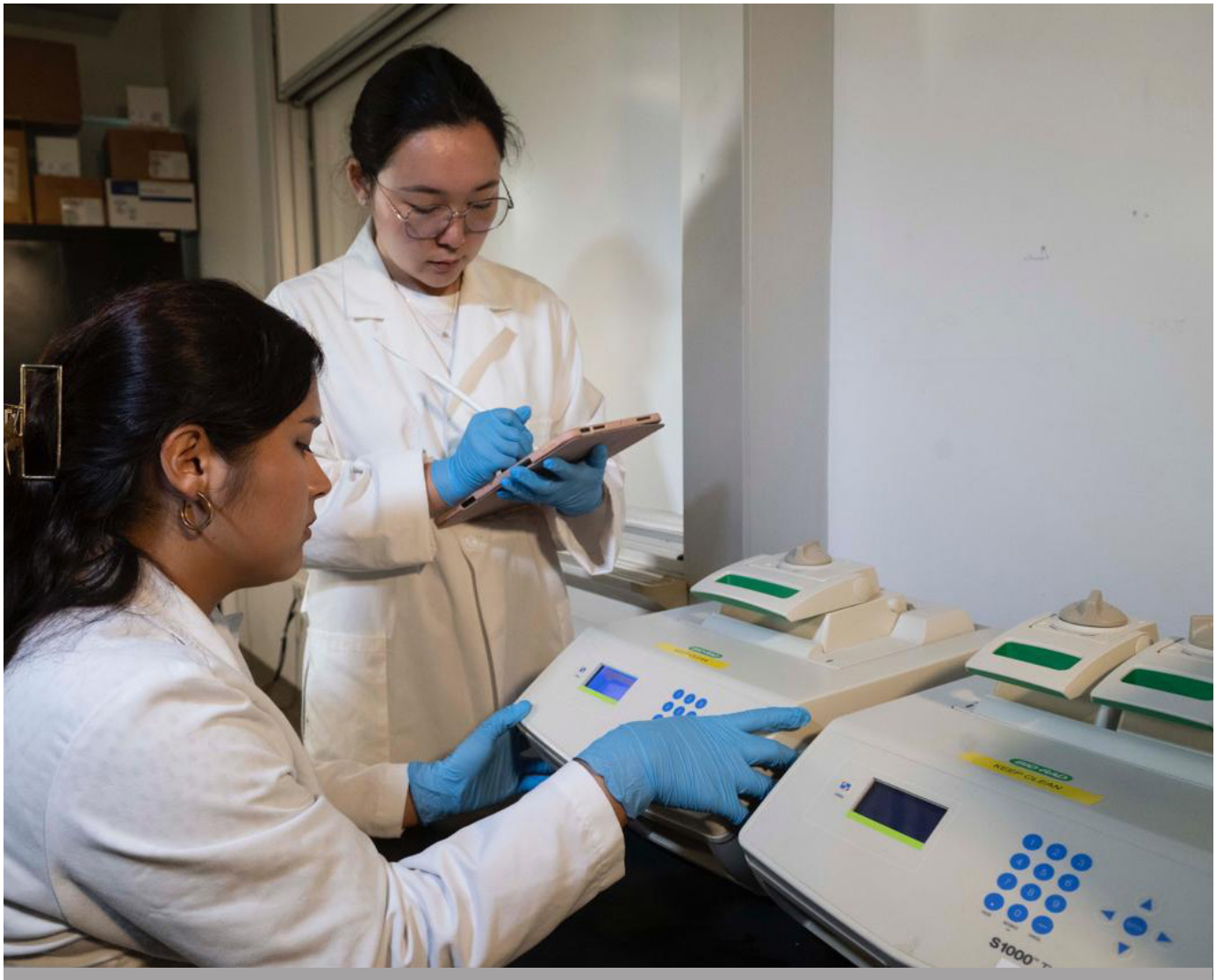
Future work includes bioinformatics analysis to characterize genetic variations from sequencing data and studying the tagged TUBB3 gene's role in tumor progression across cancer cell lines.

Work Cited

Theodorakis, N. G., & Cleveland, D. W. (1992). "Increased stability of microtubules from vinblastine-resistant cells is associated with tubulin mutations that may encode for altered contact between subunits." Journal of Cell Biology, 119(5), 1253-1260.
Leandro-García, L. J., Leskelä, S., Landa, I., Montero-Conde, C., López-Jiménez, E., Letón, R., ... & Robledo, M. (2010). "Tumoral and tissue-specific expression of the major human β-tubulin isotypes." Cytoskeleton, 67(4), 214-223.

Acknowledgement

The authors thank NYU Tandon School of Engineering's Office of Undergraduate Academics for their generous funding of the project, as well as NYU Tandon's Department of Chemical and Biomolecular Engineering and NYU Abu Dhabi for their support throughout the project.



Preparing a PCR reaction to create custom template DNAs for CRISPR.

NURBERGEN AITMUKHANBETOV

Major
Mechanical Engineering

Faculty Supervisor
Iskender Sahin

Location: **NYU New York**

ADVANCING GLAUCOMA TREATMENT: INNOVATIVE DRAINAGE DEVICES TO PREVENT HYPOTONY

My research addressed glaucoma, a progressive eye disease affecting over 100 million people globally. Despite available treatments, such as the Ahmed Glaucoma Valve (AGV), postoperative complications like hypotony (low intraocular pressure) invoke improved solutions.

I developed two next-generation drainage devices designed to outperform the AGV. These devices feature a unique feedback mechanism ensuring a complete closure to prevent over-drainage and hypotony at all stages.

> I plan to continue this research as part of my Capstone Project. Together with my team, we intend to conduct numerical simulations on all the new valve designs, as well as in vitro testing, to identify the most efficient drainage devices. If our comparative experiments yield satisfactory results, we plan to collaborate with New World Medical Inc., one of the leading producers of valved anti-glaucoma devices, to further continue our experiments in an in vivo setup.

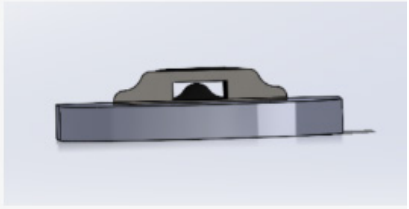
Our solutions:

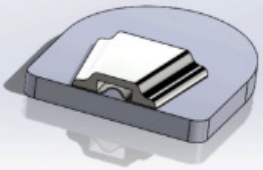
#3 NC - AGV IMPROVED

01 Single membrane system

02 Improved open closing mechanism

03 Preserved dimensions





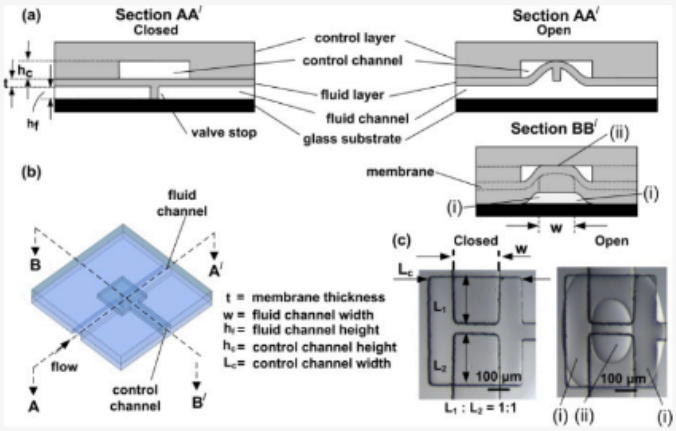
Our solutions:

#1 NC - NORMALLY CLOSED VALVE

01 Single membrane valve mechanism

02 Closing mechanism: control channel

03 More freedom to adjust opening pressure (membrane thickness)



Proposed glaucoma drainage device designs.

YAAKULYA SABBANI

Major
Computer Science & Interactive Media

Faculty Supervisor
Asif Equbal

Location: **NYU Abu Dhabi**

QUANTUM PREDICTIVE ANALYTICS: DEPLOYING HYBRID DEEP LEARNING ARCHITECTURES FOR STATE TRANSITION MODELING IN QUANTUM SYSTEMS

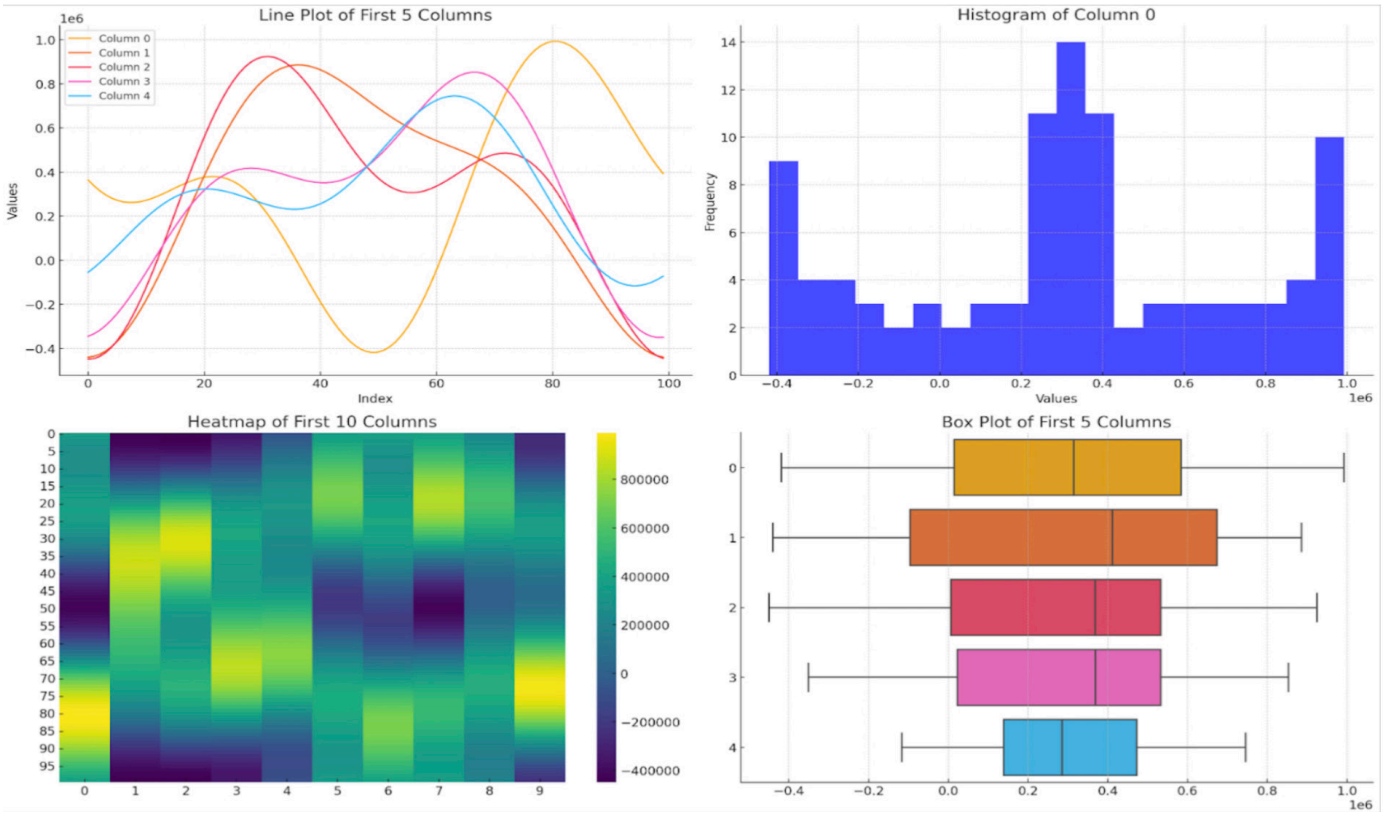
I explored the intersection of machine learning and quantum computing to enhance predictive modeling of quantum state transitions. Tackling the challenges posed by the high-dimensional nature of quantum data, I designed a hybrid deep learning architecture that combined Convolutional Neural Networks (CNNs) for processing spatial data with Recurrent Neural Networks (RNNs) for capturing temporal dynamics. To further improve the model's accuracy and stability, I incorporated ensemble techniques like boosting and bagging, ensuring robust and reliable predictions.

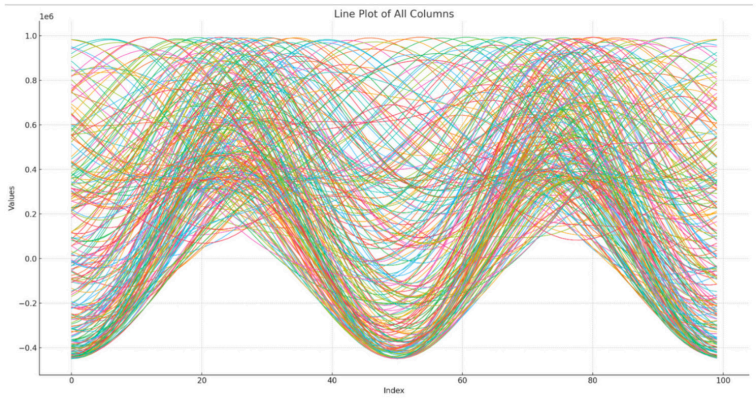
The datasets I worked with comprised two billion complex Hamiltonian parameters derived from quantum experiments (SpinEV) — are essential for understanding the wave-energy relationships and the evolution of quantum systems. I applied advanced preprocessing techniques, including normalization and strategic feature extraction, to maximize the model's efficiency and interpretability. This preparation laid the groundwork for more precise and meaningful insights into quantum state dynamics.

For validation, I implemented a rigorous 10-fold cross-validation process, achieving a validation accuracy consistently above 85%. This approach demonstrated the robustness and generalizability of the model. Compared to traditional methods such as logistic regression and single decision trees, which achieved only about a 25% reduction in Mean Squared Error (MSE), my model outperformed these benchmarks significantly, reducing MSE by over 50% to an impressive value of 0.012. These results highlight the potential of hybrid deep learning in tackling the complex demands of quantum data modeling.

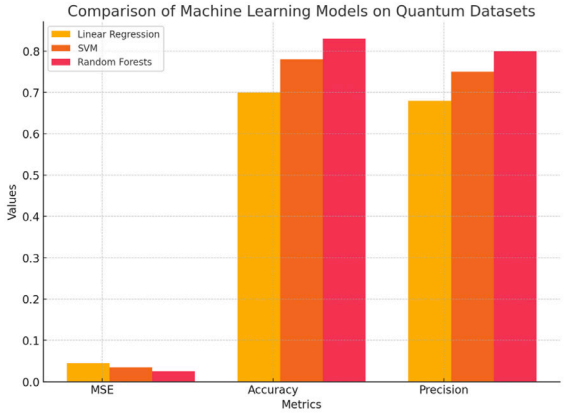
> **This research has been a remarkable journey into the world of quantum computing, combining the intricacies of quantum mechanics and the potential of machine learning.**

> Looking ahead, I am excited to contribute to the fields of quantum computing and cybersecurity by addressing real-world challenges such as quantum cryptography and secure communication systems. This project has not only laid a strong foundation for my future endeavors but has also opened doors to new opportunities for innovation and discovery. It represents the start of a lifelong commitment to exploring the most complex questions at the intersection of technology and science.





Wave graph representation of Final.dat file along with HamZ_12.dat



AYMANE OMARI

Major
Computer Science and Economics

Faculty Supervisor
Luca Maria Pesando

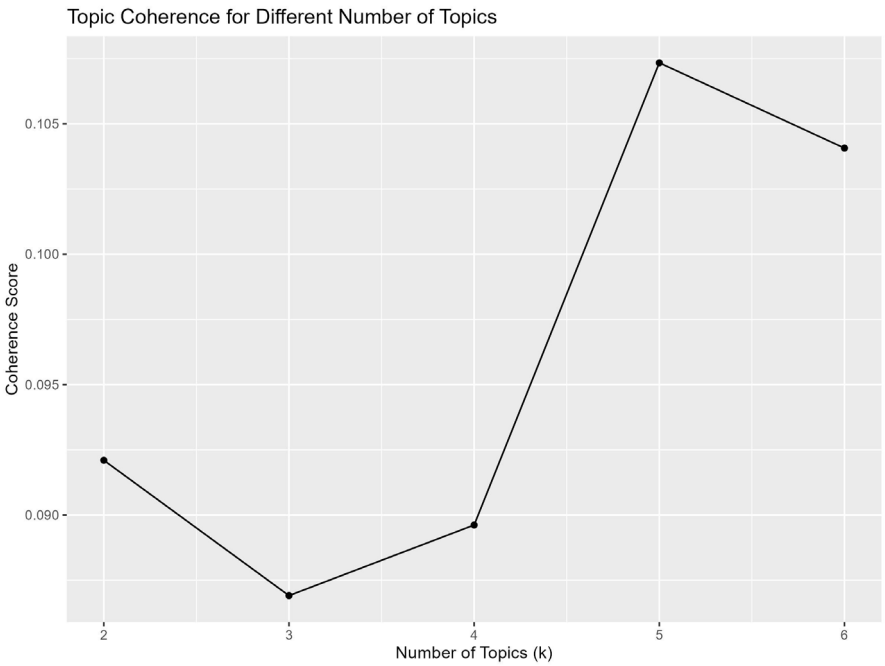
Location: **NYU Abu Dhabi**

UNDERSTANDING PARENTING PRACTICES AND STYLES IN GHANA USING COMPUTATIONAL METHODS

I focused on analyzing interview data from families in Ghana to understand the thematic content related to family dynamics and social structures. The interviews, stored in JSON format, contained responses and questions that often referenced the concept of "family." My goal was to classify these texts to identify when keywords such as "family" appeared, providing insights into the social fabric of the Ghanaian communities involved.

To achieve this, I processed the interview data by extracting relevant text segments and handling variations in identifiers like "INT" and "R" labels, which were inconsistently used in the transcripts.

I utilized spaCy for text vectorization, transforming the interview content into numerical data suitable for logistic regression modeling. This model helped classify the text based on the presence of specific keywords, focusing on capturing the context and nuances of discussions around family. Throughout the project, I faced challenges in parsing the diverse formats of labels and identifiers within the interviews, which I addressed by refining my code to standardize these variations. This meticulous approach enabled a more accurate analysis, ultimately providing deeper insights into the familial structures and themes prevalent in the Ghanaian interview data.



NURGUL ZHUMASHEVA

Major
Civil Engineering

Faculty Supervisor
Joseph Chow

Location: **NYU New York**

TRAFFIC DIGITAL TWIN TO IMPROVE EMERGENCY RESPONSE IN NYC

I focused on optimizing emergency vehicle response times in New York City, a critical issue given the increasing response times and the importance of timely interventions. I began by identifying and selecting key features and target variables for supervised machine learning models, which would serve as the foundation for predicting emergency response times. Using data from the FDNY and DOT, I processed traffic simulation outputs from SUMO, transforming this raw data into a structured dataset suitable for machine learning applications.

I then applied various techniques, including Grid Search, Random Search, and Bayesian optimization, to tune the hyperparameters of different regression models. My goal was to identify the most effective model for predicting emergency response times, which I determined based on the Root Mean Squared Error (RMSE) results from cross-validation. After selecting the best-performing model, I calibrated it to ensure accurate predictions of emergency response times under real-time traffic conditions.

NYU TANDON SCHOOL OF ENGINEERING

C2SMARTER CONNECTED COMMUNITIES WITH SMART MOBILITY TO EQUITABLY REDUCE CONGESTION

FDNY

Applications of Traffic Simulation-Based AI Models in Predicting Emergency Vehicle Performance During Emergency Responses

Nurgul Zhumasheva[1], Farnoosh Namdarpour[2], Fan Zuo[2], Hannah Bonestroo[2], Joseph Chow[2]

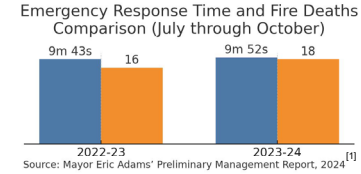
1. NYU Abu Dhabi 2. NYU Tandon School of Engineering

Abstract

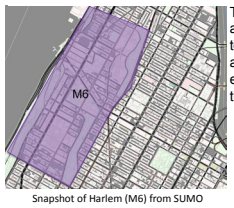
This study develops predictive models for emergency response using supervised ML. Data from the FDNY and DOT is simulated using SUMO and organized into an edge-based grid. Hyperparameters are tuned using Grid and Random search and Bayesian optimization for various regression models, with the best model selected based on RMSE. The model is calibrated to predict emergency response times in real time.

Background

The increasing emergency response times in NYC over the past decades pose a significant threat to public safety, as even a few seconds' delay can mean the difference between life and death, or minimizing property damage from fires. Studying and improving these response times is crucial to ensure effective emergency interventions.



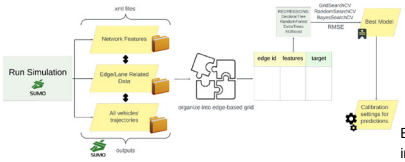
Source: Mayor Eric Adams' Preliminary Management Report, 2024 [1]



Snapshot of Harlem (M6) from SUMO

Traffic in Harlem was analyzed as a testbed to examine strategies aimed at optimizing emergency response times in NYC.

Framework



Methodology

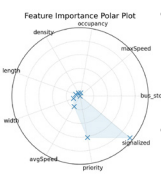
- Features were selected based on their potential influence on travel time of emergency vehicles, which is the time needed to pass the edge.
- Both features and the target were derived from SUMO outputs, including map, edge, lane, trajectory, and bus stop files.
- Grid and random search methods were used for hyperparameter tuning, but Bayesian optimization was preferred for its efficiency and ability to find optimal parameters with fewer iterations [2].
- RMSE, with cross-validation, was used to evaluate and compare the regression models.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N} \|y(i) - \hat{y}(i)\|^2}{N}}$$

Findings

Bayesian Optimization outperformed Grid and Random Search in terms of the lowest RMSE on the test set across all models.

ExtraTreesRegressor achieved the lowest test RMSE, making it the most effective model for travel time prediction.



- Using ExtraTreesRegressor for feature importance analysis, traffic light green time (47.2%) and edge priority (30.7%) were identified as the most critical factors in predicting emergency response times.
- Free flow speed and the number of bus stops on the edge had minimal impact on predictions.

Works Cited

[1] "PRELIMINARY MAYOR'S MANAGEMENT REPORT," City of New York, United States, Jan. 2024. [Online]. Available: https://www.nyc.gov/assets/operations/downloads/pdf/pmmr2024/2024_pmmr.pdf

[2] R. Turner et al., "Bayesian Optimization is Superior to Random Search for Machine Learning Hyperparameter Tuning: Analysis of the Black-Box Optimization Challenge 2020," PMLR, Aug. 07, 2021. https://proceedings.mlr.press/v133/turner21a.html

AJLA SACIC

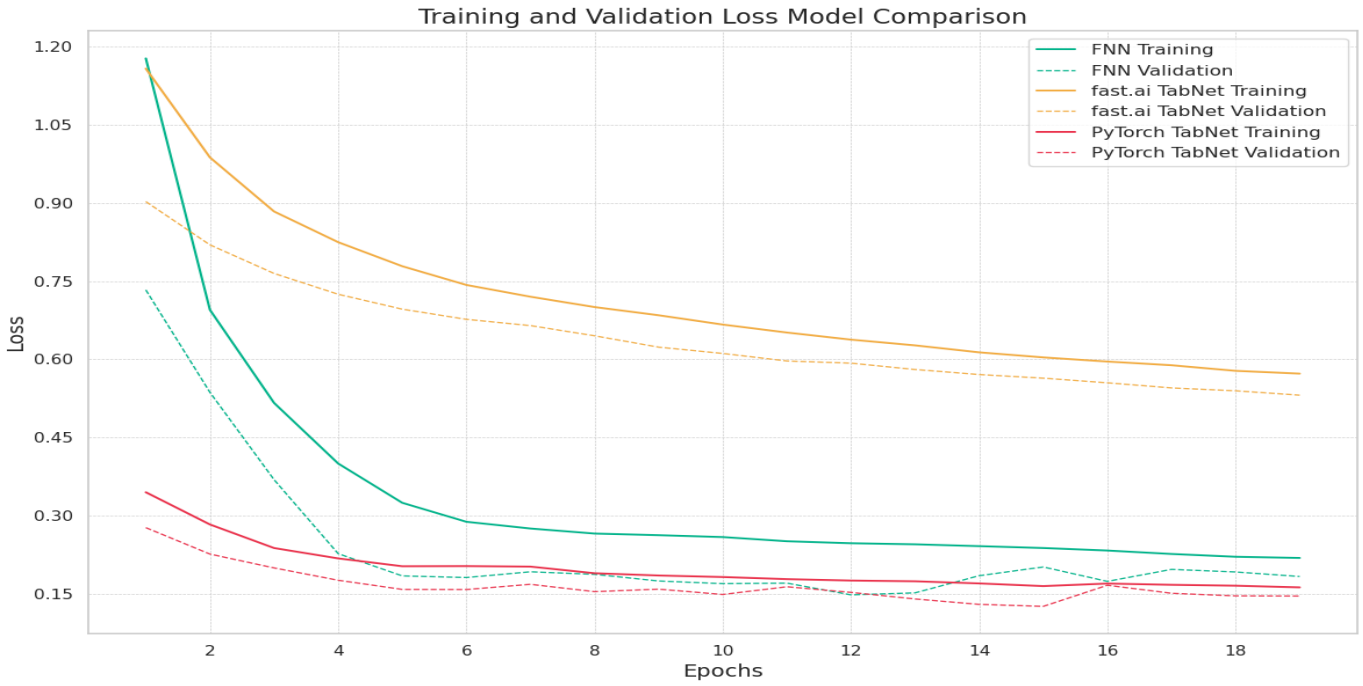
Major
Computer Science

Faculty Supervisor
Asif Equbal

Location: **NYU Abu Dhabi**

DEEP LEARNING FOR DNP: PREDICTIVE MODELS FOR ENHANCED MRI AND NMR PERFORMANCE

Dynamic Nuclear Polarization (DNP) is a transformative technique utilized to enhance the sensitivity and contrast of Magnetic Resonance Imaging (MRI) and Nuclear Magnetic Resonance (NMR) spectroscopy. However, the efficiency of DNP is highly dependent on a multitude of factors, necessitating a predictive model to optimize experimental setups for maximal sensitivity improvements. This research investigated the predictive capabilities of three neural network-based solutions, two TabNet and one FNN implementation, to forecast DNP enhancement. Each model was evaluated using two data preparation methods, matrix and tabular data, to determine the most effective approach. The comparative results showed that PyTorch TabNet implementation performs the best, exhibiting an improvement by half an order of magnitude.



ANEK RAJBHANDARI

Major
Psychology

Faculty Supervisor
Emily Balcetis

Location: **NYU New York**

EFFECTS OF RACIALLY TARGETED FOOD MARKETING ON INSTAGRAM: ADOLESCENTS' FOOD CHOICES AND VISUAL INTEREST IN IDENTITY-CONGRUENT PEOPLE IN FOOD ADS

This project examined the role of social media, particularly how influencers and celebrities impact teenagers' junk food consumption and choices through targeted marketing. Targeted marketing involves directing advertisements to specific demographic groups, often using individuals who share the same racial or ethnic identity as the target audience. Junk food companies, with their large budgets, aim for a high return on investment by targeting groups likely to buy their products.

Our research focused on how racial identity influences the effectiveness of these ads. Preliminary findings show that when teenagers see someone from their racial group endorsing junk food, they are more likely to choose unhealthy snacks. This "attentional stickiness" of seeing someone who looks like them in advertising makes these ads more persuasive.

We also conducted workshops with adolescents from racial and ethnic minority groups to raise awareness of these issues. Through engaging and interactive sessions, we explored concepts like targeted marketing, media representation, and attentional stickiness. We then measured how these workshops influenced the teens' food choices and their interactions with social media influencers.

Members of the NYU Social Perception Action and Motivation Lab who created and delivered the workshops bringing awareness to teens about influencer promotions on social media.

JIYA CHAUDHARY

Major
General Engineering

Faculty Supervisor
Khalil Ramadi

Location: **NYU Abu Dhabi**

GUT EX-VIVO MODELING PROJECT

I worked on developing an Ex-vivo gut modeling setup in the Ramadi Lab. The project's goal was to replicate the chemical environment within a rodent's body to sustain the gut's viability post-dissection. By incorporating essential ions, nutrients, and gases, the gut could remain alive and functional for several hours after removal. My role in the project focused on constructing a system that accurately replicated these conditions. I approached this objective through the perfusion method, aiming to maintain the system's temperature by continuously circulating a warm ionic solution through a custom-designed chamber using a peristaltic pump. With guidance from members of the lab, I built a plexiglass chamber coated with a thick layer of PolydimethylSiloxane (PDMS), complete with appropriate inlets and outlets to ensure smooth and regular flow. This setup laid the foundation for future research, including the study of gut motility, pill propagation, and the effects of electrical stimulation and sensors on the tissue.

> **Working on this project was a transformative experience that made me appreciate and comprehend the intersection between engineering and biology. It taught me not only the technical skills required for sophisticated experimental setups but also the importance of interdisciplinary collaboration in pushing the boundaries of research.**

APARNA RAJEEV

Major
Political Science

Faculty Supervisors
Laure Salma Assaf and Samuel Mark Anderson

Location: **NYU Abu Dhabi**

RIDING ON THE EDGE OF EXTREME HEAT

This research project, implemented as a part of the Abu Dhabi Public Spaces Project by the Arts and Humanities Anthropocene Research Kitchen, investigated how everyday urbanism unfolds against the backdrop of delivery drivers in an increasingly climate-changed city of Abu Dhabi. The project aimed to critically examine and visualize Abu Dhabi city through the eyes of the food delivery riders, perhaps the most visible occupants of the Abu Dhabi public spaces. Utilizing ethnographic frameworks and interviews, supplemented by other arts-based research methodologies, this project provided me with a valuable opportunity to explore how delivery riders, mostly migrant workers from South Asia, interact with the public spaces of an increasingly climate-changed city of Abu Dhabi. Delving into the overlapping themes of climate change, the future of work, labor relations, migration, and race, the research provides insights into the overlooked aspect of precarity in the gig economy against the backdrop of life in the Anthropocene.

ASHOK TIMSINA

Major
Computer Science

Faculty Supervisors
Azhar Zam and Pauline John

Location: **NYU Abu Dhabi**

DEEP LEARNING ENHANCED OPTICAL COHERENCE TOMOGRAPHY ANGIOGRAPHY FOR IN-VIVO HUMAN SKIN VASCULAR IMAGING

Optical Coherence Tomography (OCT) is a powerful, non-invasive imaging technique that captures high-resolution cross-sectional images of biological tissues, making it a key tool in medical diagnostics. OCT angiography (OCT-A) enhances this capability by capturing detailed images of blood vessels, allowing for the visualization of microvascular networks crucial for diagnosing conditions such as diabetes, cardiovascular diseases, and dermatological disorders. However, traditional OCT-A construction methods are often slow and require multiple scans from the same spot, which can lead to motion artifacts and reduce clinical efficiency. Over the summer, I worked on improving the construction of OCT-A images for in-vivo human skin vasculature using deep learning techniques. I trained a model called SVC-Net that uses adjacent OCT B-scans from a single volume scan to create detailed OCT-A images. The model has an encoder-decoder architecture with EfficientNetB0 as the encoder, and I tested the models in two variations: one using three adjacent scans (3N) and another using five (5N). Our initial results showed that the 5N model outperformed the 3N, delivering better accuracy and generalization. This progress points to the potential for more precise and efficient non-invasive diagnostic tools in dermatology and beyond, helping to improve the detection and monitoring of microvascular changes linked to various medical conditions.

> **We drafted a conference paper and submitted to SPIE Photonics West. This experience gave me valuable insight into the health-tech domain, showing me the transformative potential of deep learning in advancing diagnosis, prognosis and improving healthcare.**

RAHMA BEETHOVEN

Major
Biology Brain and Cognitive Specialization

Faculty Supervisor
Dan Ohtan Wang

Location: **NYU Abu Dhabi**

THE ROLE OF M6A READER PROTEIN YTHDF1 IN THE FORMATION OF SPATIAL COGNITIVE MAPS

I have always been fascinated by the mechanisms of memory formation, particularly spatial memory, which is crucial for understanding how organisms navigate their environments. For my project, I developed a virtual reality setup for mice, enabling them to perform memory tasks while we record their neural activity using two-photon calcium imaging. This advanced imaging technique allows us to observe neuronal activity in real-time, providing insights into how memories are formed at the cellular level. The study aims to compare place cell formation in the brains of control mice and those with a conditional knockout, focusing on the role of m6A RNA modification in this process. By understanding how m6A influences memory formation, this research could reveal new aspects of memory biology and potential therapeutic targets for memory-related disorders.

We perform weekly genotyping experiments for the new born mice. We start by extracting DNA and then PCR.

ALEXEY MAGAY

Major
Computer Science

Faculty Supervisor
Yi Fang

Location: **NYU Abu Dhabi**

A LIGHT AND SMART WEARABLE PLATFORM WITH MULTIMODAL FOUNDATION MODEL FOR ENHANCED SPATIAL REASONING

This project focused on enhancing the independence of individuals with blindness and low vision (pBLV) by developing a novel assistive technology.

The core innovation is a fine-tuned, spatially enhanced multi-modal large language model (MLLM) integrated into a lightweight, user-friendly hardware component attached to glasses. Unlike current models that lack spatial reasoning, this approach enables better understanding of environmental contexts, crucial for navigation and object recognition. By leveraging advanced visual language models (VLMs), the system provides real-time, spatially aware feedback, significantly improving the ability of pBLV individuals to navigate and interact with their surroundings. The project is rigorously evaluated using the VizWiz dataset, along with a custom-designed dataset, showing significant improvements in both accuracy and user experience.

MINH QUAN NHAM

Major
Computer Engineering

Faculty Supervisor
Michail Maniatakos

Location: **NYU Abu Dhabi**

ACCELERATING FULLY HOMOMORPHIC ENCRYPTION USING GPUS

My project aimed to build upon my senior-year Honors Research, in which I utilized the GPU simulator platform AccelSim to analyze how certain GPU hardware parameters affect the performance of fully homomorphic encryption (FHE) programs. These parameters were limited by the simulation itself, and to make more significant hardware changes, I needed to have a much better understanding of the simulator. I delved deeper into the inner workings of AccelSim and of GPUs, with a final goal of adding new functionality to the hardware itself to leverage the characteristics of FHE programs and enhance their performance. Throughout the project, I proposed several prospective hardware modifications, with one implementation making tangible improvements to our selected FHE workloads.

> **This research project provided me with numerous opportunities to grow, hone my research skills, and learn complex concepts effectively. The experience was a gateway for me to learn in-depth about the intricate architecture of modern GPUs, with an emphasis on understanding why even the simplest parts were designed the way they are.**

MAHEEN EATAZAZ

Major
Computer Science

Faculty Supervisors
Michail Maniatakos and Dunia J. Mahboobeh

Location: **NYU Abu Dhabi**

BIAS IN FEDERATED HEALTHCARE ENVIRONMENT

My project involved addressing demographic bias in Federated Learning (FL) systems within the healthcare domain. Recognizing the critical impact of bias in machine learning models, particularly in healthcare, I aimed to investigate and mitigate algorithmic bias, which can lead to unfair treatment decisions and compromised patient safety.

I began by conducting extensive technical training on machine learning models, including implementing Convolutional Neural Networks (CNN) and ResNet-18, and establishing baseline model performance using datasets like CIFAR-10. I then shifted focus to sample bias, conducting controlled experiments to analyze its effects on model performance.

To apply these insights in the medical field, I selected the NIH Chest X-ray and MIMIC-CXR datasets, completing the necessary ethical training and agreements for access. I implemented bias detection techniques, focusing on statistical parity, and discovered significant biases based on age and gender. I then adapted the ResNet-50 model for multi-label classification and transitioned my work to a federated learning setup to study bias in decentralizedenvironments.

This research enhanced my understanding of algorithmic bias in healthcare and provided practical solutions for mitigating bias in FL systems.

> **One of the most valuable aspects of this experience was learning to navigate the ethical and legal considerations of working with sensitive medical data, including completing CITI training and adhering to data usage agreements. This experience has deepened my understanding of the importance of data privacy and security in healthcare applications.**

AAKARSH SINGH

Major
Interactive Media

Faculty Supervisors
R. Luke Dubois and Todd Bryant

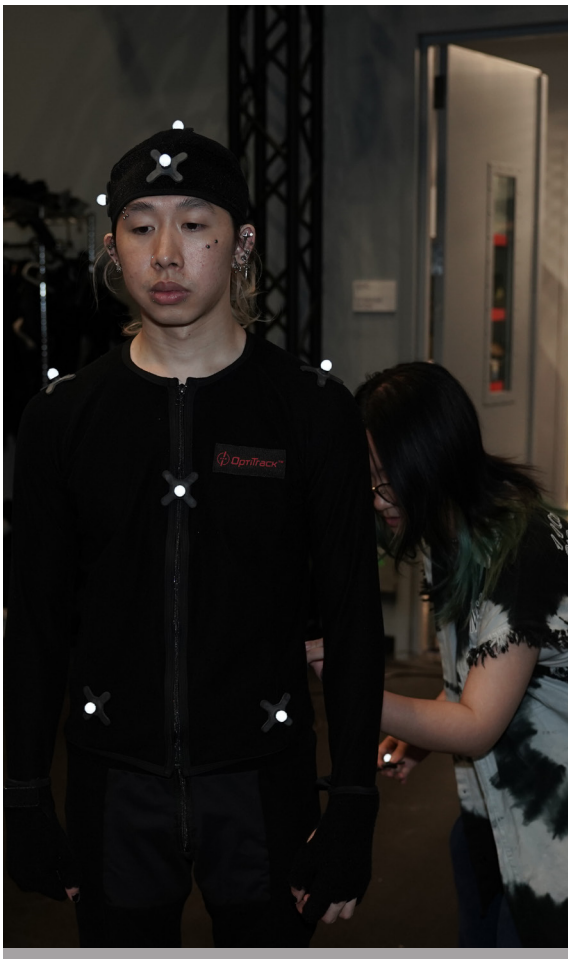
Location: **NYU New York**

EXPLORING EMERGING MEDIA TECHNIQUES: EVALUATING VOLUMETRIC CAPTURE, MOTION CAPTURE, AND ICVFX IN EXPERIMENTAL PRODUCTION

Volumetric capture, motion capture, and virtual production are three emerging media techniques revolutionizing the media and entertainment industry. This research project aimed to compare these three techniques and evaluate their effectiveness against each other through the production of an experimental fashion film. The results showcase the three completed demos, highlighting the distinct visual and practical outcomes of each technique.

Actor during virtual production stage.

Captured actor from volumetric capture stage, imported into virtual environment.



Actor getting ready for motion capture.

SHUBHAN BHATIA

Major
Physics

Faculty Supervisor
Andrea Valerio Macciò

Location: **NYU Abu Dhabi**

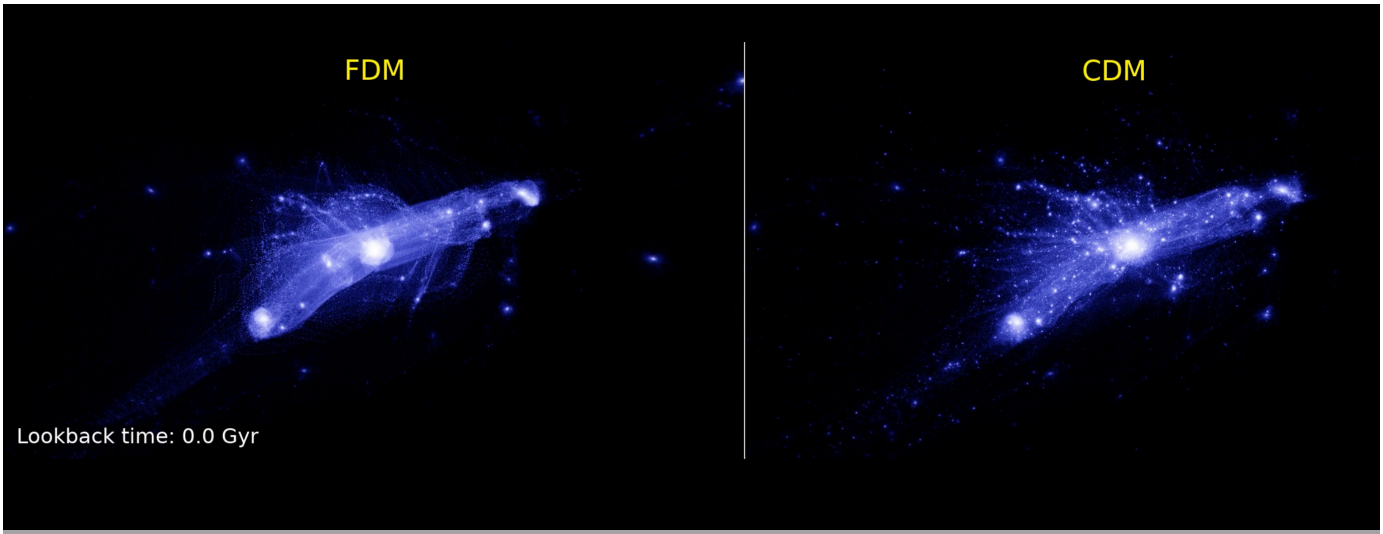
FUZZY - GASOLINE: A HYDRODYNAMICAL N-BODY CODE FOR FUZZY DARK MATTER

Small scale challenges facing the widely accepted Lambda-CDM (LCDM) cosmological model have crept up in the past few decades. The most predominant challenge faced by the LCDM model, dubbed as the core-cusp problem, is the shallower central dark matter (DM) distribution in dwarf galaxies (indicated by their observed rotation curves) that contradict LCDM's theoretical predictions of cuspy central dark matter distribution in these galaxies.

I investigated the implications of Fuzzy Dark Matter (FDM) cosmologies on structure formation in dwarf galaxies (with halo masses of roughly 10^9 solar masses) by analyzing a set of 30 novel N-body hydrodynamical simulations (called Fuzzy-Gasoline) on NYUAD's Falcon2 HPC cluster. Fuzzy Dark Matter, a dark matter model that is a member of the ultralight scalar regime (associated with Axion-like particles) features a unique 'Quantum Potential' (QP) that acts as a damping force to small scale density perturbations against gravitational collapse.

I found that although FDM resolves the core-cusp problem for dwarf galaxies (in our sample consisting of 3 systems), the 'bright' properties in these systems such as their star formation rates, stellar and gas density distributions, are indistinguishable from their corresponding NIHAO CDM simulations. My research presents the 'first of its kind' results of the baryonic properties of galaxies that feature FDM's non-linear wave dynamics.

To further investigate this issue, future research projects could involve increasing the number of Fuzzy-Gasoline systems and broadening the range of halo masses to gain a holistic understanding of the hybrid feedback processes from FDM's QP and baryonic dissipative processes.



Cosmological snapshot comparing the dark matter distribution in a FUZZY-GASOLINE system: FDM (left) vs CDM (right).

OMAR MOSTAFA

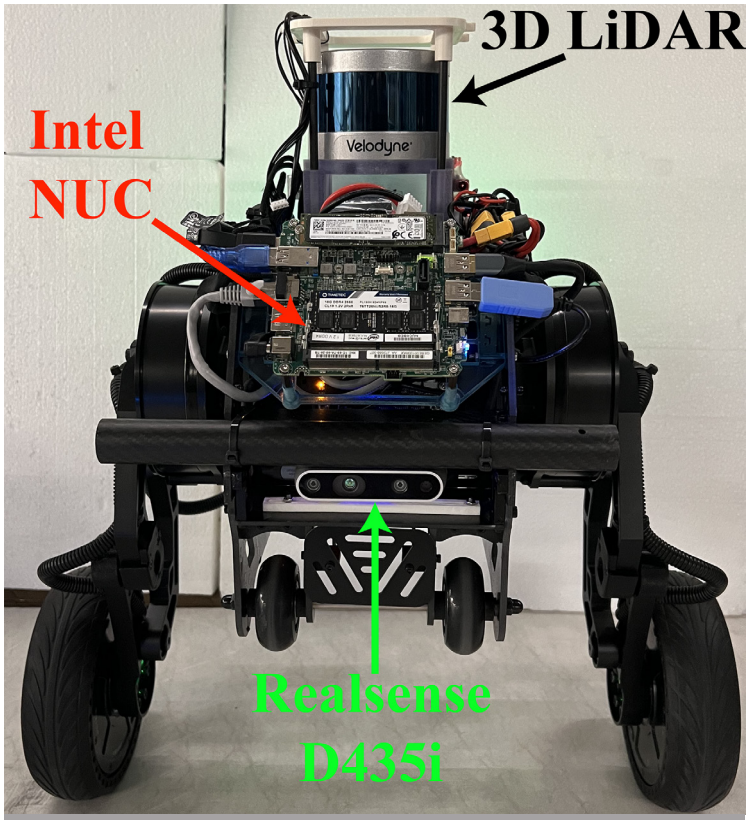
Major
Electrical Engineering and Computer Science

Faculty Supervisor
Anthony Tzes

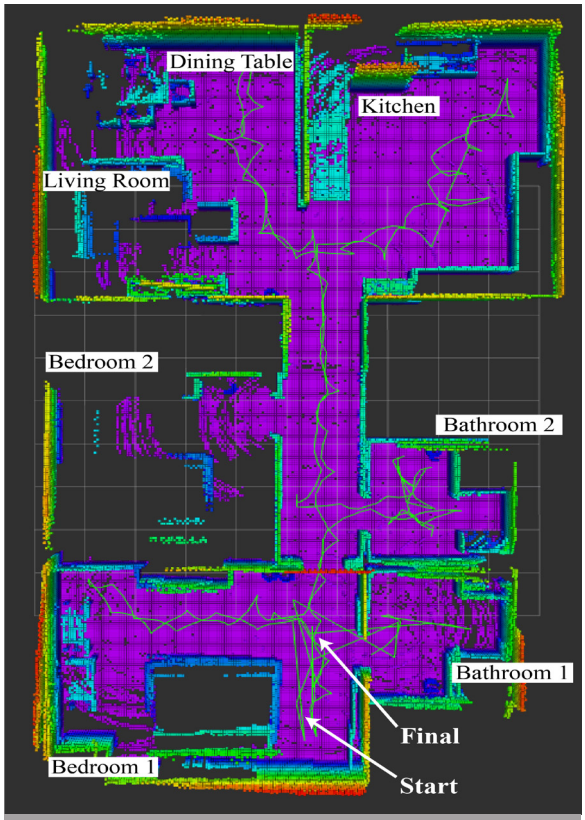
Location: **NYU Abu Dhabi**

SAFE EXPLORATION ALGORITHM FOR UNKNOWN INDOOR ENVIRONMENTS

This research proposes a robust exploration algorithm designed to address the challenges of exploring unknown cluttered indoor environments with noisy sensor data while ensuring both safety and efficiency. The algorithm utilizes LiDAR PointCloud data to compute all available headings at the robot's current position and selects the ones that guarantee the exploration of new, unobserved areas. The algorithm incorporates a greedy selection strategy to avoid revisiting already explored areas, choosing the heading that maximizes the safety margin from obstacles and the potential for exploration. In practice, the method prioritizes obstacle avoidance by calculating the optimal heading that keeps the robot at a safe distance from obstacles while expanding its explored space. The robot's position is updated using a constant distance.



Experimental validation with a self-balanced dual-wheeled robot, in a real-world, obstacle-rich apartment setting demonstrated the algorithm's robustness in mitigating sensor noise and preventing drift.



The results showcase the algorithm's ability to mitigate sensor noise, avoid drifts, and adapt to challenging exploration scenarios, making it a reliable solution for practical applications.

NATTY METEKIE

Major
Computer Engineering

Faculty Supervisor
Shivendra S. Panwar

Location: **NYU New York**

SHOULD YOU TRUST YOUR NETWORK EMULATOR OR SIMULATOR?

Experimental research in computer networks often uses network emulation or simulation to recreate specific network settings in a controlled environment, such as a testbed. However, certain settings of widely used network emulation and simulation tools can cause incorrect behavior and inconsistent experimental results, potentially yielding contradictory outcomes for the same hypothesis depending on the tool that is used. This often goes unnoticed, as researchers typically use one approach and do not validate their results using different methods. Our research addressed this issue by identifying and demonstrating (on the FABRIC and CloudLab testbeds, and the ns-3 network simulation platform) specific scenarios where some research tools behave in incorrect or unexpected ways. Then, as case studies, we reproduced selected published results using different methodologies, and showed that we drew different conclusions depending on the approach that was used. Ultimately, our research sought to provide insights that can guide the selection of tools and methodologies to enhance the accuracy and consistency of future studies in the field.

TOMIRIS DOSKHOZHINA

Major
Biology

Faculty Supervisors
Carlos Carmona-Fontaine and Natalia Podolska

Location: **NYU New York**

MECHANISMS OF IMMUNOSUPPRESSION IN THE TUMOR MICROENVIRONMENT

I worked on a cancer biology research project in the Carmofon Lab within the Center for Genomics & Systems Biology. I investigated the mechanisms of immunosuppression in the tumor microenvironment. It was discovered earlier in the lab that certain polyamines are produced by macrophages in the tumor microenvironment, which are capable of inhibiting T cell-mediated killing of cancer cells. My goal was to study whether the deletion of key genes in that polyamine pathway can rescue the killing of cancer cells by immune cells in the presence of polyamines.

I enhanced my lab skills in protein and RNA extraction, qPCR, Western Blot, cell survival & growth assays, bacterial transformation for the CRISPR-Cas9 system, and the design of primers using bioinformatics tools for manipulating specific genes in cancer cell lines. I used an automated microscope to observe the interactions between melanoma cancer cells and cytotoxic T lymphocytes in culture, and created slideshows to visualize those dynamics.

> **Thanks to my summer research experience, I feel more confident as I transition to my own Capstone project. Beyond enhancing my lab skills, I have developed an ability to identify potential challenges in experimental settings and propose effective solutions, ensuring the successful execution of experiments. I am now planning to work remotely to analyze single-cell RNA sequencing data from our experiments, aiming to uncover the genetics layer of the cell interactions we observed.**

MOMCILO RANDELOVIC

Major
Bioengineering

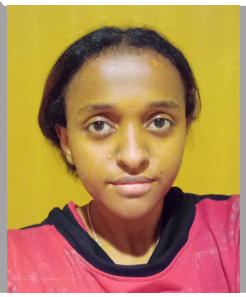
Faculty Supervisor
Sanjairaj Vijayavenkataraman

Location: **NYU Abu Dhabi**

CHARACTERIZATION OF DIFFERENT BIOGELS

I learned how to dialyze and lyophilize different solutions, as well as how to use finalized bioink mixtures in both the digital light processing 3D printer and the extrusion-based 3D printer. My project was to combine mixtures of different amine and aldehyde groups to form biogels. The primary amine was a natural polymer, while I experimented with polysaccharides and synthetic polymers as aldehyde groups. In the end, I found a mixture that formed a gel using a combination of a polysaccharide and a natural polymer, and now I must test this gel in a 3D printer. Alongside this project, I carried out degradation testing of modified polysaccharide-based and protein-based gel mixtures by weighing the samples in different pH PBS solutions every week. I also learned how to synthesize modified natural polymers, as this is a frequently used method in the lab and is valuable to know. Lastly, I learned how to culture my own cells to test cell viability on my gels further down the line.

> **Working in the Vijay lab over the summer was an incredible experience. Learning about how different polymers interact with each other and using this knowledge to attempt to formulate new bio-gels is riveting when you think of all the applications of 3D bioprinting.**



DEBORAH BAHIRU SISAY

Major
Biology

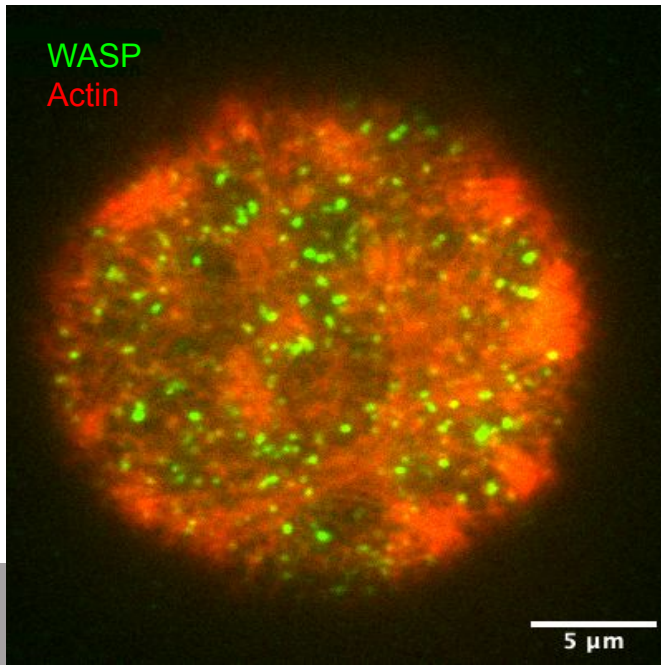
Faculty Supervisor
Arjun Narayanan

Location: **NYU Abu Dhabi**

UNDERSTANDING THE ROLE OF REGULATORY PROTEINS IN ACTIN CORTEX FORMATION AND DYNAMICS

This research project involved exploring what the roles of various regulatory proteins (CAP, ARP2/3, etc.) are in Actin cortex formation and dynamics.

We used the classical approach of knocking down the gene responsible for producing that protein to see how the development of the *C-elegans* (our model organism) Oocyte cortex was affected. This involved culturing, imaging, and image analysis.



Total internal reflection fluorescence (TIRF) image of a C. *elegans* oocyte cortex. WASP is shown in green and actin filaments are shown in red.

> The project is a balance of both Biology and Physics. While the models we're testing and the computational tools we use are rooted in physics, the data collection relies on biological research methods. This work is still in progress, and we aim to contribute to the growing body of research on this subject.

SIPAN HOVSEPIAN

Major
Electrical Engineering

Faculty Supervisor
Jose Balsa-Barreiro

Location: **NYU Abu Dhabi**

FROM PEARLING VILLAGE TO GLOBAL HUB: TRACING DUBAI'S URBAN MORPHOLOGICAL EVOLUTION AND ECONOMIC DIVERSIFICATION THROUGH SPACE SYNTAX ANALYSIS

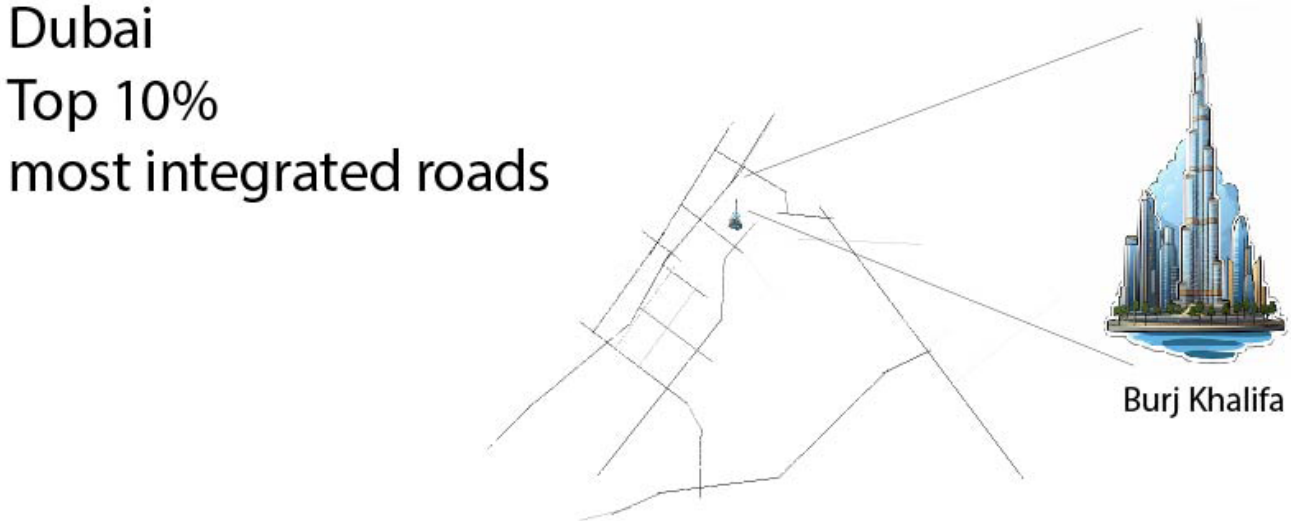
I examined the urban morphological evolution of Dubai, tracing its transformation from a small pearling village (before mid-20th century) to a global hub, with a particular focus on the impact of the oil boom (during mid-20th century) and subsequent economic diversification. Historically, settlements in the Gulf region were small, focused on fishing and trade, with infrastructure reflecting these modest needs.

The discovery of oil reserves in the region, however, provided the resources to expand beyond these fishing settlements, leading to the rapid development of larger and more diverse cities. This expansion, driven by technological advances like air conditioning and the influx of immigrating expatriates, resulted in a new urban morphology that contrasted sharply with traditional settlements, prioritizing mass transit over walkability.

Influenced by national strategies such as Vision 2030 and United Nations Sustainable Development Goals (SDGs) Dubai shifted its focus toward economic diversification, declining its dependency over oil industry.

This shift led to the development of multi-purpose neighborhoods that redefined the image of the largest Emirati city. My research addresses the gap identified by Jeremy Whitehand's critique of Euro-American-centric urban studies by providing a detailed analysis of Dubai's unique urban development.

A significant contribution of my study was the creation of an extensive axial map of Dubai, comprising over 25,000+ lines, which serves as a foundational tool for further research in the field.



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In addition to guidance given by my supervisor, I also received mentorship from Keyvan Karimi (University College London) and Mark David Major (Abu Dhabi University). Currently I am working on the draft of a paper where I plan to outline my research findings and publish in academic journals. This summer research assistantship with CITIES was a great start for my future research projects, as I gained practical experience in the field and a valuable network of academics and professionals.

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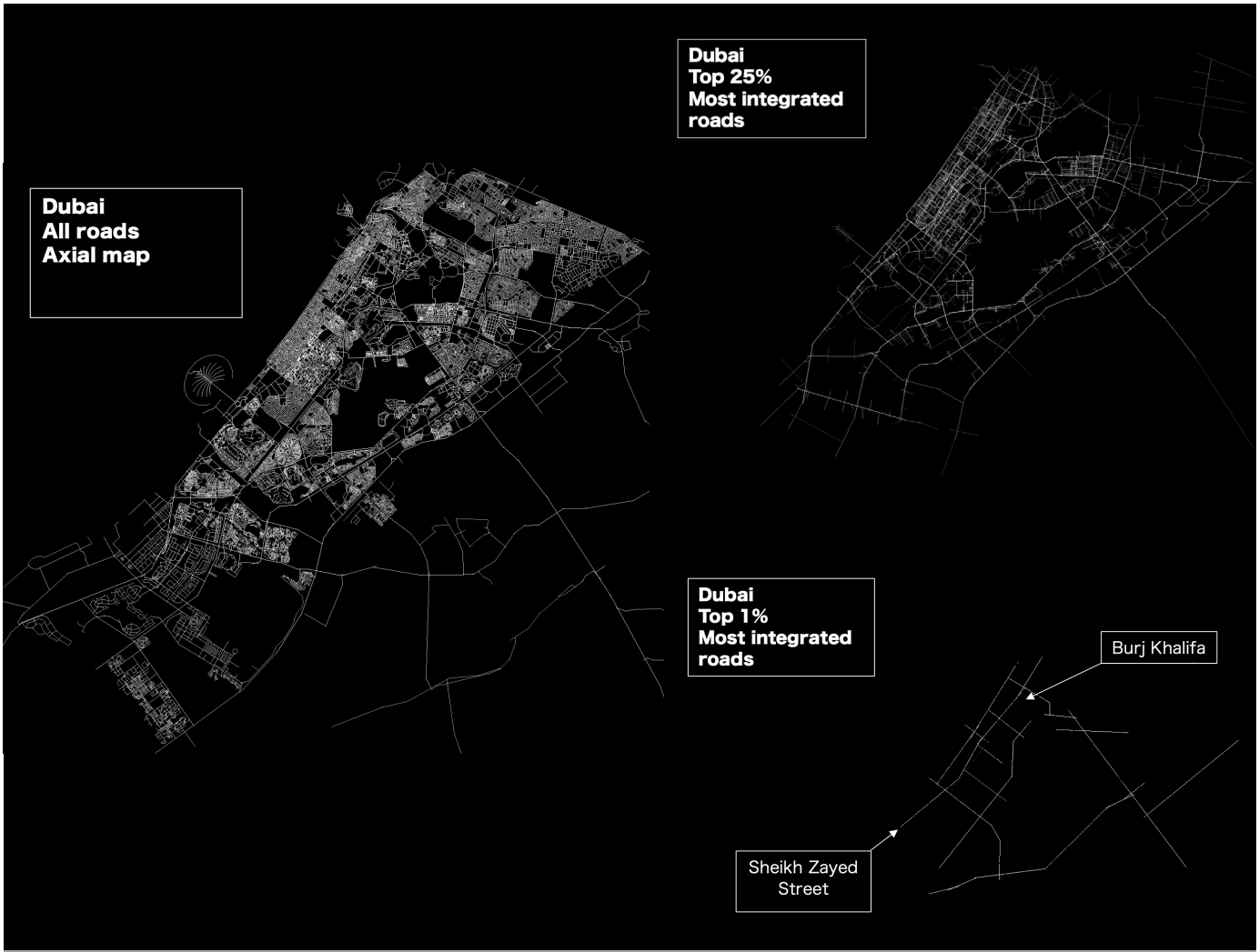


This visualization highlights the most integrated roads in Dubai based on space syntax analysis.

SALMA ALSAGHIR

Major
Computer Engineering

Faculty Supervisor
Asif Equbal

Location: **NYU Abu Dhabi**

QUANTUM SENSING: NMR - MOUSE AND ITS APPLICATION IN CULTURAL HERITAGE

Over the summer, I engaged in a series of research projects centered on the use of the NMR MOUSE for advanced material analysis. I began with a project funded by the Zayed Museum, focusing on the non-invasive analysis of cultural heritage artifacts. Using the NMR MOUSE, I studied various artifacts, including paintings, frescoes, and mummies, to determine their composition, moisture content, and preservation state. I explored depth profiling and relaxation time measurements to uncover valuable insights into the aging processes and structural integrity of these objects.

Additionally, I initiated a new project in collaboration with the Bioengineering Department to analyze hydrogels using the NMR MOUSE. The bioengineering team provided me with GelMA hydrogel samples, which I first analyzed in their liquid state before solidifying them under UV light. Utilizing the PM5 NMR MOUSE from Magritek and Prospa software, I conducted experiments to collect data on different depths and analyze relaxation times and echo decays.

> **This project laid the groundwork for future studies on various hydrogels and tissue samples, which I plan to continue next semester. This experience has provided me with a solid foundation in non-invasive analysis techniques, crucial for both cultural heritage preservation and material science applications.**

NATHAN BEHAILU ZEWDIE

Major
Computer Science

Faculty Supervisor
Gabriel Koehler-Derrick

Location: **NYU Abu Dhabi**

BIG DATA RESEARCH ON COLONIAL IRELAND

My research involved extracting and analyzing colonial Ireland data from roughly 16,000 pages using Optical Character Recognition (OCR) technology. Similar to the OCR process, I built post processing code to ensure that the retrieved data was accurate and usable.

This was critical in converting raw, tabular data into an organized databases that could be studied to gain insights into the socioeconomic dynamics of colonial Ireland. Our study aimed to explore how changes in property rights during the colonial period influenced local development, particularly in terms of investment and land inequality. By analyzing this historical data, we were able to investigate how variation in local legibility of land from resulted in significant and long-lasting disparities in the security of land tenure, and public expenditures across Ireland. This study examines the long-term effects of colonial policies on property rights and economic inequality, providing important historical insights on the role of maps in defining local development trajectories.

> **This project gave me, as a Computer Science major, the chance to use my technical expertise in a unique, multidisciplinary setting. I was able to apply my experience in computer science to solve problems involving the integration of historical and contemporary data analysis, such as creating algorithms for OCR post-processing and managing sizable databases. While working on this project, I was reminded of how passionate I am about using technology to address practical issues and I discovered new applications for computational approaches in other industries.**

SALEM EYOB

Major
Biology: Brain and Cognitive Studies

Faculty Supervisor
Dan Ohtan Wang

Location: **NYU Abu Dhabi**

EPITRANSCRIPTOMIC REGULATION IN TRAUMATIC EXPERIENCE - DEPENDENT BEHAVIORAL OUTCOMES IN HUMANS

I explored the relationship between epitranscriptomics and post-traumatic stress disorder (PTSD) to uncover the biological mechanisms underlying trauma. I began by developing a comprehensive index of RNA modification regulators, encompassing over 90 proteins. The project then proceeded with a genome-wide association study (GWAS) meta-analysis, where I aggregated and analyzed data from multiple ethnic cohorts to identify potential PTSD biomarkers and investigate the role of post-transcriptional RNA modifications.

Utilizing METAL software, I conducted the meta-analysis to uncover both novel and previously reported genetic variants associated with PTSD. I then annotated significant single nucleotide polymorphisms (SNPs) and mapped their locations within genes involved in RNA modifications, aiming to identify specific genetic factors that may influence people's susceptibility to PTSD. In Stage II of my project, I employed Mendelian randomization (MR) to examine how SNPs associated with RNA modification factors might affect PTSD. I collected data on RNA expression, splicing, and protein levels from various databases and performed MR analysis using the TwoSampleMR package. To ensure the validity and robustness of my findings, I conducted extensive sensitivity analyses and colocalization studies.

This involved assessing heterogeneity, horizontal pleiotropy, and other relevant factors to confirm the reliability of the MR conclusions and rule out potential trait overlap. This research aims to elucidate the genetic and epitranscriptomic contributions to PTSD, providing deeper insights into the disorder's biological mechanisms as a result of traumatic experiences.

> **Understanding the profound impact of trauma on the body and mind, including its intergenerational effects, has reshaped my perspective on the interconnectedness of genetics, environment, and mental health, offering a new lens through which to view how traumatic human experiences influence our biological systems.**

SOYINI ALEXANDER

Major
Psychology with a specialization in Brain and Cognitive Science

Faculty Supervisor
Catherine Hartley

Location: **NYU New York**

THE INFLUENCE OF GEOLOCATIONAL NOVELTY ON EPISODIC AND AUTOBIOGRAPHICAL MEMORY

I assisted in the data collection for a study led by Susan Benear, a Postdoctoral Researcher in the Hartley Lab, in which a group of participants aged 10-25 completed two tasks, designed to assess memory specificity three times weekly for three months. The first task involved choosing between the correct image and a similar lure, and the second consisted of verbal recordings of their autobiographical memory of the previous day's experiences. Additionally, we continuously tracked participants' movements using GPS, enabling the calculation of measures of novelty and routineness in their daily movements. I assisted in collecting the data by downloading Qualtrics questionnaires and running a Python script to extract the relevant data needed to track participants in the study. Also, I invited new participants to the study through a database of children and adults who are interested in participating in research. Finally, I aided in tracking incoming data from research participants, checked data quality to see if participants missed tasks, and ensured that reminders to complete tasks were sent out through a server designed to send SMS messages to participants in the study. The data collected will be used to analyze changes in geolocation patterns across adolescent development and explore how these changes relate to the accuracy and detail in both experimental and autobiographical memory.

> **“The Hartley Lab offered me an excellent opportunity to gain exposure to human psychology research. In addition to my work on the project, I completed Level One and Two training for the NYU MRI center at the Washington Square campus and assisted with mock scans for research participants for a separate project. This hands-on experience has significantly enhanced my understanding of neuroimaging techniques. While studying away in Fall 2024 in New York, I will continue my work in the Hartley lab, allowing me to delve deeper into human research methods and data analysis.”**

BINGRUI SU

Major
Physics

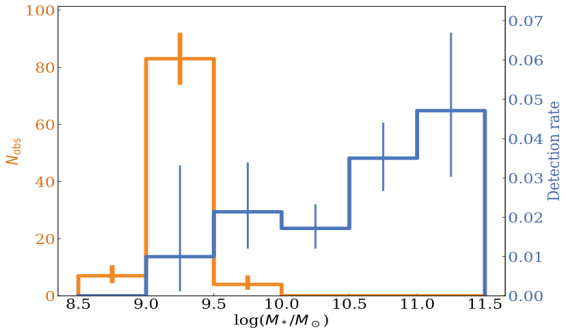
Faculty Supervisor
Ingyin Zaw

Location: **NYU Abu Dhabi**

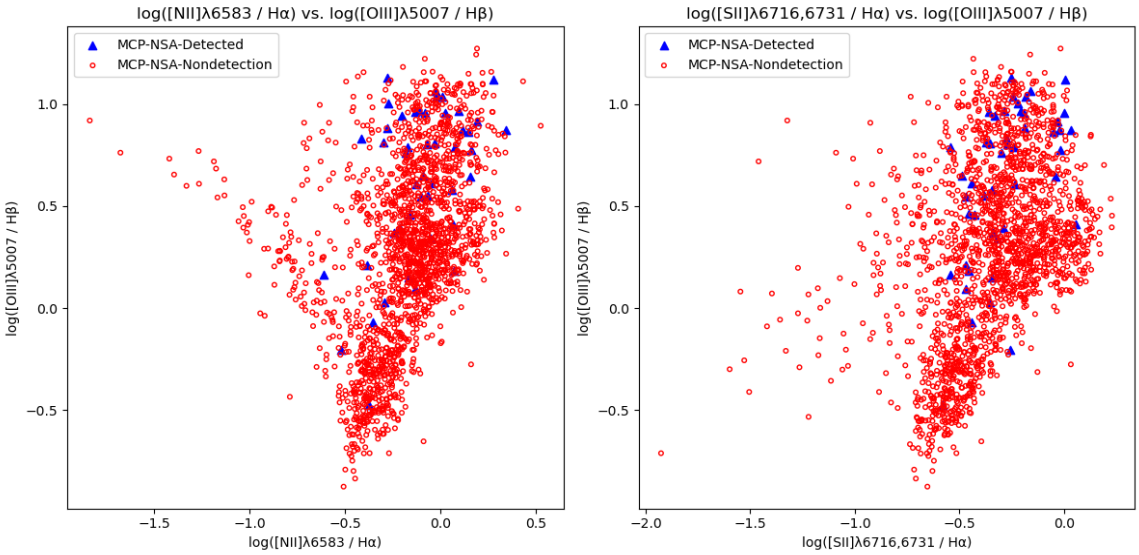
MUTI WAVE LENGTH STUDY OF MASER HOSTED AGN

Water masers offer valuable insights into astrophysical phenomena such as star formation and active galactic nuclei (AGN). It has been confirmed that various parameters are associated with water masers. Research indicates that a critical radius for water molecules exists, and maser luminosity is proportional to both the luminosity and the mass accretion rate (Neufeld & Maloney, 1995). Research has also shown that maser luminosity is strongly linked to source luminosity and mass accretion rates, with a critical radius identified for maser emission. Observations across infrared (IR), X-ray, and optical bands have revealed correlations between maser activity and environmental conditions.

My research integrated multiwavelength data from major sky surveys, including SDSS for optical, Chandra and XMM-Newton to a comprehensive catalog. Using this multiwavelength catalog, I applied machine regression to spectroscopy data, enabling a deeper understanding of the parameters influencing maser occurrence. After cleaning and the datasets, the models identified significant correlations, providing quantitative insights into the interplay of maser luminosity with spectroscopy data from different wavelengths.



Rate of detection by relative mass.



BPT Diagram by detection and non-detection

ELISAVET PERPATARI

Major
Computer Engineering

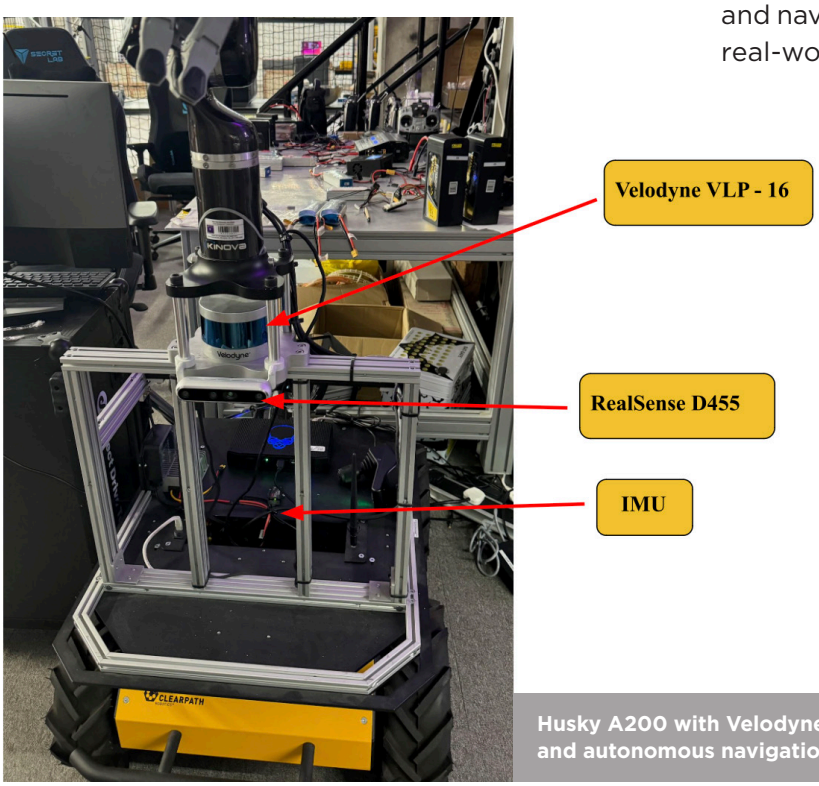
Faculty Supervisor
Anthony Tzes

Location: **NYU Abu Dhabi**

ENHANCING HUSKY A200 LOCALIZATION AND NAVIGATION THROUGH KISS-ICP, RTAB-MAP, AND ADVANCED SENSOR INTEGRATION

I aimed to enhance the localization and navigation capabilities of the Husky A200 robot by integrating advanced sensor systems and algorithms. Initially, I focused on improving odometry accuracy using KISS-ICP, which enhanced localization by relying on 3D point clouds from LiDAR, eliminating the need for IMU data. My experiments showed that excluding IMU data provided more stable and accurate odometry feedback. I also developed a navigation algorithm that controlled the robot's movements based on pose feedback, allowing it to follow a pre-planned trajectory.

Furthermore, I integrated RealSense cameras and RTAB-Map for Simultaneous Localization and Mapping (SLAM). This setup improved the robot's ability to map environments and navigate while avoiding obstacles. RTAB-Map utilized data from the LiDAR and camera, performing real-time loop closures and optimizing the map for accurate localization. By integrating IMU, LiDAR, and camera data, along with a comprehensive transformation tree, I ensured precise sensor data fusion, enabling the Husky A200 to navigate complex environments autonomously. As part of this project, I demonstrated significant improvements in the robot's localization and navigation accuracy, making it more robust for real-world applications.



Husky A200 with Velodyne VLP-16, RealSense D455, and IMU for 3D mapping and autonomous navigation.

MOHAMED BENAICH

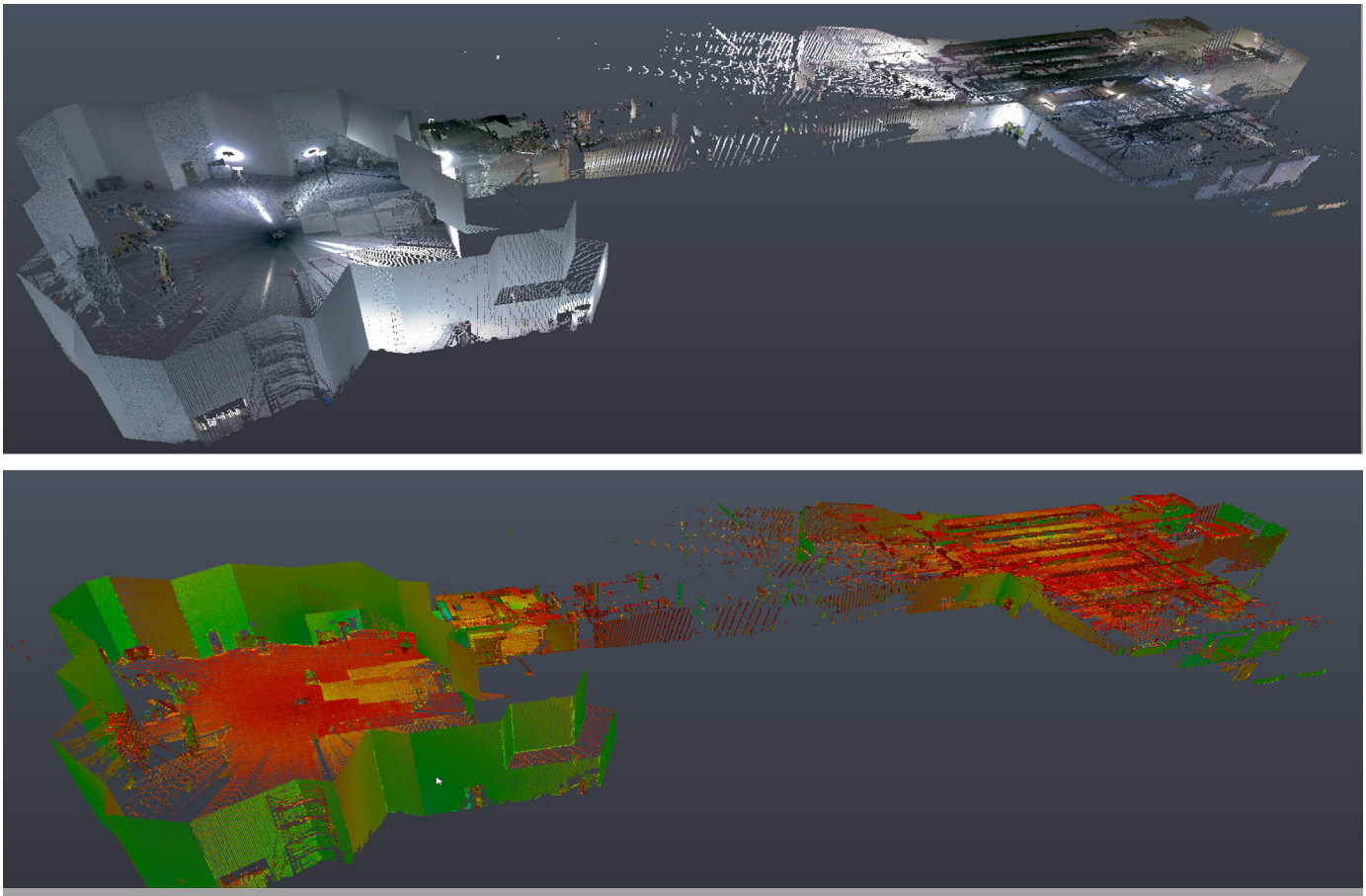
Major
Computer / Electrical engineering

Faculty Supervisors
Borja Garcia De Soto and Samuel A. Prieto Ayllon

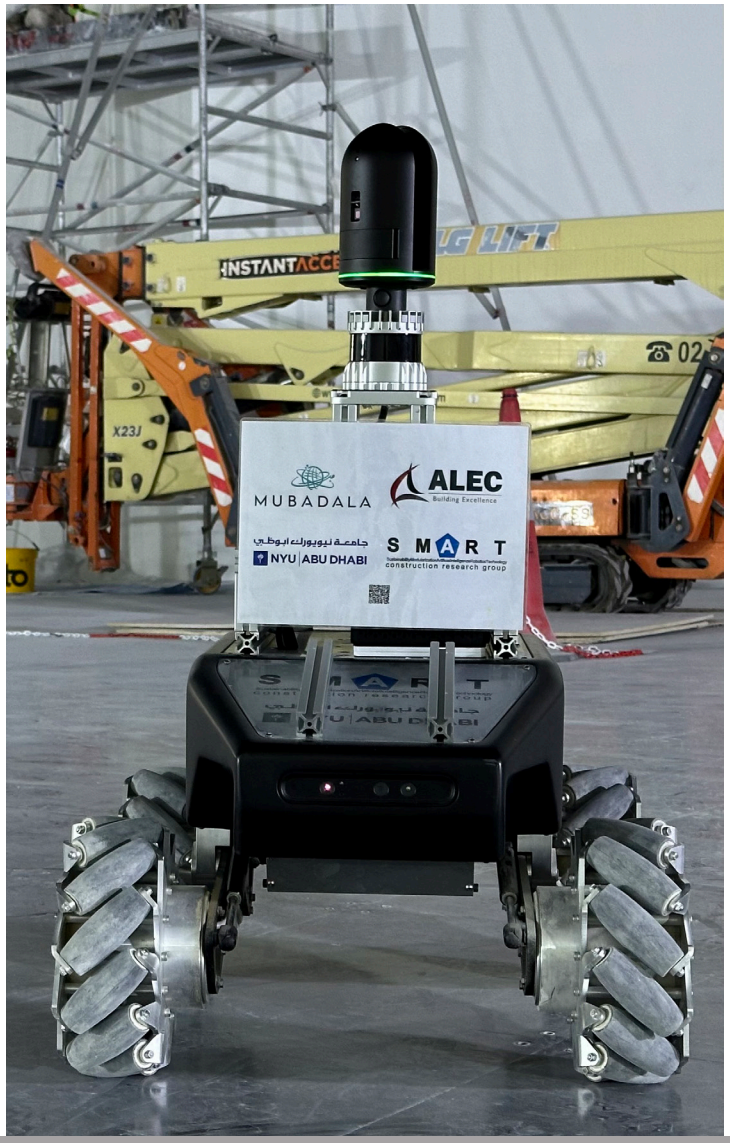
Location: **NYU Abu Dhabi**

ROBOTS FOR AUTONOMOUS DATA COLLECTION ON CONSTRUCTION SITES

My work focused on automating data collection using the Leica BLK360 LiDAR in construction sites. The project aimed to enhance efficiency and accuracy in data acquisition by leveraging LiDAR technology and the Robot Operating System (ROS). I was responsible for integrating the BLK360 into a multi-agent robotic system to capture high-resolution 3D point clouds, infrared images, single LDR images, and 360-degree panoramic images. By using ROS, I automated the data collection process, reducing the need for manual intervention and minimizing errors. I tested and implemented various functionalities provided by the BLK360 API, ensuring seamless integration with our robotic platform.



Point cloud captured with the BLK360 scanner, showing (top) RGB color data for realistic visualization and (bottom) reflectance data highlighting surface properties.



Robotic platform with Leica BLK360 LiDAR being tested in one of ALEC's project in Saadiyat Island.

> This work was conducted as part of the Mubadala-NYUAD Collaborative Project, in close collaboration with the ALEC Innovation Team, utilizing one of its construction projects in Saadiyat as a testing site. The project involved regular collaboration between the research lab and industry partner, periodic meetings, and clearly defined tasks, fostering a well-organized and engaging work environment. This research highlights the potential of robotic systems to revolutionize data collection in the construction industry by enhancing efficiency and productivity.

JODY ALY

Major
Bioengineering

Faculty Supervisor
Kenichiro Kamei

Location: **NYU Abu Dhabi**

VASCULARIZATION OF CEREBRAL ORGANOID

The research project I assisted in mainly focused on generating vascularized brain organoid to explore the potential in modeling neurological diseases. Organoids, as three-dimensional structures derived from stem cells, provide a more accurate representation of human tissues compared to traditional 2D cultures. This shift toward 3D culture systems, particularly with brain organoids, has paved the way for a deeper understanding of complex tissue interactions and disease mechanisms. Brain organoids are especially valuable in neurological research due to their ability to replicate the architecture and cellular diversity of the human brain. The project focused on the importance of vascularization within brain organoid by integrating endothelial cells to promote the formation of blood vessels. This vascularization is crucial for mimicking the natural environment of tissues, supporting nutrient exchange and waste removal, and enhancing the overall physiological relevance of the models. A central part of my work was preparing the generated brain organoid and endothelial cells from human embryonic stem cells for visualization using immunocytochemistry technique and visualizing the sample using Confocal Microscope. I characterized different cell types within both 2D cultures and brain organoids, applying whole-mount immunofluorescence as well as cryosection to achieve clear and accurate results.

STEFAN MITIKJ

Major
Political Science and Social Research and Public Policy

Faculty Supervisor
Muhammet Bas

Location: **NYU Abu Dhabi**

INTERNATIONAL CRISIS BEHAVIOR RESEARCH

I worked on the expansion and refinement of the International Crisis Behavior (ICB) dataset by locating and compiling in-depth sources for various global crises. My task involved finding five of the most detailed and reliable sources for each crisis, focusing on those that provided encyclopedic descriptions and were accessible without paywalls. While Wikipedia served as a starting point, I sought out articles with extensive references to primary sources, books, and academic papers to ensure the quality and depth of the information. I then organized these sources into a local webpage designed to streamline the research process.

Additionally, I participated in a survey analysis project related to U.S. public opinion on foreign disaster aid. I categorized survey responses based on predefined themes such as empathy, strategic considerations, and aid pessimism. My role required careful judgment in applying these categories and assessing the confidence level of my coding. I flagged any issues that arose, such as ambiguous responses or potential new categories, and documented them in the accompanying notes. Throughout the project, I maintained the confidentiality of the responses and ensured that my work was conducted independently.

> **I honed my skills in sourcing and evaluating high-quality academic and primary resources, which deepened my understanding of data reliability and integrity. I also improved my ability to categorize complex survey data, balancing both analytical precision and contextual understanding. This experience enhanced my attention to detail and reinforced the importance of maintaining confidentiality in research. As I navigated through different tasks, I learned the value of methodical organization and independent work, which were crucial for the success of the project.**

SAYDA ABUSALIH

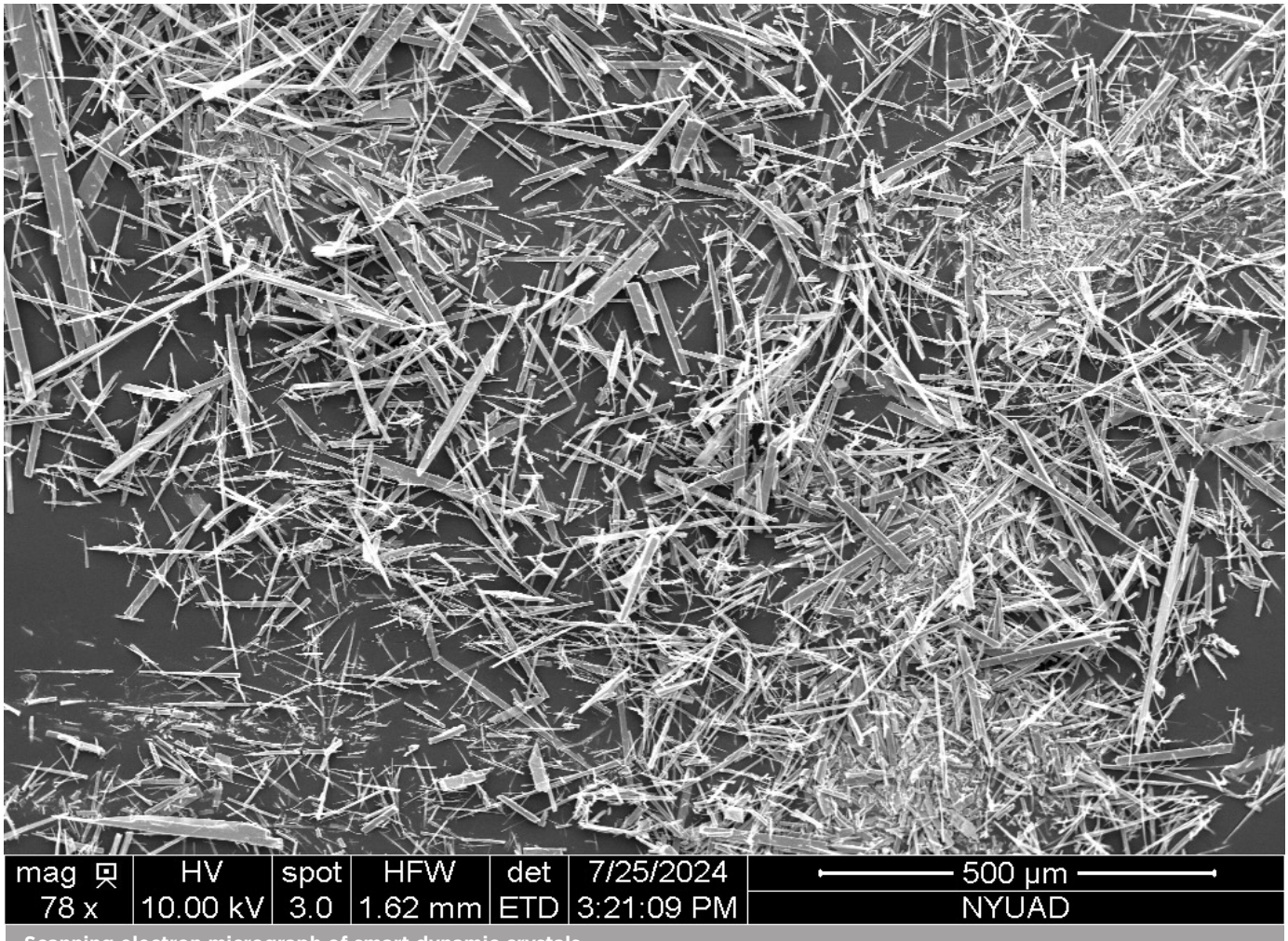
Major
Bioengineering

Faculty Supervisors
Pance Naumov and Ejaz Ahmed

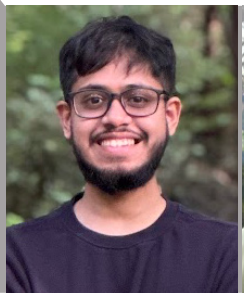
Location: **NYU Abu Dhabi**

SMART DYNAMIC HYBRID MEMBRANES WITH SELF - CLEANING CAPABILITY

I worked on a project relating to smart dynamic membranes for water desalination. The team developed a novel membrane design incorporating stimuli-responsive organic crystals into the surface layer of conventional static membranes. This design created a self-cleaning mechanism activated by slight temperature increases, effectively removing foulants without chemical cleaning. The project demonstrated significant improvements in membrane efficiency, operational lifespan, and environmental sustainability, potentially revolutionizing water treatment technologies.



Scanning electron micrograph of smart dynamic crystals.




NAUSHADUL ISLAM,
MD SHADAD FARHAN HOSSAIN

Major
Interactive Media

Faculty Supervisor
João Sedoc

Location: **NYU New York**

EMPATHIC CONVERSATIONS: A MULTI - LEVEL DATASET OF CONTEXTUALIZED CONVERSATIONS

We explored the intersection of natural language processing (NLP) and empathy detection within digital communication. The aim was to develop a model capable of assessing the level of empathy in text-based interactions, which could have significant applications in online counseling, customer service, and social media platforms.

Initially, we focused on selecting an appropriate model for this task. After evaluating various transformer-based architectures, we decided on RoBERTa due to its robust performance in text classification tasks. Utilizing the roberta-base model, we modified it for a sequence classification task, adapting it specifically to quantify empathy levels, where the output was formatted as a regression rather than a typical classification.

The training process involved a custom dataset, which we preprocessed using a tokenizer compatible with RoBERTa. The dataset was split into training, validation, and test sets, ensuring that each segment received an appropriate model evaluation phase. Throughout the project, we utilized the Hugging Face's 'transformers' library for model implementation, fine-tuning the model on the training data with a focus on optimizing the Pearson correlation coefficient to evaluate performance.

DANIE LAMINTA

Major
Biology

Faculty Supervisor
Dan Ohtan Wang

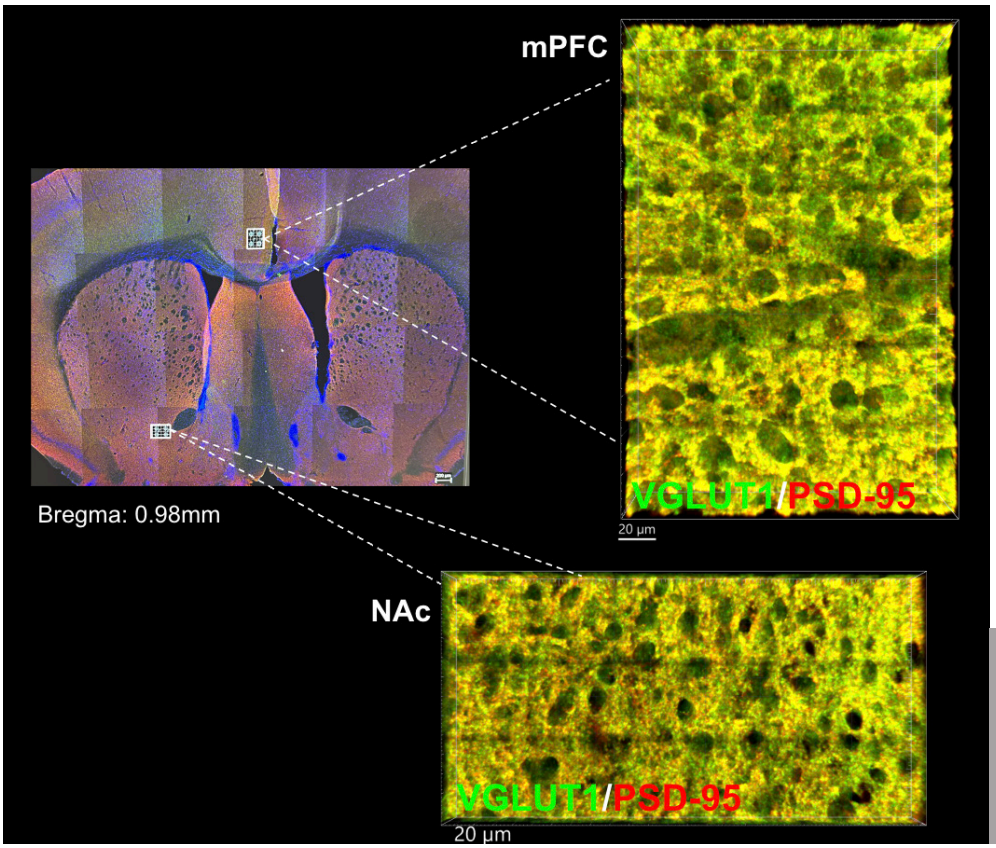
Location: **NYU Abu Dhabi**

M6A READER YTHDF3'S ROLE IN MOTIVATION, BEHAVIOR FLEXIBILITY, AND SYNAPSE ARCHITECTURE

I analyzed preliminary behavior data to explore the role of YTHDF3, an m6A reader protein, in regulating behavior, synaptic structure, and molecular pathways in the forebrain. Using conditional knockout (cKO) and wild-type (cWT) mice, behavior tests revealed that cKO male mice exhibited reduced motivation, while cKO female mice showed altered movement patterns.

Together with my supervisors, we set up a protocol for glyoxal fixation to enhance synaptic staining in the mPFC, HP, and NAc regions, aiming to link observed behavioral changes to potential synaptic disruptions. Although the protocol setup is still ongoing, it represents a key step in understanding the structural underpinnings of these behaviors.

Finally, I performed RNA sequencing analysis on the mPFC, HP, and NAc regions, identifying significant changes in pathways related to synapse structure and axon development, providing insights into YTHDF3's role in synaptic plasticity and stability.



Representative confocal images of excitatory synapse markers VGLUT1 (green) and PSD-95 (red) in the mPFC and NAc regions, used for synapse quantification.

> I will be continuing this research project for my Capstone, where I will perform the synapse staining, a crucial step in linking behavioral changes to synaptic structure. Over the summer, I gained valuable wet lab skills, including perfusion, tissue slicing, and the use of a confocal microscope for fluorescence imaging.

> One key takeaway from this experience is the realization that research is not just about data collection; it's about presenting a coherent story. Data remains just numbers without proper explanation and connection to other findings. I also learned the importance of thinking outside the box and what scientific rigor truly means. There are numerous details to consider when designing a study and justifying methods, and this experience has significantly deepened my understanding of the complexities involved in research.

RAFFAELLO KHAN AGUSTIN

Major
Social Research and Public Policy

Faculty Supervisor
Anju Mary Paul

Location: **NYU Abu Dhabi**

THE UNIVERSITY DREAMS OF FILIPINO PARENTS FOR THEIR UAE - EDUCATED CHILDREN

Filipino migrants, one of the top migrant populations in the UAE, send their children to the numerous international and Filipino curricula schools available in the country. These schools have a good reputation for providing a quality education for secondary education. However, when it comes to their children's tertiary education, these parents often find themselves in a quandary. Do they send their children to a university in the UAE? Or to one in the Philippines where they are still citizens? Or do they send them to a university in a third country, potentially one where their child can gain permanent residence and eventual citizenship?

This research project sought to understand the decision-making process middle-class Filipino parents in the UAE undertake as their UAE-educated children approach university age, in order to uncover the factors that could influence their university dreams and decisions for their children. We were particularly interested in how parents' social class, their child's gender and potential major, influence these decisions. In addition, this project explored the evolving reputation of UAE universities (both private and public) amongst the expatriate population in the country, and how effective its efforts to transform itself into an international higher education hub have been.

> **"Through this research project, I was able to explore themes that are directly relevant to my own background - as a Filipino who migrated for my studies. The interviews I conducted amongst the Filipino population allowed me to connect with my countrymen. It provided me an opportunity to recognize the importance of education from the perspective of parents, and how the Filipino society and culture gives high regard on getting a university education."**

RASHIK CHAND

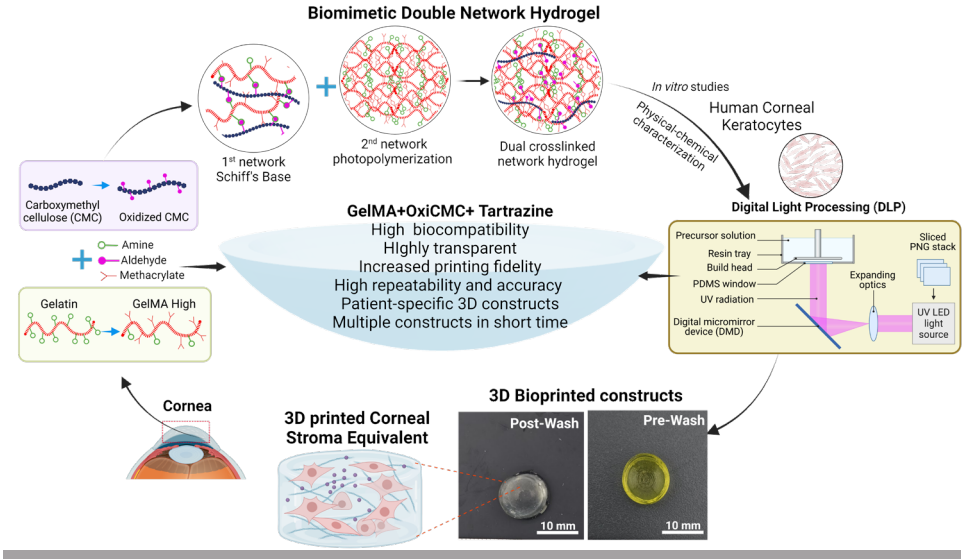
Major
Bioengineering

Faculty Supervisor
Vijayavenkataraman Sanjairaj

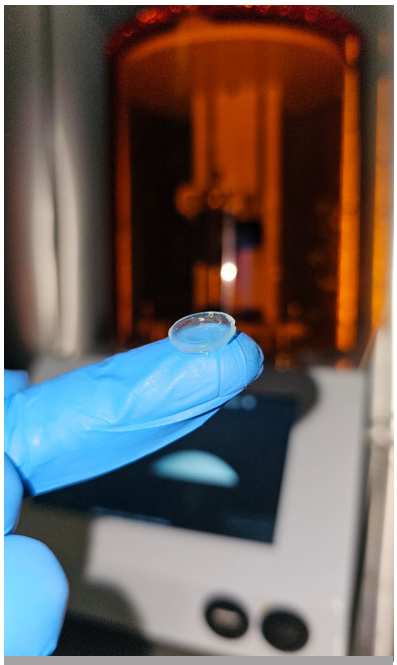
Location: **NYU Abu Dhabi**

CORNEAL BIOPRINTING

Corneal blindness is a significant global issue, exacerbated by the scarcity of donor corneas for transplantation. This study presented, for the first time, an innovative interpenetrating network hydrogel made of gelatin methacryloyl (GelMA) and oxidized carboxymethyl cellulose (OxiCMC) for bioprinting a biomimetic corneal stroma equivalent. Various GelMA and OxiCMC combinations were optimized for printability and assessed through rheological studies and other evaluations. Using digital light processing (DLP) bioprinting with tartrazine as a photoabsorber, we successfully fabricated high-resolution, reproducible 3D constructs that closely mimic the native corneal stroma. These constructs achieved a compressive modulus comparable to native tissue and maintained optical transparency. The dual crosslinking strategy enhanced the mechanical properties without using synthetic materials or toxic crosslinkers. Scanning electron microscopy revealed improved porosity and structural integrity, supporting better nutrient diffusion and cell viability. In vitro tests showed high cell viability and desirable proliferation of human corneal keratocytes within the constructs. Overall, the GelMA-OxiCMC hydrogel system for DLP bioprinting offers a promising solution for corneal tissue engineering, potentially addressing the donor shortage and advancing regenerative medicine for corneal repair.



Graphical Abstract.



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BRUNA ARAUJO PEREIRA

Major
Art & Art History

Faculty Supervisor
Andreas Valentin

Location: **Brazil**

ART BY THE PUBLIC: COMMUNITY-BASED MUSEUMS IN BRAZIL

Over the summer, I visited art institutions across the cities of Rio de Janeiro, Recife and São Paulo, Brazil. My goal was to find out if and how they are increasing access to the public, as well as incorporating them into the decision-making process. The curators and coordinators I interviewed also talked about their engagement with sections of society that visit the museum the least, namely low-income and Black people. All of the institutions demonstrated community-based approaches. Museu da Maré highlighted the history and culture of the favela through resident-donated objects, while Museu de Favela used photography and interviews to uplift the life stories of the surrounding community.

Even the more traditional Museu de Arte do Rio works with people that have personal connection to the topics of each exhibition, in a process of "shared curation". These approaches celebrate marginalized voices and challenge top-down museum models.

> **It was rewarding to speak to a diverse group of art professionals and learn more about the backstage work of running a socially-engaged art institution. Through this research I also came up with new references and questions that have been useful in the development of my Capstone installation project in Visual Arts.**

Painted wall at Museu da Maré, Rio de Janeiro, where I spoke to museum educators.

Visit to “Entre o Aiyê e o Orun,” exhibition about Afro-Brazilian mythology at Caixa Cultural, Recife.

"Museu de Favela is a virtue of an honest attitude.” Visit where I spoke to the coordinator. Rio de Janeiro.

ANNAFEW BISWAS

Major
Mechanical Engineering

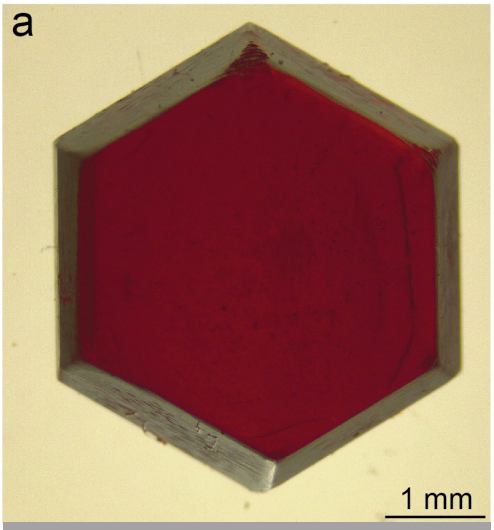
Faculty Supervisors
Pance Naumov and Marieh Bassam Al-Handwi

Location: **NYU Abu Dhabi**

SELF HEALING PEROVSKITE CRYSTALS

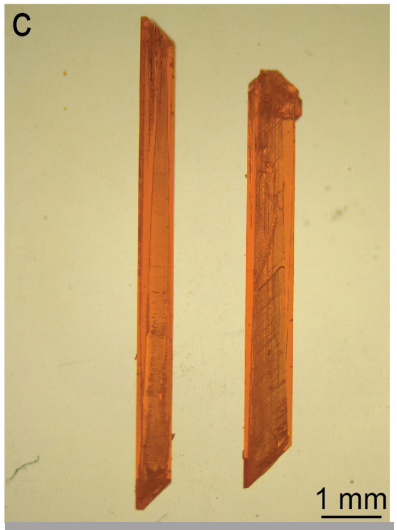
One of the key pillars of the UAE's Vision 2030 is to reduce reliance on oil and gas by fostering green jobs and industries, which involves a transition to alternative energy sources such as solar energy. In this project, I collaborated with members of the Smart Materials Lab to investigate a promising class of materials known as hybrid organic–inorganic perovskites (HOIPs). These materials are considered the next generation of photovoltaics and light-emitting diodes. However, the use of HOIPs in polycrystalline films currently faces challenges related to defects and poor stability. To address some of these issues, I synthesized and grew various HOIPs as single crystals, enhancing the stability of the material and reducing defect density, which leads to superior optoelectronic properties and performance. In addition to growing single crystals, I expanded my research to explore the self-healing capabilities of various HOIP crystals, aiming to improve their mechanical properties and wear resistance. I discovered that these crystals can readily self-repair, achieving a remarkable healing efficiency of approximately 70%. Moreover, after testing the healed crystals as photodetectors, I observed an impressive recovery of the generated photocurrent compared to pristine crystals. Additional characterizations were conducted, including scanning electron microscopy to observe and evaluate the healed material at the crack site, and nanoindentation to determine mechanical properties such as hardness and Young's modulus.

Optical images of different single crystals of perovskite grown in the lab.



A hexagon-shaped crystal of methylammonium bismuth iodide ((CH3NH3)3Bi2I9).

A crystal of methylammonium lead bromide ($CH_3NH_3PbBr_3$).



Crystals of cesium lead bromide ($CsPbBr_3$), displaying their characteristic rod-like morphology.

ALEXANDER CHRISTOU

Major
Social Research and Public Policy

Faculty Supervisor
Rana Tomaira

Location: **NYU Abu Dhabi**

BIKING UNDER THE SUN: INVESTIGATING THE GROWTH AND CHALLENGES OF CYCLING IN ABU DHABI

For my Capstone project, I aimed to better understand how people navigate Abu Dhabi on a bicycle, both for commuting and for leisure. Using qualitative research methods, I produced the first cycling study in the Arabian Peninsula, contributing greatly to literature on both Bike Cities and cycling usage. Through interviewing cyclists, commuters and policy-makers, I was able to make policy recommendations to stakeholders and government partners to cater to biking populations. At a time when Abu Dhabi is creating hundreds of kilometers of cycling infrastructure after the city's "UCI Bike City" designation, the findings have a direct impact on policy-makers and decisions made regarding used urban spaces and challenges. While cycling infrastructure comes from a top-down approach, this project provided real-world solutions and insight from the bottom-up, and benefitted both Abu Dhabi residents and authorities. As a CITIES Tamayyuz Research Fellow, I will be building upon this research to include scooter mobility patterns, and create a comparative study between Abu Dhabi and Dubai.

Riders participate in TrainYas, a free weekly cycling program held at Yas Marina Circuit.

World Bicycle Day 2024, hosted by Abu Dhabi Sports Council on Hudayriat Island.

ALIYA KOISHINA

Major
Psychology

Faculty Supervisor
Daryl Fougnie

Location: **NYU Abu Dhabi**

PRIORITIZATION IN WORKING MEMORY VIA METACOGNITIVE JUDGEMENTS

We have control over the contents of working memory: Retro-cue paradigms reveal that explicitly cued items are prioritized, resulting in retinotopic neural enhancement and improved behavioral performance. But how flexible is this prioritization? We examined whether participants can prioritize items in working memory based on metacognitive judgments in the absence of external cues.

We combined the standard retro-cue paradigm, where participants selectively focus on one of three oriented lines during memory maintenance, and a 'choose best' paradigm (Fougnie et al. 2012), where participants use metacognitive information to select a best-remembered item. Critically, the to-be-prioritized item was indicated either by an external spatial cue or by instructions to prioritize the best remembered item. These prioritized trials were compared with trials where no item was prioritized during memory maintenance and the to-be-reported item was indicated either by an external spatial cue (neutral trials) or by instructions to report the best remembered item. Participants performed better in cue-based prioritization than in the neutral condition of remembering three orientations without prioritization, replicating past retro-cue findings. Our results also reveal an ability to use meta-cognitive information. Participants performed better when allowed to choose the best item (compared to reporting a random item in neutral trials). Further, the combined condition (participants choose the best item to selectively maintain during maintenance) showed additive benefits of both prioritization and self-selection.

Our findings add to a growing literature showing that participants not only have metacognitive access but can use this information to make meaningful decisions. Further, the results reveal that prioritization in working memory can be flexibly directed by purely top-down and self-directed means, similar to how attention operates in perception. In ongoing work, we are collecting neural data to investigate whether the internal metacognitive driven prioritization shares similar neural mechanisms with cue-driven prioritization.

YERKEBULAN IMANBAYEV

Major
Interactive Media

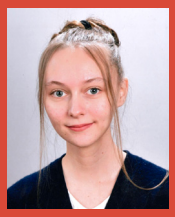
Faculty Supervisor
John Coughlin

Location: **NYU New York**

INTRODUCTION TO PEACE STUDIES AT NYU ABU DHABI

I crafted a proposal for the Peace Studies program at NYU Abu Dhabi. My work spanned three stages: first, I analyzed Peace Studies programs at NYU's peer schools, such as Georgetown University, the University of Notre Dame, the University of California, Berkeley, and others. This analysis provided me with a general insight into the structure of various North American methodologies for teaching Peace Studies. This led to the second stage of the project: examining the introductory, gateway courses of these programs, which allowed me to understand the thematic frameworks that are common to the field. Finally, I conducted a thorough analysis of readings that are considered essential to the discipline.

> **"The culmination of my work was the creation of a syllabus for the "Introduction to Peace Studies" class at NYU Abu Dhabi, which synthesized my research throughout the summer and applied it to the context of NYU Abu Dhabi."**

FATMA ALREBH, MILENA BISENIC, HEESUNG TAE, ABDULLAH SALMAN

Major
Bioengineering and Chemistry

Faculty Supervisors
Ibrahim Chehade, Rafael (Yong-Ak) Song and Andras Gyorgy

Location: **NYU Abu Dhabi**

NYUAD IGEM 2024: REEFORM – ENGINEERING THE CORAL MICROBIOME

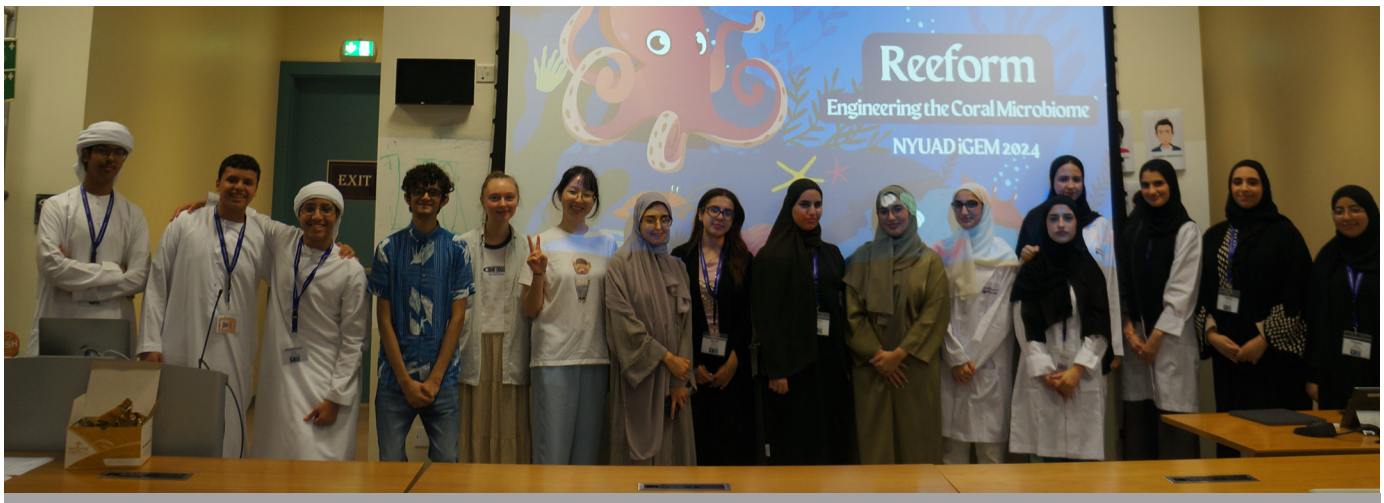
While corals occupy less than one percent of the ocean's surface area, they support an estimated quarter of marine life, or over 830,000 multicellular species. However, they are threatened by various stressors, including rising temperatures and coral disease. Corals host one of the most diverse microbiomes, and subtle changes in this microbiome can enhance traits such as heat tolerance, pathogen defense, and nutrient acquisition.

This research aimed to enhance the natural adaptive capacity of coral microbiomes via synthetic biology. Genes that modulate heat tolerance and pathogen defense will be overexpressed in two key members of the coral microbiome: Symbiodiniaceae and Endozoicomonas.

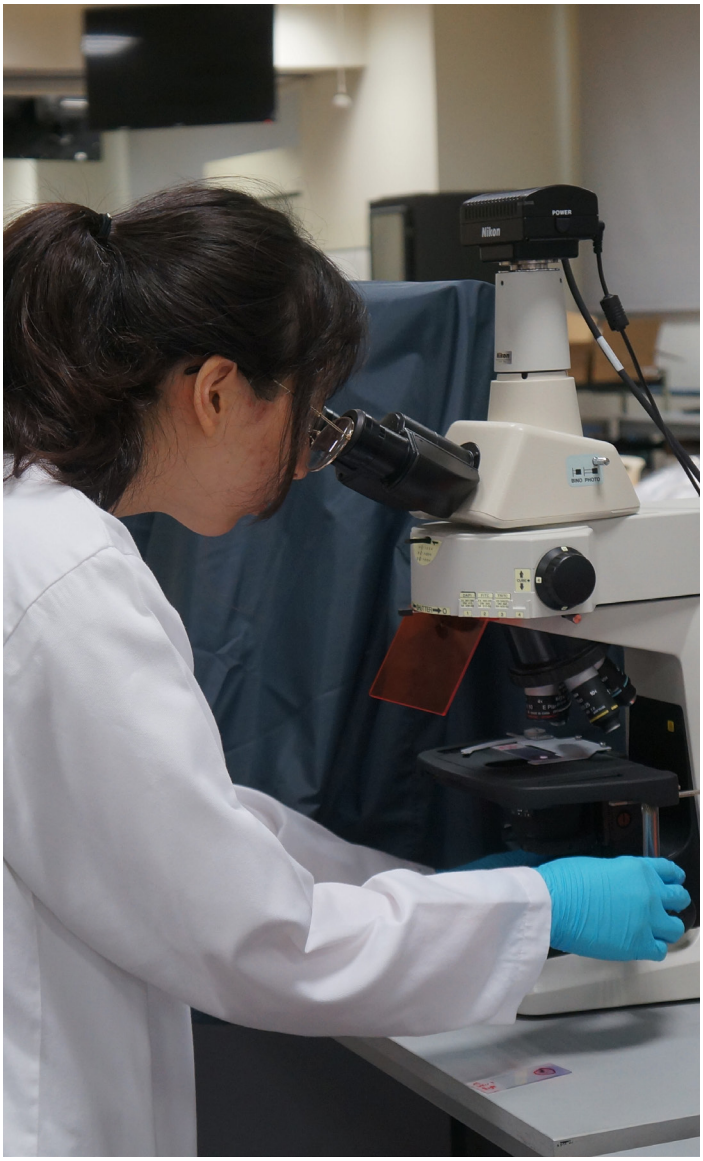
To achieve this, we performed over 40 bacterial transformations of gene expression elements, which were then combined to build 17 transcriptional units (TUs) via Golden Gate Assembly. We were responsible for the extraction, purification, and quantitation of each vector and for characterising the expressed proteins via spectrophotometry.

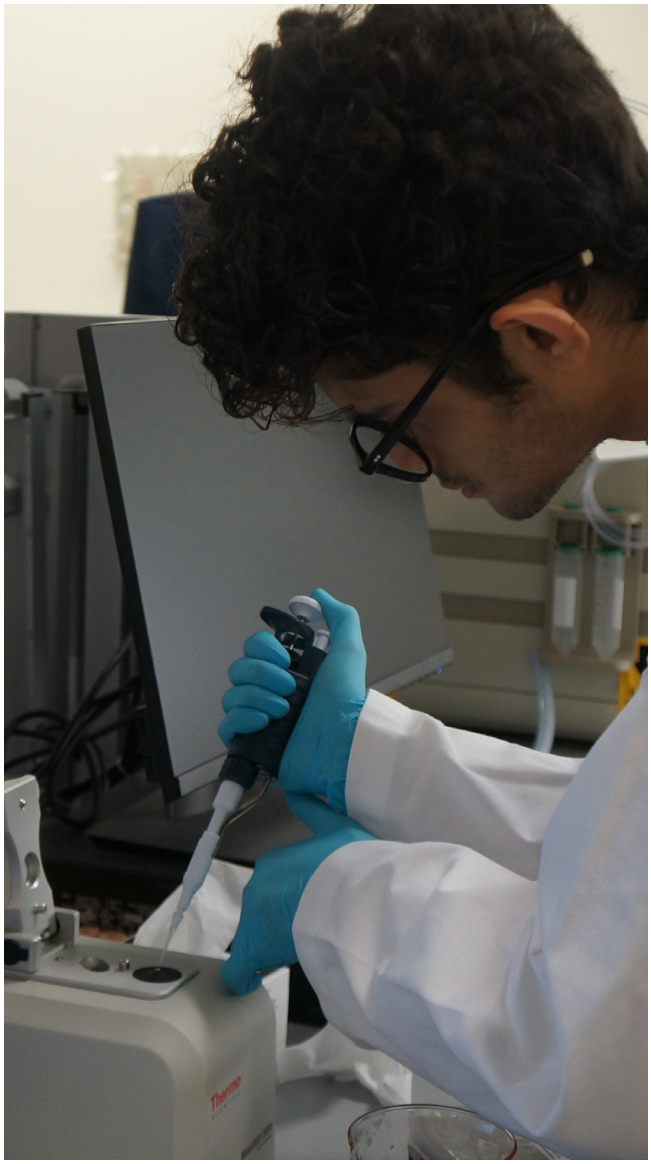
Moreover, we developed a bioinformatics pipeline for identifying gene regulatory elements in non-model organisms. This included steps such as whole genome alignment, identification of locally collinear blocks (LCBs), and phylogenetic tree generation. We identified over 500 LCBs to drive gene expression.

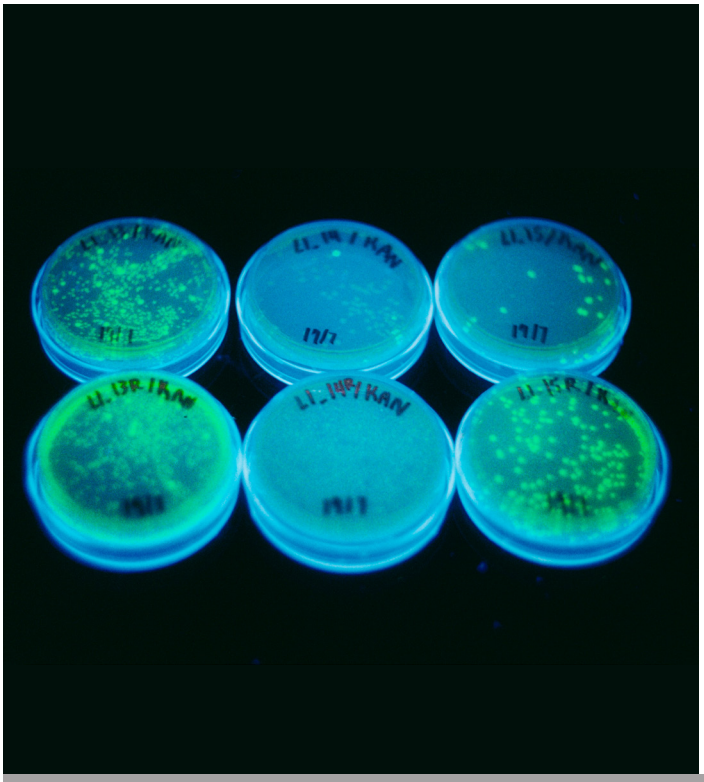
Another part of the research included designing a microfluidic single-cell electroporation device while simplifying its fabrication process with the recent high-precision 3D printing technology instead of the traditional soft lithography technique. Microfluidic electroporation is known to dramatically increase the transformation efficiency by lowering the minimum required voltage, providing a uniform electric field, and consuming less of the cell samples.

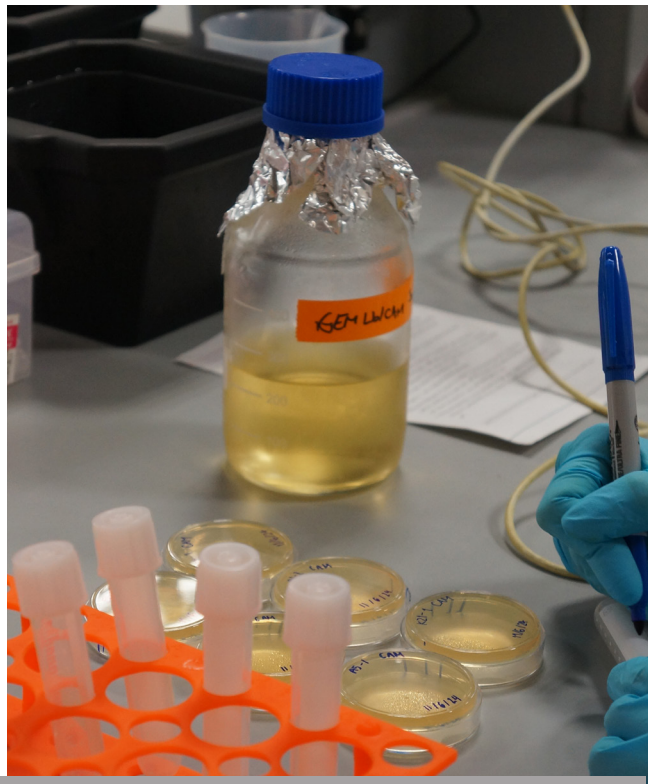


NYUAD iGEM team members with NYUAD Summer academy students.









Glimpses from Wet lab experiments conducted for Reeform.

RAWAN HABASHY

Major
Civil Engineering

Faculty Supervisors
Kemal Celik and Padmaja Krishnan

Location: **NYU Abu Dhabi**

UTILIZATION OF DESERT SAND WITH BCSA CEMENT

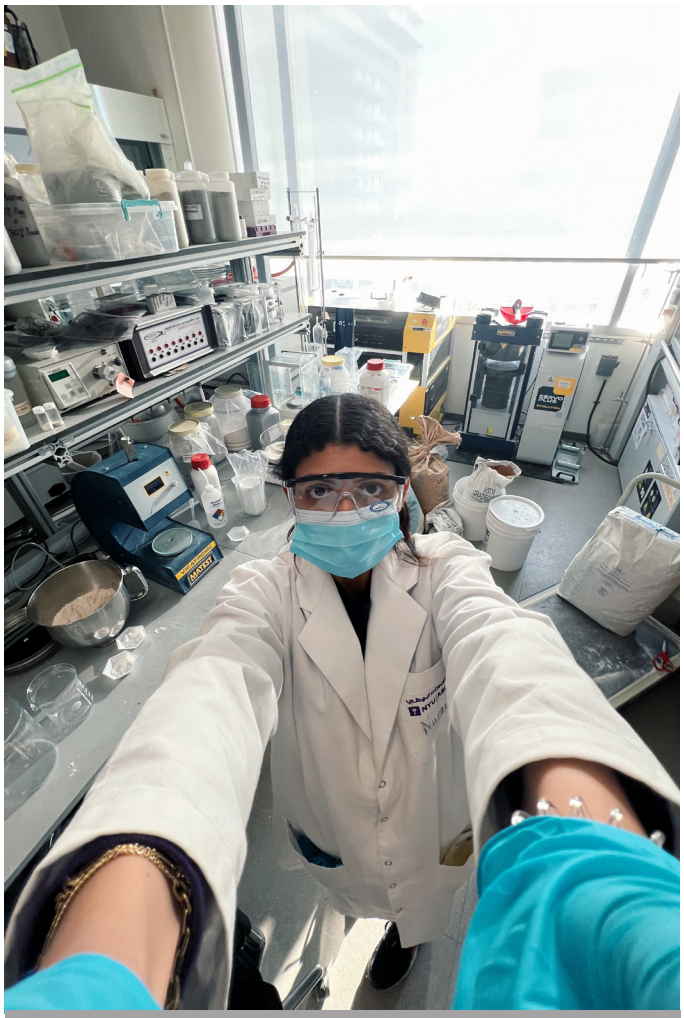
BCSA stands for Belitic Calcium Sulfoaluminate Cement. This type of cement is known for its fast-setting time, rapid strength gain, and low carbon dioxide emissions. Given the abundance of desert sand in the UAE, I aimed to explore the possibility of combining BCSA cement with desert sand.

To investigate this, I cast various mortar batches using BCSA with both standard sand and desert sand. The main challenge was dealing with the fine particle sizes of desert sand, which affected the workability of the mixtures. However, I overcame this challenge by adding a superplasticizer to the mixtures containing desert sand.

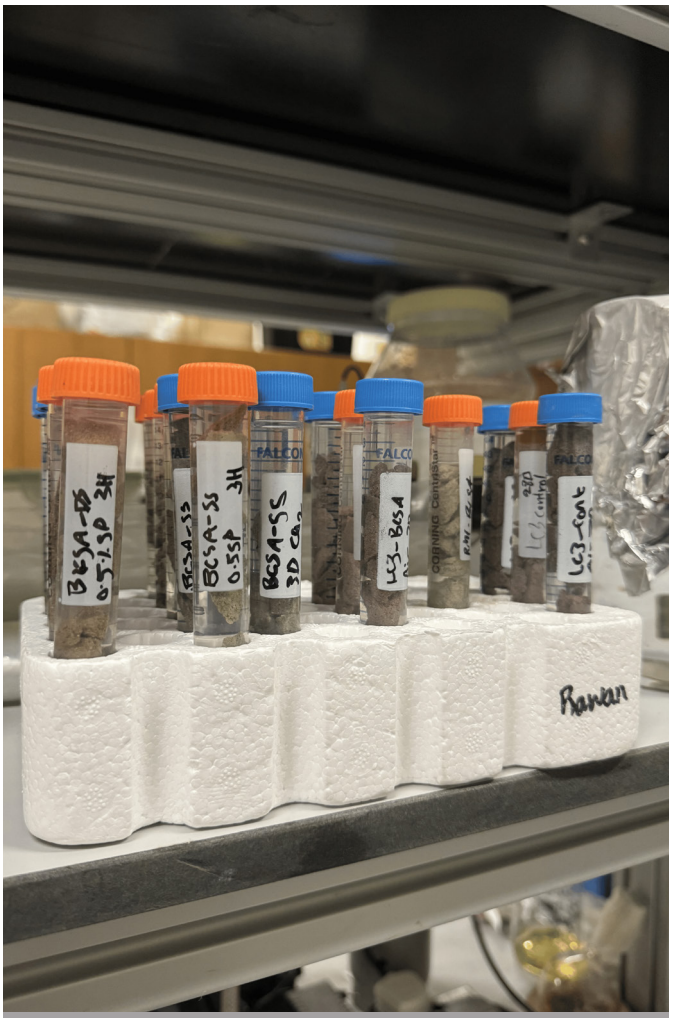
I examined the rheological properties, mechanical properties (compressive and flexural strengths), durability (chloride ion penetration), and hydration using isothermal calorimetry, as well as microstructure characterization (thermogravimetric analysis, XRD, SEM, etc.) of the BCSA-desert sand mortars.

I concluded that the compressive and flexural strengths of BCSA-desert sand mortars are comparable to those of BCSA-standard sand mortars. Therefore, there is potential for using the abundantly available desert sand in construction.

> **Being part of the AMBER Lab and working on the "Utilization of Desert Sand with BCSA Cement" project has been an absolute honor. Professor Kemal and Dr. Padmaja have supported me throughout my journey, and I am grateful for their constant guidance and motivation. In addition, we are expecting to have our paper published.**

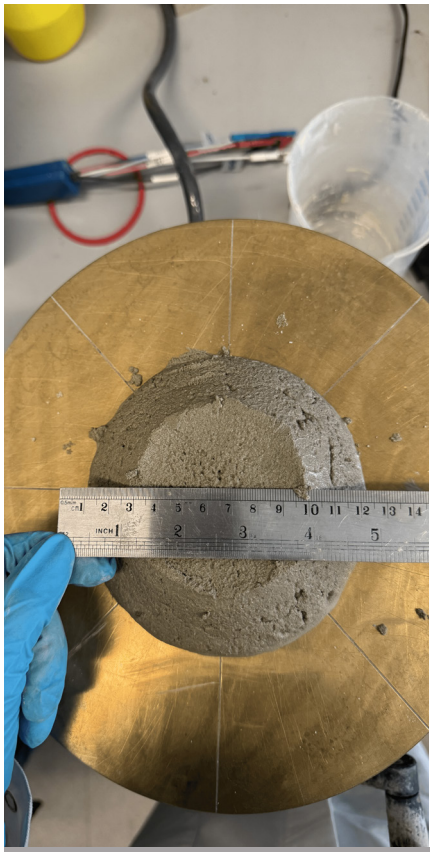


Documenting memories in AMBER Lab.



Preparing samples for microstructural characterization.

Evaluating durability of the sustainable mortar samples.



Testing the workability of mortar.

Mortar samples for compressive strengths.

ZHANSAYA MAKHAMBETOVA

Major
Bioengineering

Faculty Supervisors
Khalil Ramadi and Mohamed Elsherif

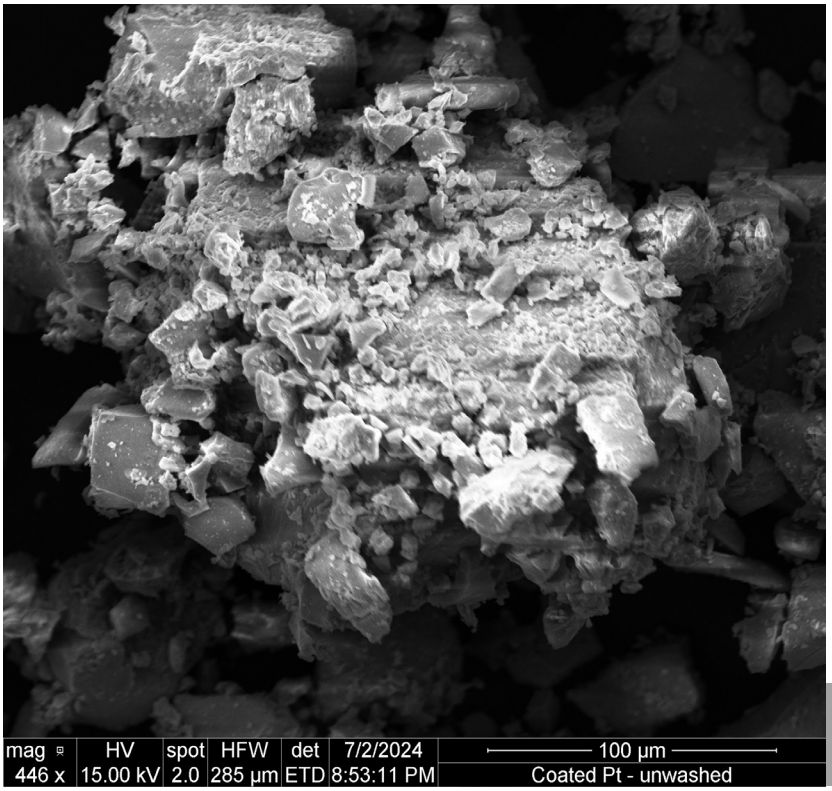
Location: **NYU Abu Dhabi**

SYNTHESIS AND DETAILED CHARACTERIZATION OF MAGNETOELECTRIC NANOPARTICLES FOR ADVANCED NEUROMODULATION APPLICATIONS

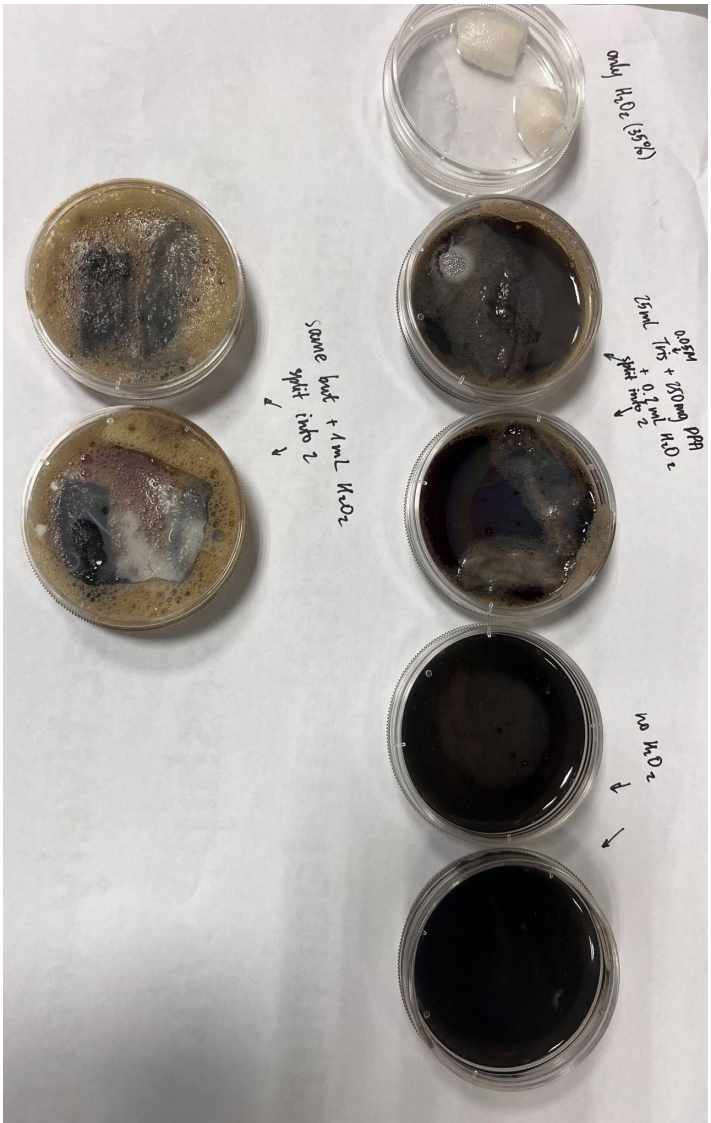
My research focused on the growing importance of nanoparticles in advancing biomedicine, particularly in the field of neural stimulation. Nanoparticles, especially magnetoelectric nanoparticles (MENPs), have the unique ability to couple magnetic and electric fields, enabling precise control over biological processes when exposed to external magnetic fields. My work involved the chemical synthesis of CoFe2O4–BaTiO3 MENPs using coprecipitation and sol-gel methods, aimed at creating nanoparticles with optimal magnetic and electric properties for biomedical applications.

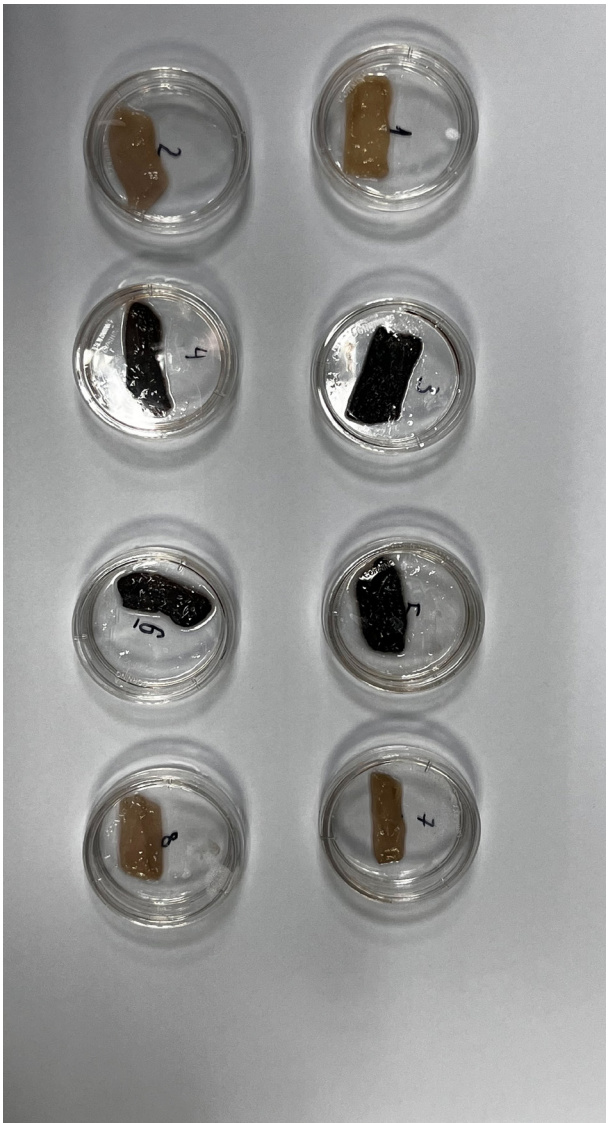
After successfully synthesizing the MENPs, I proceeded to their characterization. I measured the absorbance and transmittance of MENP suspensions using spectrophotometry to assess their optical properties. Additionally, I used a Zetasizer to determine the particle size. Additionally, I was trained in scanning electron microscopy (SEM) and successfully imaged the nanoparticles to analyze their morphology. To evaluate their magnetic properties, such as coercivity, I employed a vibrating sample magnetometer (VSM). Furthermore, I investigated their functional integration by coating live tissue and analyzing changes in chemical bonding using Fourier-transform infrared spectroscopy (FT-IR). This step was crucial in evaluating the potential interaction between MENPs and biological tissue, providing insights into their biocompatibility. This research contributed to a broader understanding of MENPs and their possible applications in non-invasive biomedical therapies.

SEM operation process.



SEM image of synthesized MENPs core-shell structure.





MENPs- and polydopamine-coated sheep intestine samples under varying concentrations and conditions.

SANSHIKA GARG

Major
Bioengineering

Faculty Supervisor
Georgia Schafer

Location: **International Centre for Genetic Engineering and Biotechnology (ICGEB) South Africa**

GENERATION OF SARS-COV-2 PSEUDOVIRIONS FOR INFECTION STUDIES

The primary objective of this project was to create non-replicative SARS-CoV-2 pseudovirions, which are lentivirus-based and express the Spike protein of SARS-CoV-2 along with a luciferase gene. These pseudovirions were used to assess infectivity in engineered HEK-293T cells that express the ACE2 receptor, a key entry point for SARS-CoV-2.

My role involved several critical tasks, including cell culture, transfection, harvesting of pseudovirions, and conducting luciferase assays to measure successful infection. I worked on transfecting HEK-293T cells with plasmids to produce these pseudovirions, harvesting them, and subsequently infecting target cells to analyze the efficiency of infection. The results were quantified through luminometry, which measured luciferase enzyme activity as an indicator of infection.

This research is highly relevant to ongoing efforts to combat the COVID-19 pandemic, as it provides a safer and more controlled method to study the mechanisms of SARS-CoV-2 infection without the risks associated with live virus studies. Additionally, by testing potential inhibitors that could block the interaction between the SARS-CoV-2 Spike protein and the ACE2 receptor, this project contributes to the development of therapeutic strategies aimed at preventing viral entry and reducing the spread of the virus.

> **During this research project, I honed critical skills that are foundational in bioengineering, particularly in biomanufacturing and virological research. I gained hands-on experience in advanced techniques such as cell culture, transfection, and performing luciferase assays. These skills have deepened my understanding of experimental design and data analysis, equipping me to tackle complex challenges in bioengineering.**

ALBINA UVASHEVA

Major
Psychology

Faculty Supervisor
Niobe Way

Location: **NYU New York**

THE LISTENING PROJECT

I assisted with a research project that examined interpersonal curiosity in 6th-grade students in New York public schools. The study involved students completing online surveys, questionnaires, and participating in a curiosity game designed to measure their interpersonal curiosity. After completing my training, I assisted in data collection at two schools, where I conducted interviews with students, managed recording equipment, and provided technical support to ensure the smooth completion of online surveys. I was also deeply involved in data processing and management, including transcribing interviews, verifying transcript accuracy, and organizing the data in Excel for analysis.

> **This experience helped me build essential skills and sparked a deeper interest in educational and developmental psychology, a field I was just beginning to explore.**

> **My summer research led to a personal project titled Interpersonal Curiosity Predicts Empathy Among Middle School Students. I had the privilege of presenting this work as a poster at the APS Virtual Global Psychological Summit 2024, marking a meaningful milestone in my academic journey.**

YOGESH DHUNGANA

Major
Economics

Faculty Supervisor
Veda Binod Narasimhan

Location: **NYU Abu Dhabi**

ASSESSING MIGRATION PATTERNS IN RURAL VILLAGES OF UTTAR PRADESH, INDIA: A STUDY FROM 1991–2011

I worked on an ongoing research project analyzing the migration patterns in rural villages of Uttar Pradesh, India, across different time periods—1991, 2001, and 2011—using large-scale government census data. The main objective was to study how population changes across various geographic regions in the most populous state of India may have been influenced by administrative restructuring (e.g., changes in the number of Gram Panchayats) or socioeconomic factors, such as education, employment, and infrastructure development. My work primarily focused on visualizing key demographic variables across three different census years, including total population, populations of Scheduled Castes/Tribes, and literacy rates.

To achieve this, I cleaned and processed population census data from 1991, 2001, and 2011 in Stata by merging the data with core key datasets based on a unique identifier called shrid2. This identifier was used to link villages across all datasets. The cleaned and merged data was then exported to QGIS for visualization. In QGIS, I created layers for each census year and generated the shrid2 field for each village polygon, allowing me to join the merged CSV files to their corresponding shapefiles. This workflow allowed me to accurately visualize and analyze population shifts and migration patterns in rural Uttar Pradesh, providing insights into how various factors may have influenced migration over time.

> **The opportunity allowed me to apply classroom skills to real-world scenarios, analyzing large-scale government census data. Extensive data cleaning, matching, and visualizing of the demographic data using Stata and QGIS has greatly honed my technical and research abilities.**

Mapping population datasets using QGIS for migration pattern analysis across rural villages of Uttar Pradesh, India.

REHNUMA TASKIN

Major
General Engineering

Faculty Supervisor
Francesco Arneodo

Location: **NYU Abu Dhabi**

SIMULATION OF COSMIC RAY DETECTOR BASED ON MUOGRAPHY PRINCIPLES

My summer research project involved simulating a cosmic muon detector to study the internal characteristics of large structures through muography. This technique uses muons, high-energy particles from space, to analyze and infer the composition and density of materials within objects, offering valuable insights for archaeological Applications.

My research involved modifying an existing muon detector using the Geant4 toolkit and simulating it with the Open Graphics Library (OpenGL). The detector comprises 20 plastic scintillators arranged such that every set of 10 scintillators is oriented at a 90-degree angle relative to the adjacent set. This configuration ensures that each scintillator in one set is rotated 90 degrees from one another and same configuration is applied to all neighboring scintillators set. As muons travel through the detector, they deposit energy in the scintillators and measuring the amount of energy deposited by the muons, we get clues about the density and composition of the material within the object.

The primary focus of my project was to study the energy deposited by muon collisions with the plastic scintillators inside the detector. The unique geometric arrangement of the scintillators, modified to triangular pyramidal shapes using trapezoidal forms, was designed to optimize the detection and measurement of muon interactions. The coordinates and sizes were calculated precisely to achieve this specific geometry of the detector.

The project is entirely based on C++ language and ROOT framework. With an unique geometry, the energy deposition inside detector were kept recorded for further studies. This project comes as a different approach to the conventional detector geometries and holds a great potential for archeological studies.

> **“The experience opened my eyes to the vast and exciting possibilities within particle physics.”**

AAYAN MASOOD PATHAN

Major
Mathematics

Faculty Supervisor
Balázs Maga

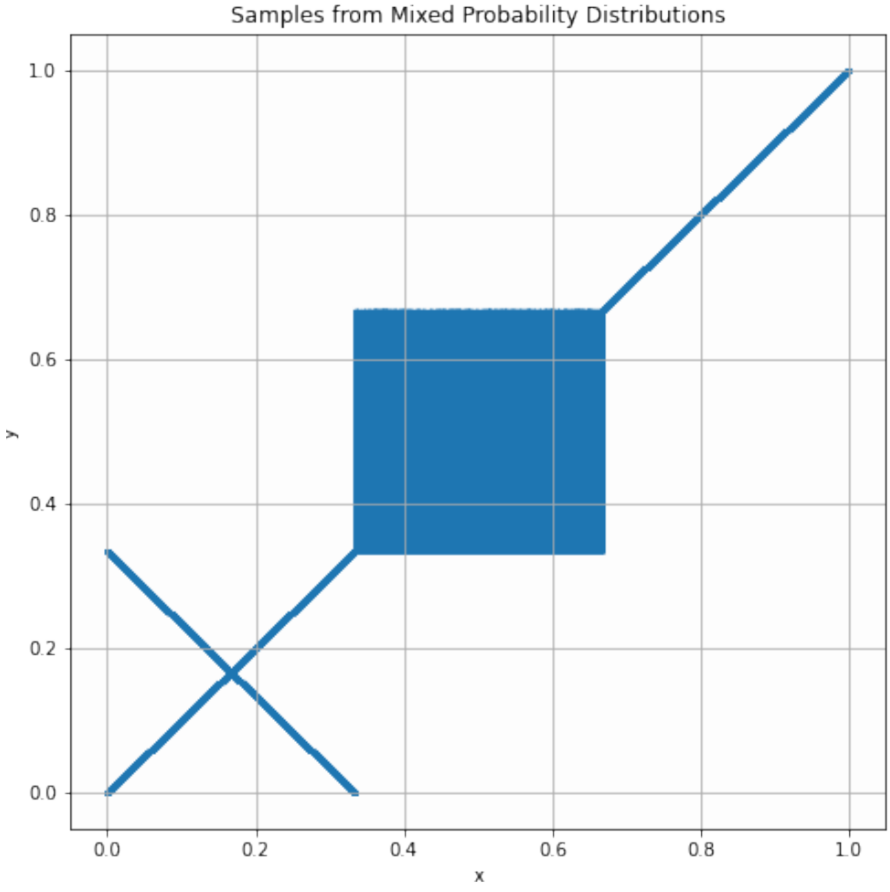
Location: **Hungary**

PATTERN FREE PERMUTONS

My research project focused on the study of permutons, a relatively new concept in the field of combinatorics. Permutons are probability measures that represent limits of permutations, which are simply ways to arrange a set of objects. I was particularly interested in exploring the Shannon entropy of these permutons, a measure of uncertainty or randomness in a system. To put it simply, Shannon entropy helps quantify how unpredictable or complex a pattern is.

I investigated how certain patterns within permutations could be avoided while still maintaining the properties of permutons. Pattern avoidance is a concept where certain sequences or arrangements are intentionally excluded from permutations. I analyzed how this avoidance influenced the Shannon entropy, providing insights into the relationship between structure and randomness.

Throughout my research, I used mathematical and computational methods to model these relationships, aiming to uncover new connections between permutons, their entropy, and pattern avoidance.



Simulated visual representation of a permuton, developed using Python.

MUHAMMAD ZAEEM SHAHZAD

Major
Computer Science

Faculty Supervisor
Muhammad Shafique

Location: **NYU Abu Dhabi**

ENHANCING ROBUSTNESS OF MACHINE LEARNING-BASED ADVANCED DRIVER ASSISTANCE SYSTEMS FOR ADVERSE WEATHER

My research project focused on enhancing the robustness of machine learning models used in Advanced Driver Assistance Systems (ADAS), particularly under adverse weather conditions such as extreme fog, rain, and snow. I identified a critical gap in the ability of existing models to perform reliably in these scenarios due to the scarcity of relevant datasets and the limitations of current Deep Neural Networks (DNNs). To address these challenges, I generated synthetic datasets using the imgaug Python library, simulating adverse weather conditions on the KITTI and BDD100k datasets. I trained YOLOv8n and UNet architectures on these augmented datasets, aiming to improve their robustness. Additionally, I developed a novel UNet architecture with a switch mechanism that dynamically adjusted the model's processing based on the detected weather conditions. This architecture was further optimized using DNN compression techniques from the EfficientNet methodology, resulting in a significantly reduced model size without compromising performance. Overall, my work culminated in a robust ADAS pipeline capable of handling extreme weather conditions and retaining base performance of all DNNs in the pipeline.

> **“The guidance and mentorship I received from Professor Shafique and the research team at the eBRAIN Lab were truly transformative in my journey through this project. Their expertise and unwavering support challenged me to think critically and creatively, allowing me to explore the cutting-edge intersections of Machine Learning and ADAS technology. Their encouragement fueled my passion for innovation, and their insights provided a deeper understanding of the complexities involved in enhancing system robustness under adverse weather conditions. Working with such a dedicated and knowledgeable team not only honed my technical skills but also inspired me to push the boundaries of what is possible in ensuring driver safety through an ML-based ADAS.”**

AYA EL MIR,
LUKELO LUOGA

Major
Computer Engineering

Faculty Supervisor
Muhammad Shafique

Location: **NYU Abu Dhabi**

ADVANCING HEALTHCARE IN LOW-RESOURCE ENVIRONMENTS THROUGH AN OPTIMIZATION AND DEPLOYMENT FRAMEWORK FOR MEDICAL MULTIMODAL LARGE LANGUAGE MODELSON

Our project built upon our Capstone work, addressing the critical shortage of medical professionals in low-resource countries, particularly in Africa, by overcoming barriers to deploying advanced Artificial Intelligence in healthcare. The research focused on optimizing Multimodal Large Language Models (MLLMs) for resource-constrained environments lacking high-performance computing (HPC) infrastructure. We introduced TinyLLaVA-Med-F, a medical fine-tuned MLLM, and its quantized variants, which significantly reduce memory usage without significant loss in accuracy. These optimized models, such as TinyLLaVA-Med-FQ4 (Fine-tuned 4-bit Quantized), reduce memory demands by up to 90%, enabling deployment on consumer-grade GPUs like the RTX 3050. This demonstrates the feasibility of using advanced AI tools in under-resourced healthcare systems, paving the way for accessible, AI-driven solutions to support medical diagnosis. Our work highlights the transformative potential of AI in improving healthcare delivery where it is needed most, offering a foundation for future research in accessible MLLMs for healthcare.

> **Being able to work on a single project for more than an academic year alongside a dedicated fellow computer engineering teammate was one of the main highlights of my NYUAD experience. This journey was also enriched by the guidance of various members of the eBRAIN Lab, whose expert insights and support were invaluable. Our work led to two publications: one at the 2024 IEEE International Conference on Image Processing (ICIP 2024) and another at the IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI 2024).**
>
> ***Aya El Mir***

KEVIN BRIAN

Major
Bioengineering

Faculty Supervisor
Khalil Ramadi

Location: **NYU Abu Dhabi**

SYNTHESISING FLUORESCENT CARBON NANOPARTICLES FROM PLASTIC WASTE

Our research focused on producing Carbon Quantum dots from waste materials like plastics. This innovative approach offers an alternative to traditional recycling methods like the use of furnaces, while also opening up new possibilities for applications such as drug delivery. It originally started with the conversion of reusable masks into quantum dots during the COVID-19 pandemic, and now we are excited to explore other waste materials for this purpose.

Applications of quantum dots span a wide range of scientific disciplines, from engineering solar cells, in polymer systems, to developing nano-systems for drug delivery. By successfully synthesizing Carbon-based quantum dots that have higher biocompatibility, we seek an improvement in the already-established therapeutic methods, while at the same time creating novel, and cheaper ways to manage plastic wastes.

> **“If there is more to the word 'nano', then Quantum dots are about to show us what it is!”**

Converting Plastic wastes (PET) into Blue Emissive Quantum Dots.

Blue Emissive Quantum Dots.

NEDIYYA KHAN

Major
Literature

Faculty Supervisor
Israa Mahgoub

Location: **NYU Abu Dhabi**

FAMILY BUSINESS HISTORIES

During my work as the student research assistant with the Family Business Histories program, I was responsible for a variety of tasks on the Spotlight Series (https://familybusinesshistories.org/spotlights/). The article collection delves deeply into the histories of regional family businesses. I was involved in the entire lifecycle of each article I worked on, including conducting in-depth historical research, sourcing archival documents and visuals and managing academic references. I was also responsible for much of the research administration of this collection, including managing hundreds of archival and academic references in Zotero and other systems, which was especially critical given the size of the collection. In addition, I supported the team with the Arabic translations of the collection to ensure that the research was open and accessible to the local audience in MENA. I also took on web development tasks, and used WordPress to upload research articles. Despite being new to the skill, I quickly became proficient and was entrusted with working on the website backend.

CHALHOUB GROUP 1955

AL RAJHI BANK 1957

AL FAHIM GROUP 1958

ALSAHL GROUP 1959

AL GHURAIR GROUP 1960

AKWA GROUP 1959

EASA SALEH AL GURG GROUP 1960

MAISON SAMIRA MAATOUK 1960

Family Business Histories Spotlights Article Collection.

AZAZ-UR-REHMAN NASIR

Major
Electrical Engineering

Faculty Supervisor
Muhammad Shafique

Location: **NYU Abu Dhabi**

DESIGNING A LATENCY PREDICTION FRAMEWORK FOR HARDWARE AWARE NEURAL ARCHITECTURE SEARCH

I undertook a project focused on creating a latency prediction framework for hardware-aware Neural Architecture Search (HW-NAS). One of the core challenges for efficient HW-NAS is to get the latency of candidate models while searching the architecture space. However, deploying each and every candidate model onto a specific target hardware to compute its latency is extremely time consuming. Intuitively, a better way to do this is to train a latency prediction model using a small set of architecture-latency pairs and then predict the latency of these candidate models during search instead of actually deploying and running each model on the target device.

To achieve this, I explored innovative techniques to encode DNN architectures into representations that were both informative and efficient to process by the MLP-based predictor. These encoding strategies were designed to capture critical architectural details while remaining computationally manageable. To further improve the efficiency of the the framework, I iteratively increased the size of the training dataset until the predictions crossed a certain accuracy threshold. Not only did this add to the efficiency of the framework, but also allowed the predictor to reach maximum accuracy without any training overhead. Additionally, the iterative approach employed two different sampling strategies that ensured comprehensive coverage of architectural configurations, including edge cases that might otherwise be underrepresented.

The predictive framework was evaluated on a range of hardware platforms and tested across different DNN architectures, such as ResNet, DenseNet, and MobileNetV3. Through this testing, the framework demonstrated a significant improvement in accuracy and efficiency compared to existing methods, while also showcasing its adaptability to different devices and neural network configurations. This scalability highlighted the potential of the framework as a versatile tool for optimizing HW-NAS under various hardware and application constraints.

> This research deepened my understanding of the intersection between machine learning, hardware optimization, and practical deployment challenges. It was particularly rewarding to contribute to solving a real-world problem, ensuring that cutting-edge neural network technologies can be effectively and efficiently utilized in diverse environments. Moving forward, I see great potential in extending this work to include additional metrics like energy efficiency and further exploring its applicability to edge computing scenarios.

The Jetson used to compute inferences for embedded devices.

EWURABENA MAANU BOATENG

Major
Biology

Faculty Supervisors
Kirsten Sadler Edepli and Filippo Macchi

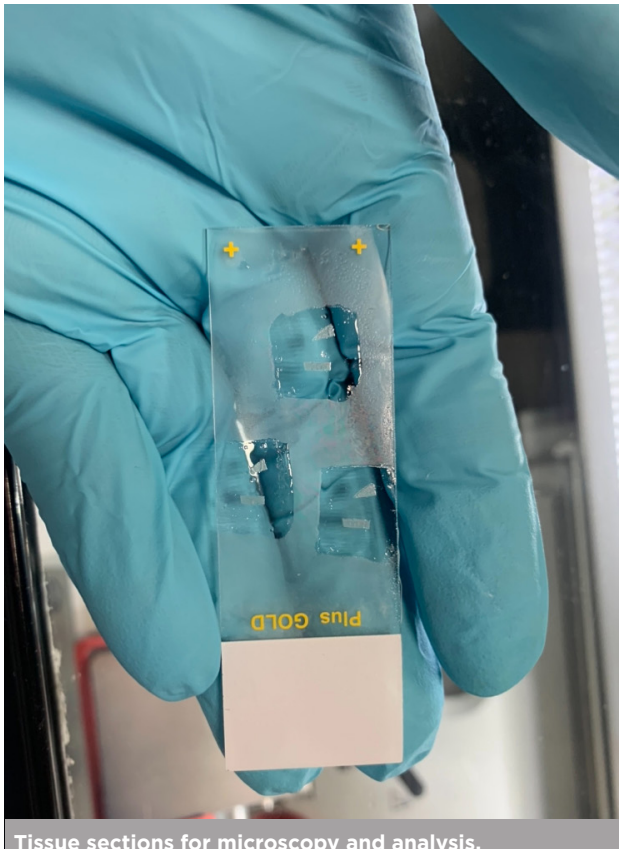
Location: **NYU Abu Dhabi**

DEFINING THE MOLECULAR AND CELLULAR IDENTITY OF OCTOPUS BIMACULOIDES

I started my research project early in my sophomore year to focus on the role of the epigenetic mark, DNA methylation in the development of cephalopods, –octopus and bobtail squid –which is an area that remains largely unexplored. Previous studies from my mentor's research group confirmed that DNA methylation is present in cephalopods, and could play a role in their embryonic development. My project aimed to explore this trying to block DNA methylation in cephalopod embryos. However, my analysis revealed that our experimental approach was not effective: there were no significant differences in methylation levels between treated and untreated samples.

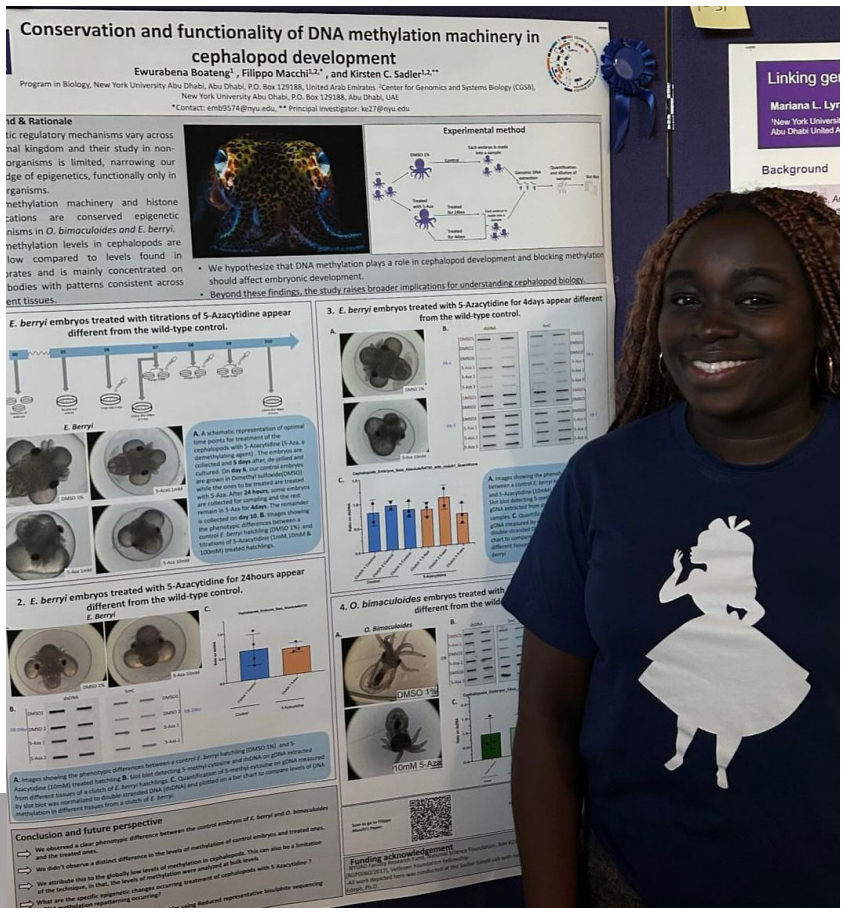
This unexpected finding shifted my research focus to a new trajectory—defining the molecular and cellular identity of arm tips in octopus as a first important step to understand how these structures regenerate. To do this, I learned new experimental and bioinformatic techniques to study the cell composition of octopus arms.

> **"This project can provide insights into the mechanisms underlying regeneration in cephalopods and potentially in other animals, like humans. I will continue this work in the upcoming semester, and look forward to learning more about cephalopod biology and general principles of tissue regeneration."**



Tissue sections for microscopy and analysis.

Microscopy is one of the main tools used by cell and developmental biologists.



Poster presentation at the NYUAD Center for Genomics and Systems Biology Conference in February 2024.


NYUAD
CAMPUS CENTER مركز الحرم الجامعي

VISITING STUDENTS

PARIS AALIYAH QUIST

Major
Global Public Health/ Biology

Faculty Supervisor
Amar Ahmad

Location: **NYU Abu Dhabi**
Home School: **NYU New York**

ASSESSING THE IMPACT OF BMI'S INFLUENCE ON HBA1C IN THE UAEHFS PIVLOT DATA USING STATISTICAL LEARNING APPROACHES

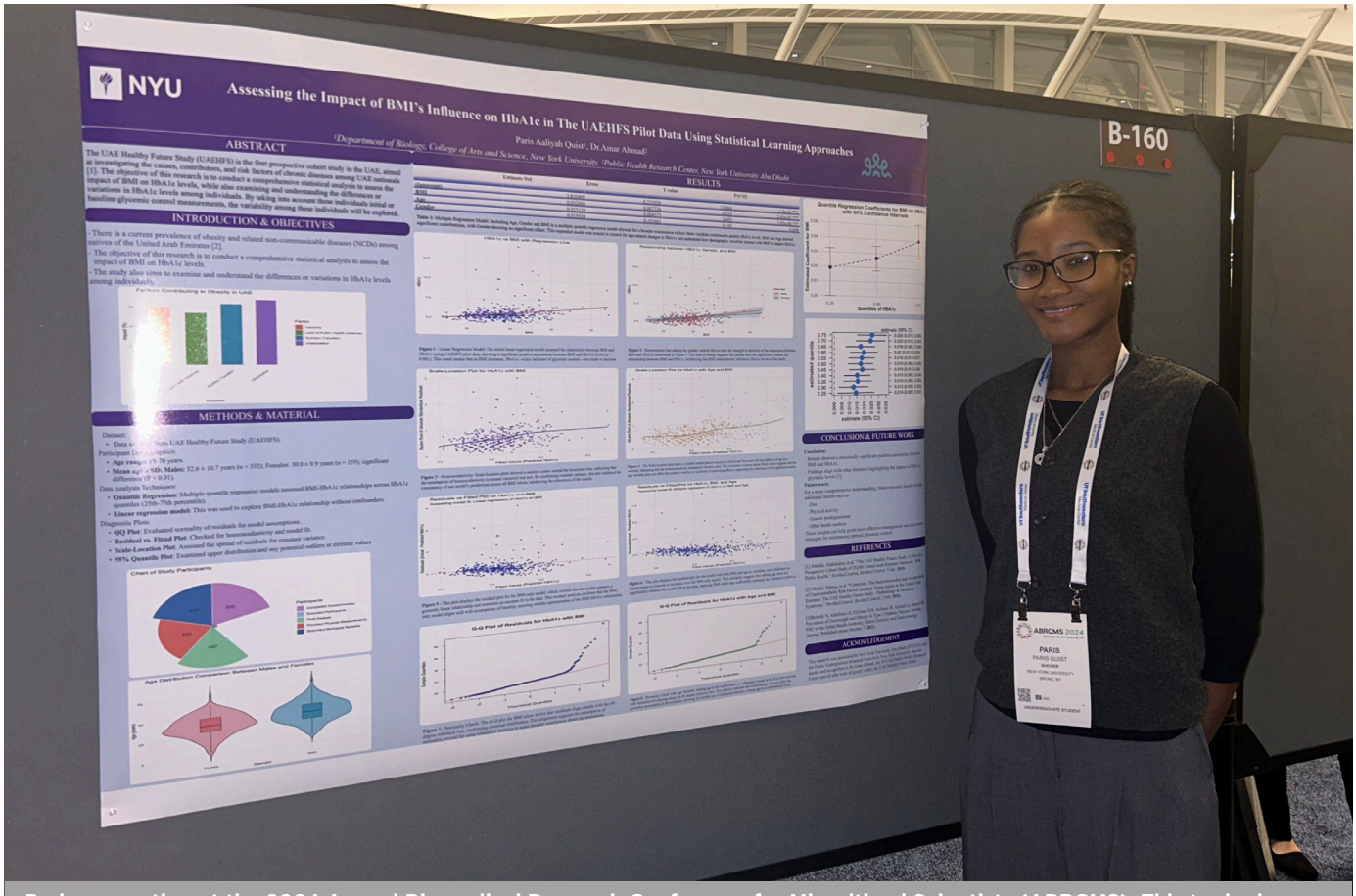
My research project focused on the UAE Healthy Future Study (UAEHFS), the first prospective cohort study in the UAE designed to investigate the causes, contributors, and risk factors of chronic diseases among UAE nationals.

I conducted a comprehensive statistical analysis to assess the impact of BMI on HbA1c levels and to explore the variations in HbA1c levels among individuals based on their baseline glycemic control measurements. Utilizing multiple quantile regression models across various percentiles (25th to 75th) of the HbA1c distribution, I analyzed data from 517 participants, considering BMI as the main predictor variable, with age and gender as covariates to adjust for confounding effects. The analyses I performed using R version 4.4.0 revealed that the impact of BMI on HbA1c becomes more pronounced at higher quantiles of the HbA1c distribution, suggesting a stronger influence of BMI on glycemic control among individuals with higher baseline HbA1c levels.

These findings highlight the potential need for personalized diabetes management strategies, especially for overweight or obese patients. This study provided important insights into the statistically significant role of BMI in glycemic control, and further research using followup data from the UAEHFS is necessary to deepen our understanding of these relationships.

> **One of the most significant skills I gained was learning how to code using R, a powerful statistical programming language. This experience allowed me to conduct complex data analyses and interpret results with precision, which was a steep learning curve but ultimately rewarding. Additionally, I learned the importance of working independently, managing my time effectively, and approaching problems with a critical mindset.**

Paris presenting at the NDiSTEM Conference, presented by Society for Advancement of Chicanos/Hispanics & Native Americans in Science (SACNAS). This is the largest multidisciplinary and multicultural STEM diversity event in the US.



Paris presenting at the 2024 Annual Biomedical Research Conference for Minoritized Scientists (ABRCMS). This took place at the David L. Lawrence Convention Center in Pittsburgh, Pennsylvania.

SAMAR AHMED

Major
Cell and Molecular Biology

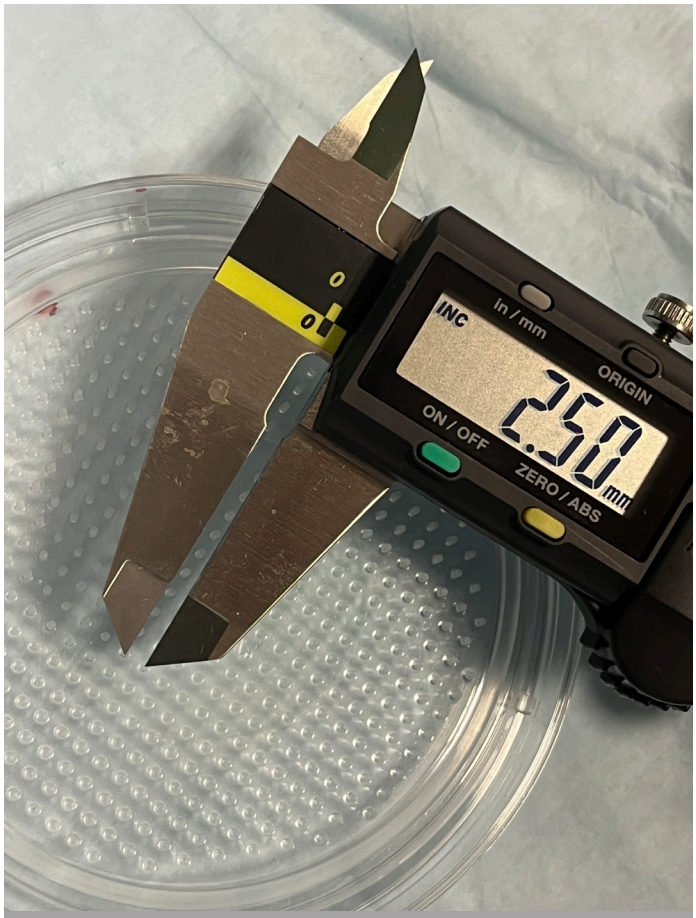
Faculty Supervisor
Azam Gholami

Location: **NYU Abu Dhabi**
Home School: **Khalifa University**

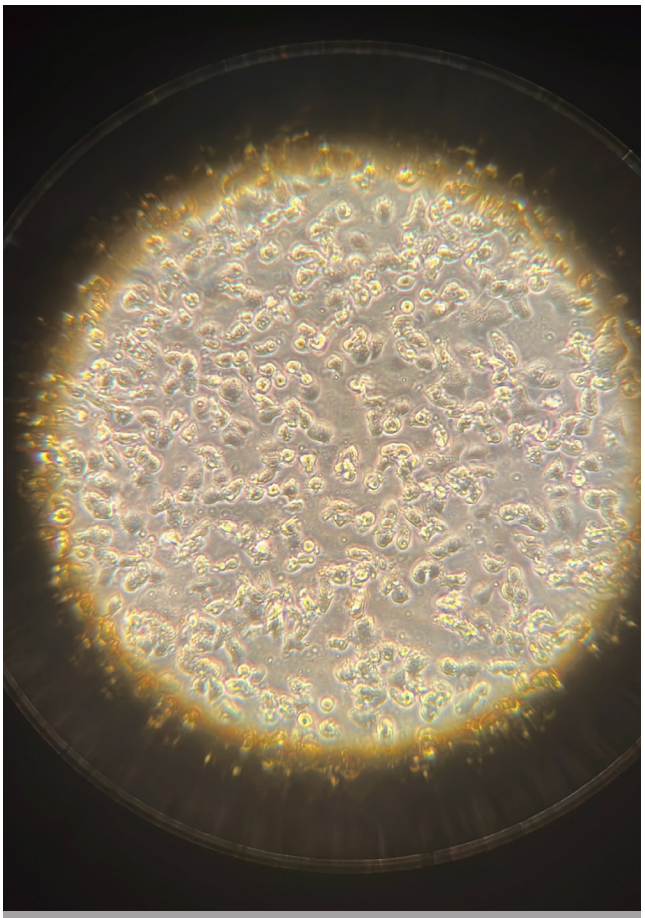
CILIA-DRIVEN FLUID FLOWS AND PROPULSION

Many organisms, like Amoeba and Algae, create patterns through processes involving cell signaling and motility. These organisms use cilia and flagella, which are slender, hair-like appendages that protrude from the cell surface, aiding in their movement. The movements of these appendages are driven by light, which triggers ATP synthesis within the cells. This ATP production controls the beating frequency of the flagella, enabling the cells to move in a coordinated manner. The formation of patterns through these movements is significant because patterns are ubiquitous in nature. Whether in the arrangement of leaves, the structure of crystals, or the behavior of living organisms, patterns play a crucial role in the organization and function of natural systems. The ability of cells to respond to environmental stimuli, such as light, and create patterns through their movements is a fundamental aspect of life. It highlights the intricate connections between cellular activities and the broader patterns we observe in the natural world, illustrating the importance of these processes in the functioning of ecosystems and the development of complex biological forms. Additionally, studying these cellular patterns can provide insights into similar processes in the human body, such as the formation and maintenance of heart patterns.

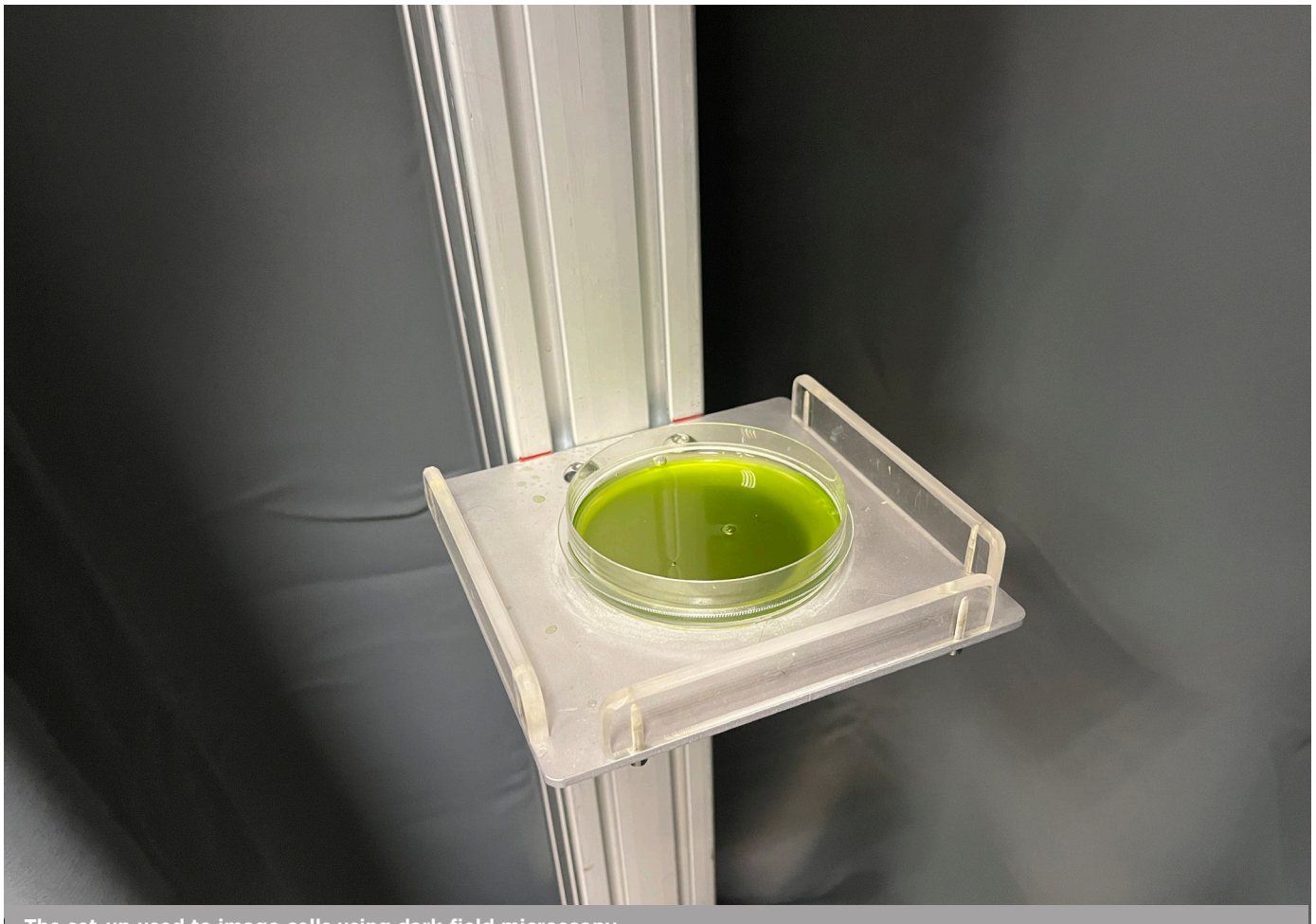
> **I have learned how to culture and work with non mammalian cells (amoeba and algae).**



Measuring the dimensions of the PDMS molds prior to the experiment for reproducibility purposes.



Dicty cells imaged under a light microscope to check confluence of the plate.



The set-up used to image cells using dark-field microscopy.

IMAN ZERMEÑO

Major
Global Public Health: Sociology

Faculty Supervisors
Antje Von Suchodoletz and Aleksandrina Dimova

Location: **NYU Abu Dhabi**
Home School: **NYU New York**

DEVELOPING AND TESTING A PARENTING PROGRAM

During my study abroad in Abu Dhabi, I served as a research assistant for the Developing and Testing a Parenting Program project. This initiative was focused on creating, designing, and implementing a parenting program tailored to the specific needs of families in Abu Dhabi, with the goal of helping them raise happy and healthy children. The program aimed to enhance parents' knowledge of early childhood development and education, strengthen their parenting skills, and inform them about available support services for additional assistance. As a research assistant, my daily responsibilities varied based on the project's needs. I played a key role in processing and editing Heart Rate Variability (HRV) data collected from both parents and children during various shared tasks and activities. In addition to data cleaning, I conducted extensive literature reviews using Covidence software, identifying the most relevant sources to support our study's objectives.

> **“As an undergraduate researcher, I gained valuable data editing skills, particularly in handling HRV data, which was a new experience for me. It was fascinating to explore the research side of psychology while simultaneously taking an Introduction to Psychology course. This experience allowed me to see firsthand how the concepts and terms I was learning in class are applied in real-world research.”**

ANSH CHOUDHARY

Major
Computer Engineering

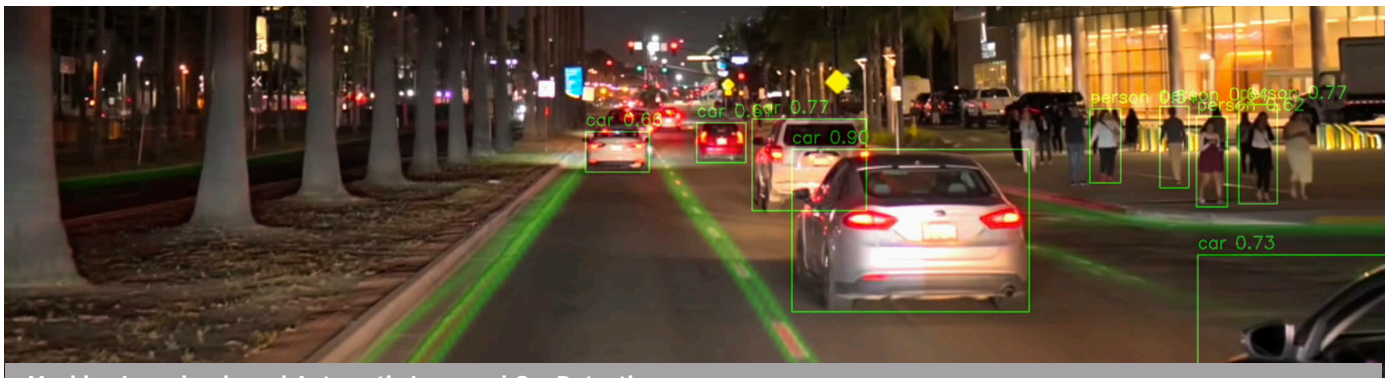
Faculty Supervisor
Muhammad Shafique

Location: **NYU Abu Dhabi**
Home School: **BITS Pilani**

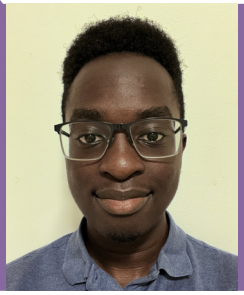
DESIGNING AN EDGE AI-BASED ADVANCED DRIVER ASSISTANCE SYSTEM

An Edge AI-based Advanced Driver Assistance System is essential for advancing the safety and reliability of autonomous vehicles, which are poised to revolutionize transportation. Recognizing the critical importance of accurately detecting lanes and tracking pedestrians, I developed an advanced system to address these challenges. In this project, I focused on leveraging state-of-the-art computer vision techniques to enhance real-time decision-making capabilities for autonomous vehicles. Utilizing the U-Net architecture for semantic segmentation, I trained the model on the BDD100K dataset, fine-tuning it to achieve precise lane detection. The model delivered impressive accuracy and Intersection over Union (IoU) scores, ensuring reliable lane identification even in complex road conditions and varying lighting scenarios. For pedestrian tracking, I implemented a custom object detection model, incorporating techniques like optical flow and perspective transformation. This allowed the system to accurately monitor pedestrian movements and predict their trajectories, thereby preventing potential collisions. By integrating lane detection and pedestrian tracking into a unified system, this project significantly enhanced the decision-making processes of autonomous vehicles, demonstrating the powerful impact of advanced machine learning models in addressing critical challenges in autonomous driving.

> “This research project was a transformative journey that pushed my technical boundaries and solidified my belief in the power of AI to drive meaningful innovation in critical industries like transportation.”



Machine Learning-based Automatic Lane and Car Detection.



KARU MBUGUA

Major
Anthropology | Pre Med Track

Faculty Supervisor
Youssef Idaghdour

Location: **NYU Abu Dhabi**
Home School: **NYU New York**

INVESTIGATING PLASMODIUM-INDUCED OXIDATIVE STRESS OF IMMUNE CELLS

While working under Dr. Youssef Idaghdour, I learned a lot about the malaria parasite Plasmodium falciparum (P. falciparum), its mechanisms of survival, and its life cycle. Causing over five-hundred thousand deaths every year and infecting hundreds of millions more, P. falciparum malaria is a pertinent public health issue. During infection, the malaria parasite exhibits intriguing behavior, namely, its ability to circumvent the immune system, oxidize its media in vitro, and trigger a fascinating event known as the bystander effect. The bystander effect is a phenomenon where, during in vivo P. falciparum infection, uninfected red blood cells (RBCs) make up the vast majority of RBC deaths instead of infected RBCs. The highly oxidative nature of P. falciparum plays a prominent role in this effect, and I wondered whether the impaired white blood cell function during infection was also a bystander effect caused by the oxidized environment.

To elucidate this, I conducted an in vitro experiment culturing malaria parasites and putting them into contact with healthy human cells. Along with uninfected controls, I created co-cultures of P. falciparum with healthy RBCs and white blood cells called peripheral blood mononuclear cells (PBMCs), respectively. After cultivating the malaria co-cultures, I stained and analyzed the samples using flow cytometry and spectrophotometry. My analysis focused on measuring the production of reactive oxygenated species (ROS) in each condition to measure impaired cellular function as a result of the oxygenated environment. The results were very promising, with the PBMC + malaria culture showing a significant increase in ROS compared to the control and RBC cultures. These results evoke questions about the molecular function of white blood cells in an oxidized milieu, which I hope to answer as part of further study.

> **During my experience working in Dr. Idaghdour's lab, I learned valuable lessons about communication, teamwork, and the expectations of working in academia. My biggest takeaway, however, was a newfound passion for biological research!**

Karu working at the fume hood.

Karu working in the lab.

FATIMA MAHROOS

Major
Chemistry

Faculty Supervisor
Pance Naumov

Location: **NYU Abu Dhabi**
Home School: **American University of Sharjah**

SMART MATERIALS FOR ELECTRONICS AND ROBOTICS APPLICATIONS

The widespread use of plastic products has resulted in a significant increase in plastic waste, the most concerning of which are microplastics. To tackle the urgent need to address microplastic pollution, we need to be able to analyze samples for microplastic contamination effectively. However, there is no standardized method in the UAE for the analysis of microplastics.

In collaboration with the Abu Dhabi Environmental Agency, we worked on developing a standardized method for the analysis of microplastics in marine water, soil, and biota. We carried out a detailed literature search, conducting literature evaluations to assess the use of various analysis techniques for the identification and analysis of microplastics in such sample types. Findings from this search were presented, and recommendations for a standardized method were made.

In concurrence, I also assisted in the synthesis of novel TADF molecules as part of the lab component of my summer research project at the Smart Materials Lab (SML). This class of materials is promising as emitters for OLED applications as they allow for enhanced efficiencies without the need for heavy metals.

> **During my time at NYUAD, I had the privilege of learning how to operate various instruments in the lab and develop my proficiency in organic synthesis. I feel fortunate to have been able to work with Dr. Naumov and his team, and am grateful for their guidance and mentorship.**

Organic synthesis as part of research on smart materials.

YUYANG HU

Major
Interactive Media Arts & Global China Studies

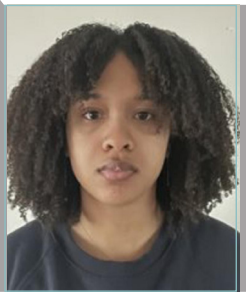
Faculty Supervisor
William Zimmerle

Location: **NYU Abu Dhabi**
Home School: **NYU Shanghai**

DIGITAL HERITAGE LIBRARY OF ARABIAN INCENSE, PERFUMES, AND FINE FRAGRANCES AT NYUAD

The research project I participated in focused on heritage studies, with a particular emphasis on Arabic scents. Our work explored the cultural and historical significance of Arabian perfumes, fragrances, and color dyes in the United Arab Emirates. As part of the project, I gained hands-on experience in analyzing organic residue samples using Liquid Chromatography/Mass Spectroscopy-Mass Spectroscopy (LC-MS-MS) and conducted ethnographic interviews with fragrance artists and perfumers in Abu Dhabi. The project required a range of interdisciplinary skills. The ethnographic works provided valuable insights into traditional practices and contemporary innovations in perfumery. I conducted field trips to local markets and shops to collect perfume samples, which were then analyzed using LC-MS-MS to expand the sample size and ensure robust data. These modern samples were compared with the chemical composition of ancient spices uncovered through archaeological research, creating a bridge between past and present. Additionally, I studied and compiled bibliographies of historical Islamic texts on perfumery, ensuring the research was grounded in solid historical evidence. I also contributed to analyzing complex data and helped build a database of digital signatures for scents and perfumes, which supported the development of an online project website and a book manuscript.

> **This research was an amazing experience for me to develop a unique combination of technical and scholarly skills. I not only mastered the scientific techniques involved in analyzing scents but also honed my ability to write and edit scientific scholarship on Arabian perfumery. I really appreciate how scents serve as a reflection of the profound cultural heritage of the Arabian people, and I am inspired to continue exploring how sensory experiences can illuminate the richness of human traditions.**



CIARA MORGAN BESS, HAORU LIU

Major
Film & Television

Faculty Supervisor
Carlos Guedes

Location: **NYU Abu Dhabi**
Home School: **NYU New York**

MUSIC AND HERITAGE STUDIES IN THE GULF REGION

We contributed to the ongoing work done by the Music and Sound Cultures (MaSC) Research Group on computational analysis of non-Eurocentic music using artificial intelligence by editing and mixing traditional music from the UAE. This had the goal of providing robust data for training and enhancing the performance of deep learning models able to process and analyze the music from this region.

Additionally, we participated in field audiovisual recordings of traditional music, focusing on editing and denoising the audio to ensure the recordings were optimized for perpetual archiving, adhering to best practices in preservation and cultural heritage.

> Originally I planned to study at NYUAD for only one semester, but after being at NYUAD for a few weeks, I knew I wanted to stay for another semester.
>
> ***Haoru Liu***

Recording the musical traditions of the Shihuh in Ras Al Khaimah.

Working session at NYUAD.

DHRUV PATEL

Major
Chemical and Biomolcular Engineering

Faculty Supervisor
Sanjairaj Vijayavenkataraman

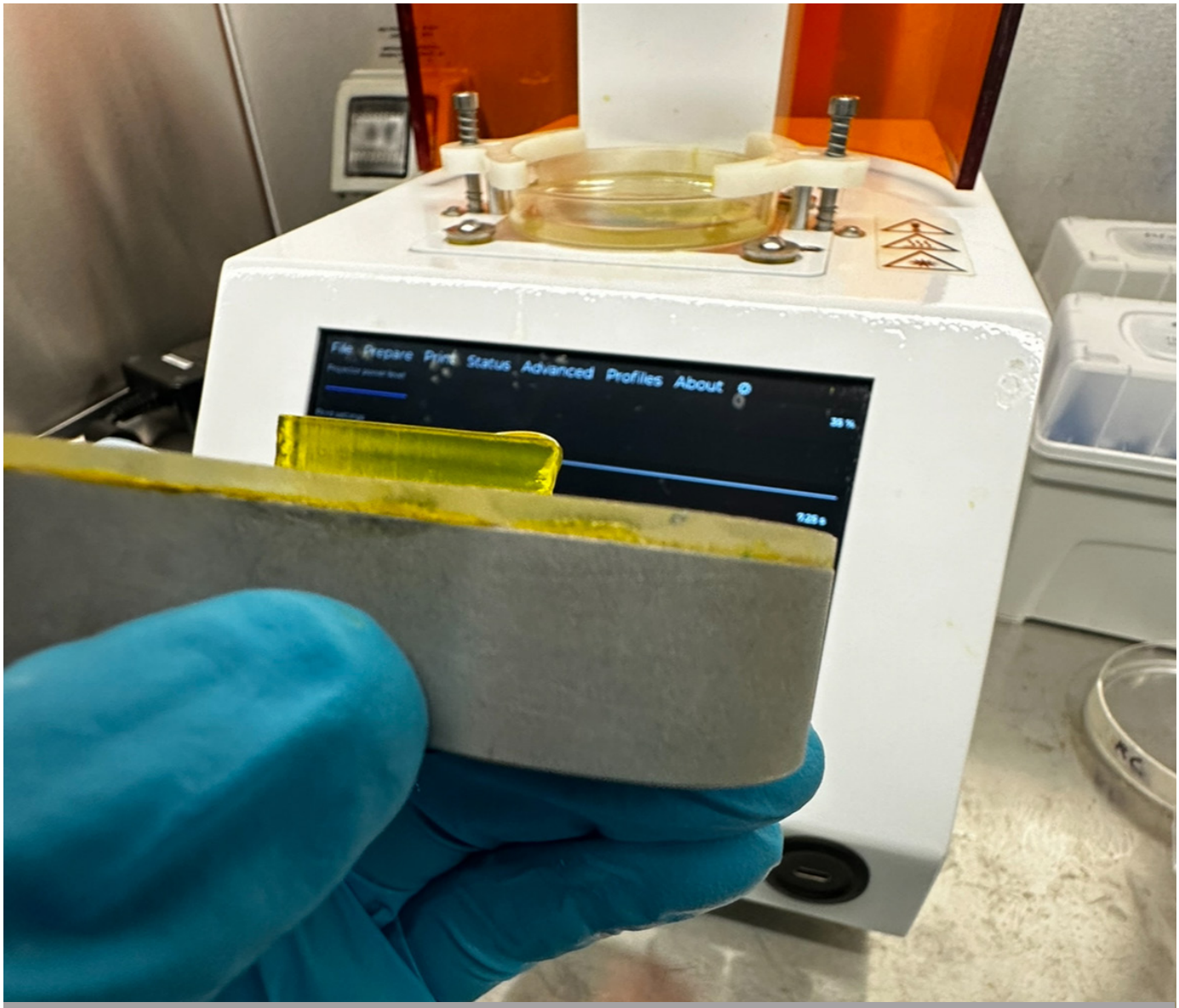
Location: **NYU Abu Dhabi**
Home School: **NYU New York**

PHOTOCROSSLINKABLE BIOMATERIALS FOR TISSUE ENGINEERING APPLICATIONS

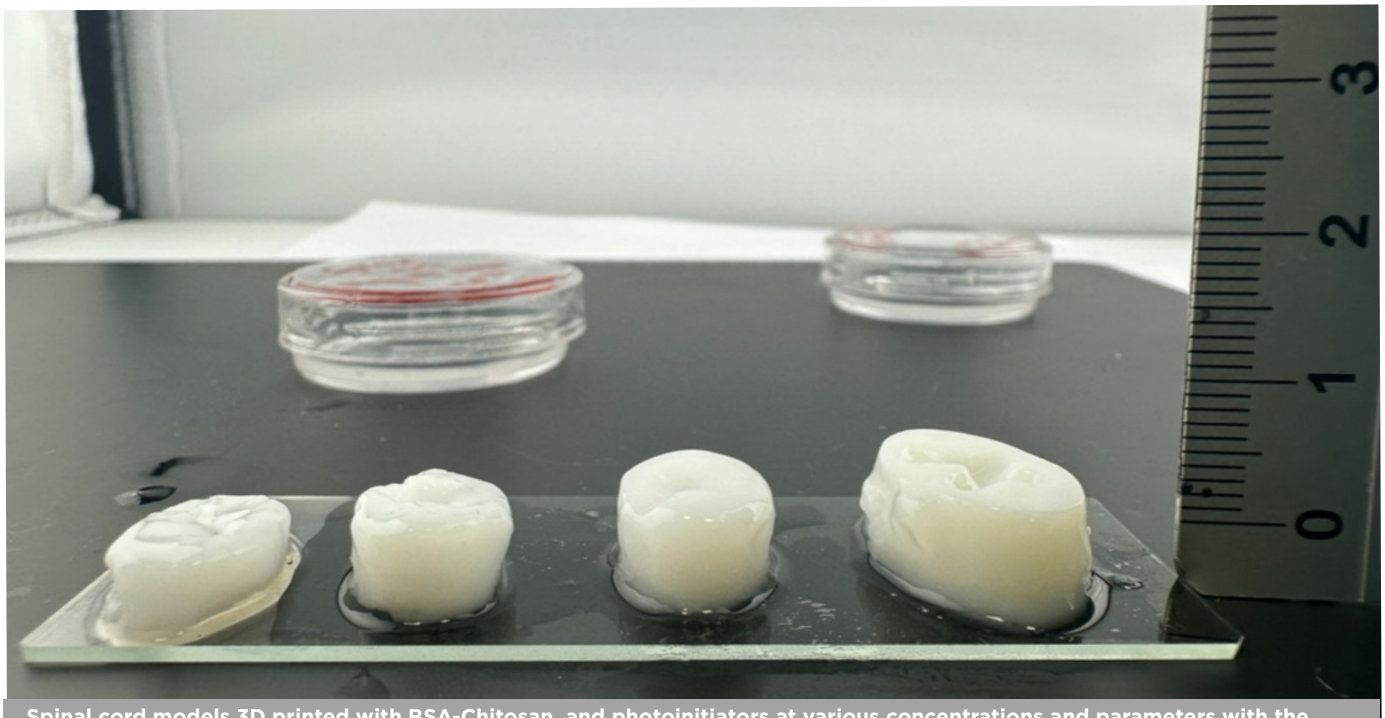
3D bioprinting of hydrogels represents a significant advancement in biofabrication for tissue engineering. My research focuses on developing a printable endometrial model using Gelatin Methacryloyl (GelMA) to biomimic the complex uterine microenvironment with a biocompatible biodegradable photocrosslinkable hydrogel, contributing to ongoing collaborative studies between the Vijay Lab and the Reverse Bioengineering Lab. The main challenge was to fabricate a complex structure with small and big pores, all while maintaining a good structural integrity. I synthesized GelMA at varying concentrations and incorporated photo absorbers to improve its printability using a dynamic light processing bioprinter. Additionally, I worked on optimizing the printing parameters such as printing temperature, light intensity, and exposure duration to enhance the scaffold's structural fidelity while ensuring its long-term cytocompatibility and mechanical stability.

I learned the synthesis procedure for BSA-Chitosan MA and prepared the precursor solution for bioprinting using the LumenX+ 3D bioprinter. This involved selecting appropriate photoinitiators and concentrations to ensure optimal printing conditions. Using the optimized concentrations and printing parameters shared by lab members, I successfully printed various 3D structures resembling small human organs, such as the spinal cord and heart chamber, with a light-based 3D bioprinter. Additionally, I prepared samples for cell culture experiments and surface morphology studies.

> **Before starting research, I was new to the tissue engineering field. However, I left the program knowing how to 3D print with hydrogels and TPU, 3D model in blender, preform compression test, degradation test, cell culture of Neural Stem Cells, NMR, take microscopic images, synthesize different hydrogels, preform mechanical calculations, write academic papers, network and much more.**



Endometrium model sample 3D printed with GelMA, photoinitiators, and tartrazine with the LumenX+ 3D bioprinter.



Spinal cord models 3D printed with BSA-Chitosan, and photoinitiators at various concentrations and parameters with the LumenX+ 3D bioprinter.

YANRUI LINDA SHAO

Major
Interactive Media Arts

Faculty Supervisor
Michael Ang

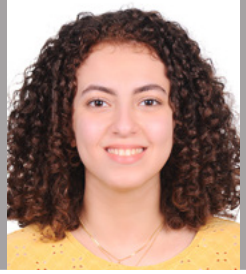
Location: **NYU Abu Dhabi**
Home School: **NYU Shanghai**

NEW INTERFACES FOR MUSICAL EXPRESSION

I secured a research assistantship award to join Professor Michael Ang's research team during my study abroad year at NYU Abu Dhabi. My primary focus was completing research for his work at the International Conference on New Interfaces for Musical Expression (NIME). As a research assistant, I brought a distinct Chinese perspective by integrating traditional pipa fingering techniques, such as lunzhi (輪指) and tantiao (彈挑), into the design of a newly developed string instrument. This instrument utilized motors and 3D-printed fingernails to replicate these intricate techniques.

> **By merging Chinese cultural elements with cutting-edge technological innovation, I contributed to fostering cross-cultural exchange and broadening the scope of musical expression in an international research context.**

Linda and Professor Ang experimenting with the DIY string instruments.



SHAHD HABIBA

Major
Biology and Chemistry

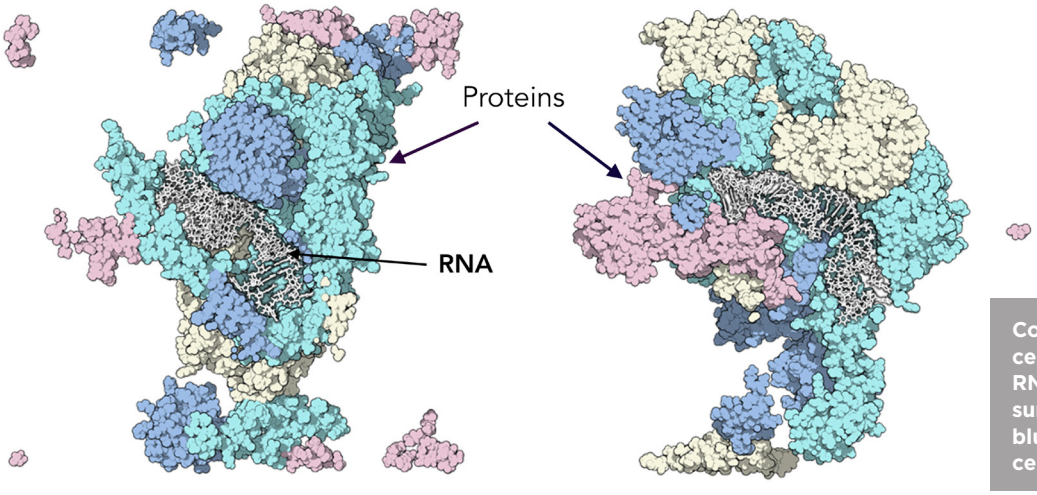
Faculty Supervisor
Serdal Kirmizialtin

Location: **NYU Abu Dhabi**
Home School: **American University of Sharjah**

COMPUTATIONAL MODELING OF RNA

The cellular environment is so crowded that the distance between neighboring proteins is smaller than their sizes. Experimental methods often face challenges in isolating signals exclusively from a single biomolecule therefore most biochemical experiments are conducted in dilute solutions. However, the effects of crowded conditions on the structure and dynamics of biomolecules in their natural environment remain largely unknown. Among biomolecules, DNA and RNA are particularly sensitive to their environmental conditions. Understanding how nucleic acid structures respond to crowding has significant implications for medicine. In my computational work, I investigated the effects of cellular crowding on the hydration and solvation of RNA molecules. Specifically, I examined how crowding agents influence the counter-ion atmosphere, which is essential for RNA folding and stability.

> **“I had the opportunity to learn and apply computer simulations to study biochemical processes. I found the process of conducting scientific research fascinating and thoroughly enjoyed collaborating with members of the Kirmizialtin Lab while learning new methods to explore biochemistry.”**



Computer simulations of cellular crowding reveal an RNA molecule (white) is tightly surrounded by proteins (purple, blue, cyan, yellow) within the cellular environment.


CAMPUS CENTER
#myN

CONFERENCE GRANTS

JULIE MATULA

Major
Chemistry

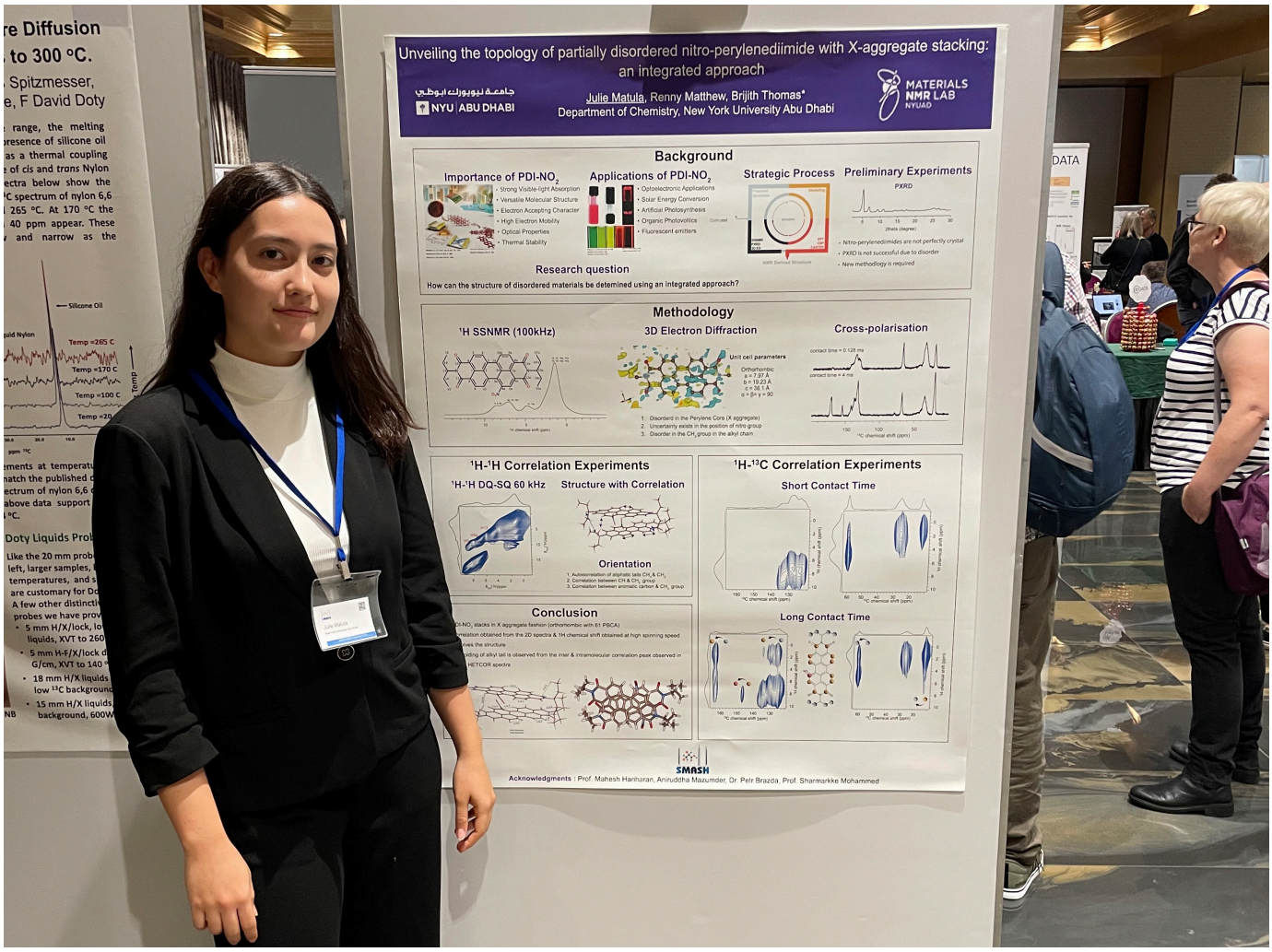
Faculty Supervisor
Brijith Thomas

Conference: **SMASH - Small Molecule NMR Conference**

Location: **Italy**

STRUCTURAL ELUCIDATION OF PARTIALLY DISORDERED PERYLENEDIIMIDE DERIVATIVES USING NMR ASSISTED APPROACH

A combination of solid-state NMR and CASTEP calculations was employed to successfully determine the packing arrangement of disordered perylene derivatives. In addition, we used other complementary techniques to obtain the unit cell parameters. The methodology can serve as a valuable guide in designing new materials with customized properties to suit a wide range of applications.



CORBAN VILLA

Major
Computer Science

Faculty Supervisor
Christina Pöpper

Conference: **Privacy Enhancing Technologies Symposium**

Location: **United Kingdom**

MEDIA TALKS PRIVACY: UNRAVELING A DECADE OF PRIVACY DISCOURSE AROUND THE WORLD

This paper provides the first global longitudinal and comparative study of privacy-related reporting from over 35,000 online newspapers, spanning 25 countries and 6 different languages. We employed a series of robust analytical analysis techniques, including time-series analysis, topic modeling, and sentiment analysis. It critically analyzes the evolution of media coverage concerning privacy across Global North and Global South regions. Our findings delineate a progressive intensification of focus on privacy issues, with an emergent statistically significant increase ($p < 0.001$) in the journalistic attention within the Global South, which augments the traditionally strong coverage from the Global North. The research identified a transition in thematic emphasis from government surveillance activities to issues surrounding data breaches and the scrutinization of technology corporations. Moreover, a predominant negative sentiment was observed in the media narratives, underscoring a pervasive disquietude in public discourses on privacy. This thorough analysis of media representations aims to enhance the comprehension of both public perception and strategic approaches to privacy concerns in the digital era.

JAE HYUNG LEE

Major
Psychology and History

Faculty Supervisor
Antje von Suchodoletz

Conference: **International Scientific Society for the Study of Behavioral Development**

Location: **Portugal**

MOTHER - CHILD PHYSIOLOGICAL SYNCHRONY DURING A FRUSTRATION SITUATION: AN EXPLORATORY STUDY

Physiological processes during parent-child interactions have increasingly been examined through heart rate variability (HRV), the degree of variation in successive heartbeats based on frequency or time, used as a measure physiological sensitivity to a stressor. HRV has been used to examine dyadic synchrony, the observation of the parent and child engaging in similar physiological patterns in a social-environmental context. But the current literature lacks methodological consensus on how to descriptively present dyadic synchrony, utilizing either an averaging or time-segment analysis. There is further lack of consensus on determining the type of dyadic synchrony presented with the parent-child dyad.

This research took a comparative approach in examining the extant descriptive methodologies and suggesting an alternative approach to determine synchrony types. An additional aspect of this research was the exploratory examination of directionality in dyadic physiological changes. Using the Granger causality, we explored if the HRV level of one dyad member at a specific time point was predictive of the HRV levels of the other dyad member.

> **This was an invaluable experience in expanding upon my Capstone research. At the conference, I got a whole new perspective of what it means to be in academia, seeing the amazing work people in the developmental psychology field did. My conference experience was also a chance for me to connect with scholars and professionals who I have referenced in my own research, to get their insights on some of the questions I had during my research process.**


جامعة نيويورك ابوظبي
NYU ABU DHABI
METHODOLOGY
Participants
33 Arab-Muslim mother-child dyads → 24 dyads for HRV analysis
Excluded when one or both dyad members required +10% manual editing or had +50% unusable data in an event
Mother-Child HRV Data
Baseline / Frustration / Recovery (5min [10 x 30s Segments])
Unit: Root Mean Square of Successive Differences (RMSSD)
Pearson Intercoder reliability: r (21) = .99, p <.01
Analytical Strategy
Averaging and Time Segment Analysis
Criterion for Preliminary Determinations of Dyadic Sy
uccessive
Difference (SDiff) valences

JENNIFER ZHENG

Major
Chemistry

Faculty Supervisor
Yi Fang

Conference: **Machine Learning for Health (ML4H)**

Location: **United States of America**

MEMORY COMPANION: A SMART HEALTHCARE SOLUTION TO EMPOWER EFFICIENT ALZHEIMER'S CARE VIA UNLEASHING GENERATIVE AI

This paper unveiled 'MemoryCompanion' a pioneering digital health solution explicitly tailored for Alzheimer's disease (AD) patients and their caregivers. Drawing upon the nuances of GPT technology and prompt engineering, MemoryCompanion manifests a personalized caregiving paradigm, fostering interactions via voice-cloning and talking-face mechanisms that resonate with the familiarity of known companions.

NADA ELSHARKAWY

Major
Computer Science

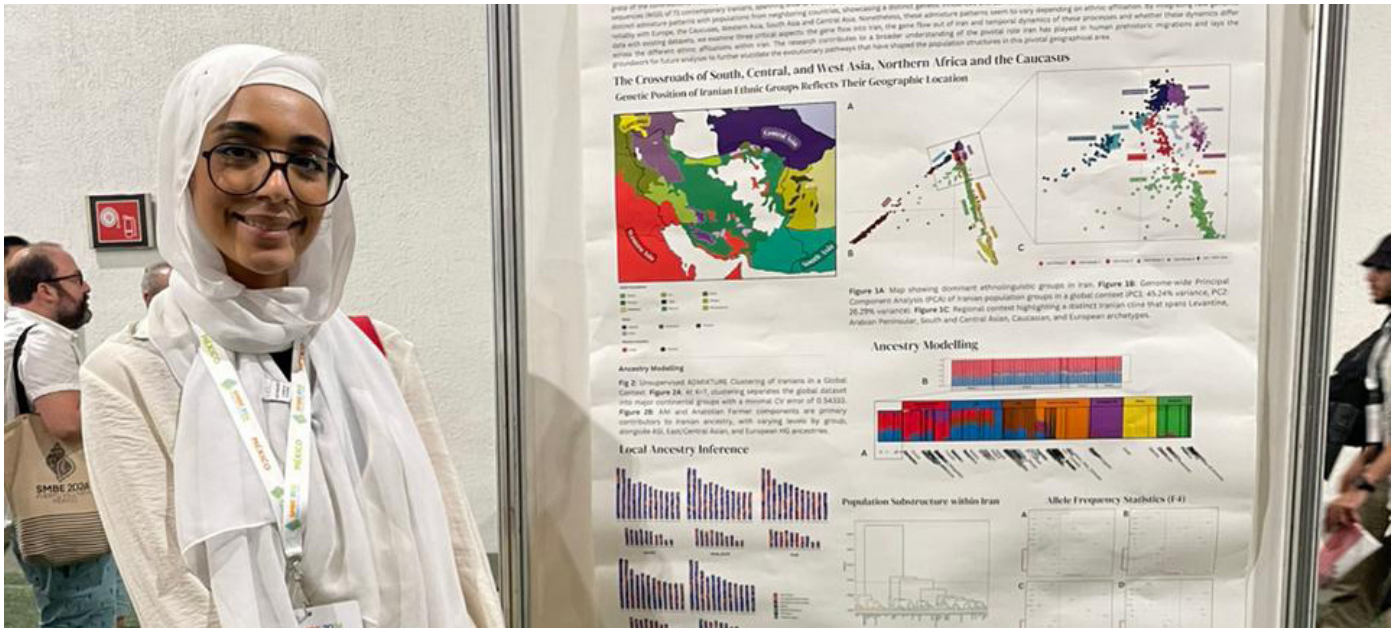
Faculty Supervisor
Aashish Jha

Conference: **Society for Molecular Biology and Evolution (SMBE)**

Location: **Mexico**

INVESTIGATING THE ANCESTRAL HISTORY AND POPULATION GENETIC STRUCTURE OF MODERN IRANIAN POPULATIONS

Iran is considered a crucial hub for human migration throughout human history; nonetheless the Iranian population and the various groups within Iran have not been adequately represented in genomic studies, which has restricted our grasp of the contributions made by Iranian peoples to the modern human genomic diversity and human population histories. This study attempted to bridge this gap by analyzing whole genome sequences (WGS) of 73 contemporary Iranians from 24 diverse ethnic populations in the context of WGS data from 4,000 individuals from world-wide human populations. Our findings indicate distinct admixture patterns with populations from neighboring countries, showcasing a distinct genetic influences and admixture patterns reflective of the region's historical interconnections, notably with Europe, Western Asia, South Asia and Central Asia. Nonetheless, these admixture patterns seem to vary depending on ethnic-affiliation. By integrating new genomic data with existing datasets, we examined three critical aspects: the gene flow into Iran, the gene flow out of Iran and temporal dynamics of these processes and whether these dynamics differ across the different ethnic affiliations within Iran. The research contributes to a broader understanding of the pivotal role Iran has played in human prehistoric migrations and lays the groundwork for future analyses to further elucidate the evolutionary pathways that have shaped the population structures in this pivotal geographical area.



MOHAMED IRFAN KARUKAPPADATH AND CHRISTOS MANESIOTIS

Major
Computer Science
Economics & Political Science

Faculty Supervisor
Daungyewa Utarasint

Conference: **The Challenges of Liberal Democracy Today**

Location: **Greece**

HOW HAVE INDIA AND THE UNITED STATES APPROACHED DATA PRIVACY CHALLENGES POSED BY THE RISE OF TIKTOK, AND WHAT LESSONS CAN GREECE DRAW FROM THEIR REGULATORY APPROACHES TO MAINTAIN A BALANCED STANCE THAT UPHOLDS LIBERAL DEMOCRACY WHILE ADDRESSING VALID SECURITY CONCERNS?

The dramatic surge of popularity accompanying new technologies, like TikTok, developed and regulated within highly restrictive security states like China, has posed pressing challenges for Western democracies. How can governments counterbalance the need to protect sensitive citizen data while preserving core principles of liberalism when it comes to these mobile applications? This paper explained how and why India and the United States have reacted regulatorily to TikTok's spread. It argued that both countries have valid and significant security concerns regarding TikTok. However, both countries have regulated TikTok in a manner that has become hyper-politicized beyond valid security concerns. In India, Prime Minister Narendra Modi's government has taken an overly broad regulatory approach to TikTok, imposing blanket bans on it and other apps to serve nationalistic political goals. The United States, on the other hand, has proceeded with greater restraint, balancing pressing national security concerns with core imperatives of liberalism. Yet, nationalistic political positioning and increasingly polarized partisanship remain, threatening to poison sound, liberally grounded decision-making with overreach driven by political, rather than security, goals. The paper conducted a comparative analysis, evaluating India's and the United States' methods, ultimately asking what insights Greece can derive from their regulatory approaches.

HONEY HTUN

Major
Physics

Faculty Supervisor
Andrea Macció

Conference: **American Physical Society**

Location: **United States of America**

A SIMPLE ALGORITHM TO PREDICT THE STELLAR MASSES OF NEARBY SATELLITES OF GALAXIES FROM DMO SIMULATIONS

Compared to Dark Matter Only n-body simulations, Hydrodynamical Ultra-High Definition simulations are computationally expensive and time consuming due to the inclusion of baryonic processes. These are also the simulations used to compare with observations. In order to resolve small scale structures of low mass satellite halos gravitationally bound to their host galaxy, this level of resolution is required. This project aimed to create a tool to predict the outputs of hydrodynamical simulations by using Dark Matter Only simulations as an input in order to reduce time and computational complexity.

NOORA JABIR

Major
Social Research and Public Policy and Arab Crossroads Studies

Faculty Supervisor
Justin Stearns

Conference: **The Middle Eastern Studies Association**

Location: **United Arab Emirates**

ARCHAEOLOGY AND HERITAGE NARRATIVES IN THE UAE

When Dubai hosted the World Expo in 2021, its logo was created in the image of a gold artifact from Saruq ul Hadid, an Iron Age archaeological site in the emirate. "This land connected ancient civilizations," Sheikh Mohammed Bin Rashid said during the unveiling of the logo, "and we will continue to be a hub that connects the world."

This instance is one of the numerous others where archaeological artifacts are used as symbols of the country's national values, made possible by decades of collaboration between the UAE and various international museums and archaeological missions. The UAE has witnessed the growth of archaeology more rapidly than most other countries—archaeologist Dan Potts observes that it goes from "being a blank on the archaeological map of Western Asia to being one of the most intensively studied regions in the entire area" in a mere forty years. In this research, I shed light on the nature of the production of national narratives using archaeological methodologies through a study of archaeology in the UAE and its rapid development over the last few years. Through ethnographic observation, archival study, and interviews with the key players in the UAE's archaeological domain, including government workers in the archaeology and tourism sector, archaeologists, conservation specialists, and so on, I highlighted aspects of the dominant discourse of heritage production in the UAE and its reliance on a Western archaeological methodology that privileges certain frameworks of knowledge production in the creation of an Emirati national identity.

SACHINTHA PILAPITIYA

Major
Economics

Faculty Supervisors
Jean Imbs and Sujeong Shim

Conference: **The National Conference on Undergraduate Research (NCUR)**

Location: **United States of America**

SWAP WORTHY? THE GEOPOLITICAL DETERMINANTS OF CHINESE CURRENCY SWAPS

Given the increasing popularity of Chinese BSAs, I ask why have some swap recipients terminated their swaps lines whilst others continue and expand their swap lines? I found that whilst economics factors have been the key determinant in previous studies on who gets swaps, political factors (both international relations and domestic institutional characteristics) are not only as important in determining who gets a swap but are in fact the only factors upon which expansions of and exit from BSAs have depended on.

AYA AMINE AND NOURHANE SEKKAT

Major
Interactive Media

Faculty Supervisor
Domna Banakou

Conference: **15th Annual Conference on Undergraduate Research on Applied Computing (ZURC2024)**

Location: **United Arab Emirates**

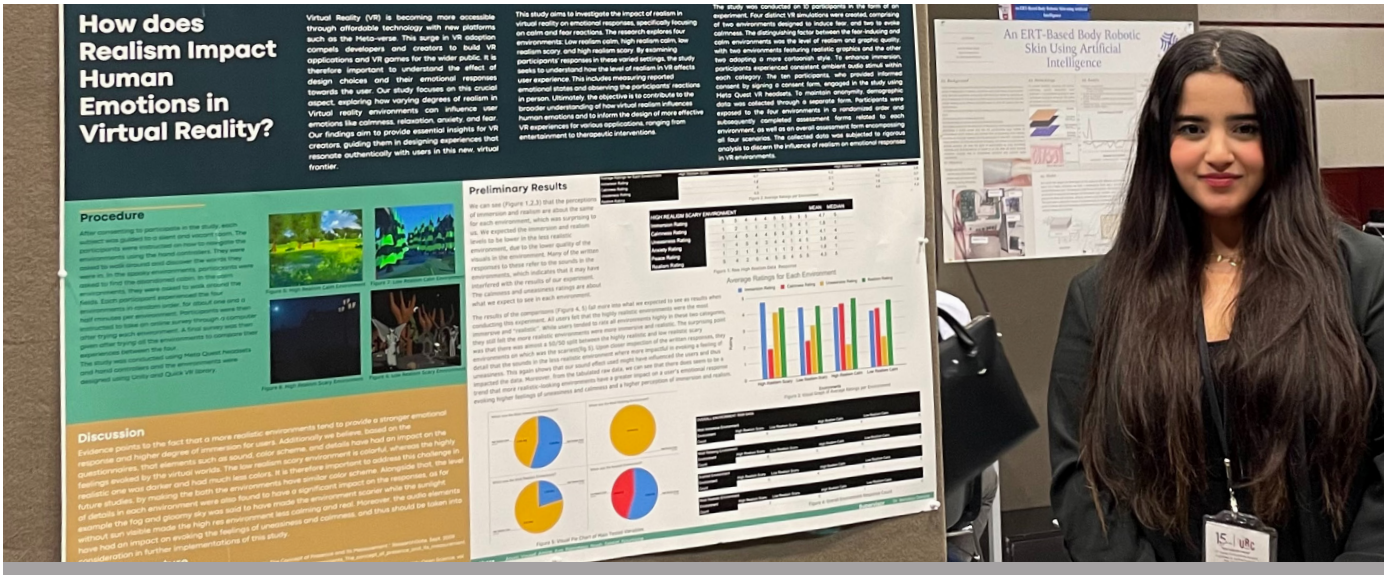
HOW DOES REALISM IMPACT HUMAN EMOTIONS IN VIRTUAL REALITY?

The pilot study delves deeper into the psychological effects of virtual realism. It employs a detailed experimental framework, where 10 participants are exposed to four VR simulations, each crafted to represent different levels of realism and designed to elicit specific emotional responses. The research methodically evaluates how these varied degrees of graphical fidelity influence emotions such as calmness, relaxation, anxiety, and fear.

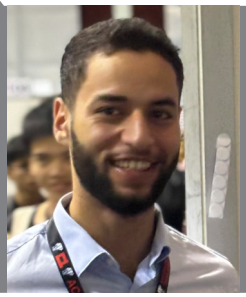
The study's methodology is rigorous, involving both qualitative and quantitative assessments of emotional responses, leveraging advanced VR technologies. This includes real-time monitoring of participants' emotional states and gathering comprehensive feedback to understand the subjective experience of each participant. The research aims to uncover the intricate relationship between virtual realism and emotional engagement, providing valuable insights into the psychological impacts of VR environments.

This research is pivotal for the development of VR content, offering crucial data for creators and developers to design more effective and emotionally resonant VR experiences. The implications of this study extend beyond entertainment, encompassing therapeutic applications and educational uses, where understanding emotional responses to virtual realism can significantly enhance the effectiveness of VR interventions.

By bridging the gap between technology and psychology, this study contributes substantially to the field of human-computer interaction. It highlights the critical role of realism in VR environments, not just as a technological feat, but as a key factor in shaping human emotions and experiences. The outcomes of this research are expected to set a new benchmark in VR development, emphasizing the importance of emotional considerations in the design and implementation of virtual environments.



Aya Amine and her co-author Nourhane Sekkat were awarded 'Best Research' for the poster category.



SALMAN ELGAMAL

Major
Electrical Engineering

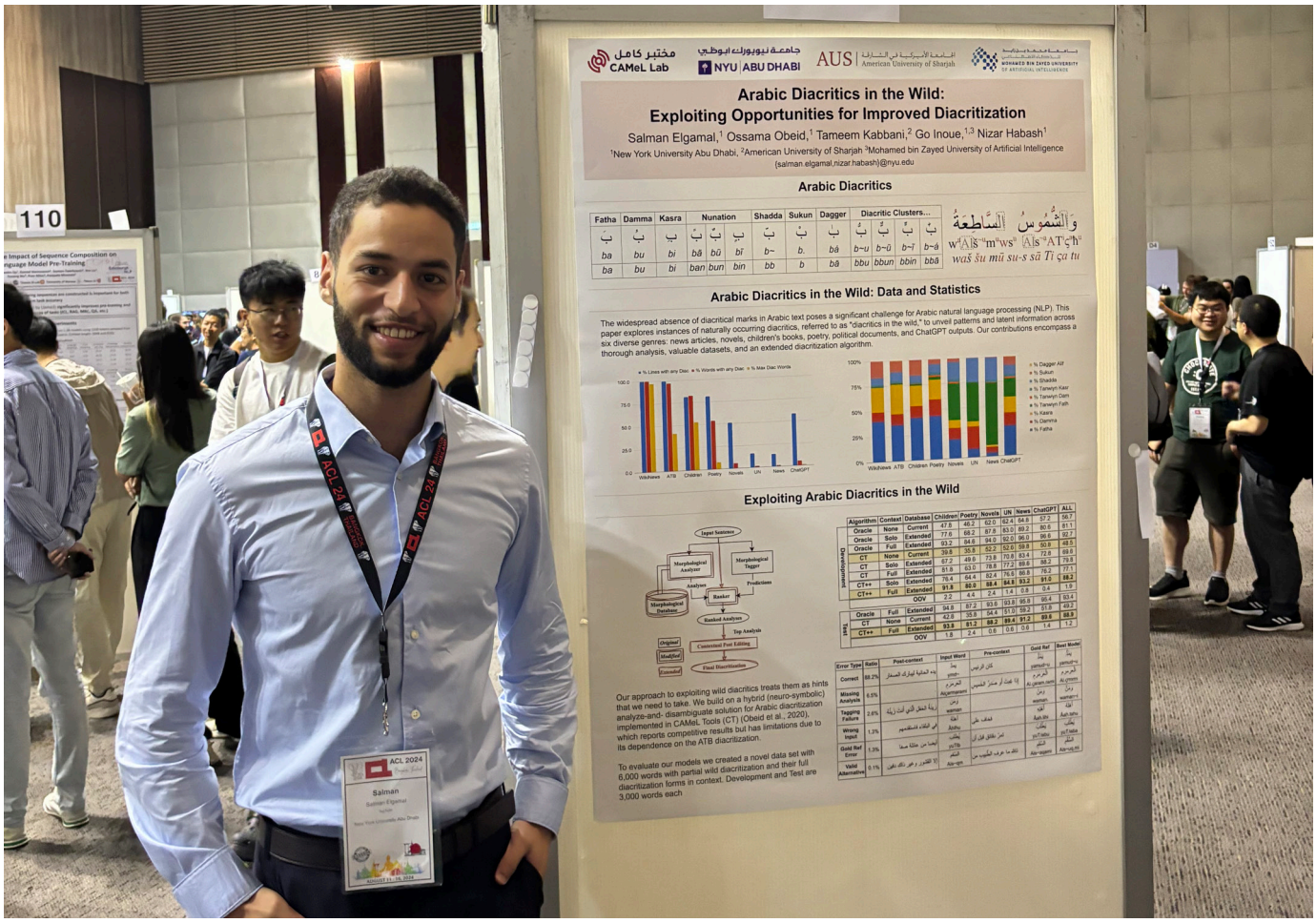
Faculty Supervisors
Nizar Habash

Conference: **Association of Computational Linguistics (ACL)**

Location: **Thailand**

ARABIC DIACRITICS IN THE WILD: EXPLOITING OPPORTUNITIES FOR IMPROVED DIACRITIZATION

The project was about utilizing a phenomonon we studied, that we named Wild Diacritics in Arabic, in order to improve word disambiguation and automatic diacritization in the state of the art arabic NLP models. We also developed two new datasets for Wild Diacritics to Max Diacritics training of models, created a standard for Max Arabic Diacritization, did a comprehensive analysis on the appearance of wild diacritics in 6 genres of text (News, Children books, Novels, Poetry, Political Documents, ChatGPT), and extended the state of the art diacritization algorithm to utilize Wild Diacs and demonstrated improved performance by evaluating on our created datasets. Everything is open-source and publicly available to the community.



AABARAN PAUDEL

Major
Computer Science

Faculty Supervisor
Aurelie Dariel

Conference: **National Collegiate Research Conference (NCRC)**

Location: **United States of America**

ENHANCING STUDENT PSYCHOLOGICAL WELL-BEING THROUGH EXPERIENTIAL DIVERSITY IN ABU DHABI: AN APPLICATION OF NUDGE THEORY

This project explored the application of nudge theory to improve student psychological well-being (PWB) in educational settings. With a focus on the concept of "Roaming Entropy" (RE), the project hypothesizes that diversifying students' daily experiences positively impacts their mental health. To put this theory into practice, the project implemented 'nudges', namely Subtle Behavioral Incentives, encouraging students in Abu Dhabi to visit a variety of locations. Key initiatives included the Passport Program and the Student Ambassador Program. These programs are designed to motivate students to explore new areas through mechanisms like social comparison, reward systems, and gamification elements. Initial findings show a promising link between heightened RE and improved PWB, underscoring the importance of experiential diversity in fostering student well-being. This study not only validates the use of nudge theory in enhancing psychological health but also offers valuable insights for educational institutions.

DANIEL AHN

Major
Chemistry

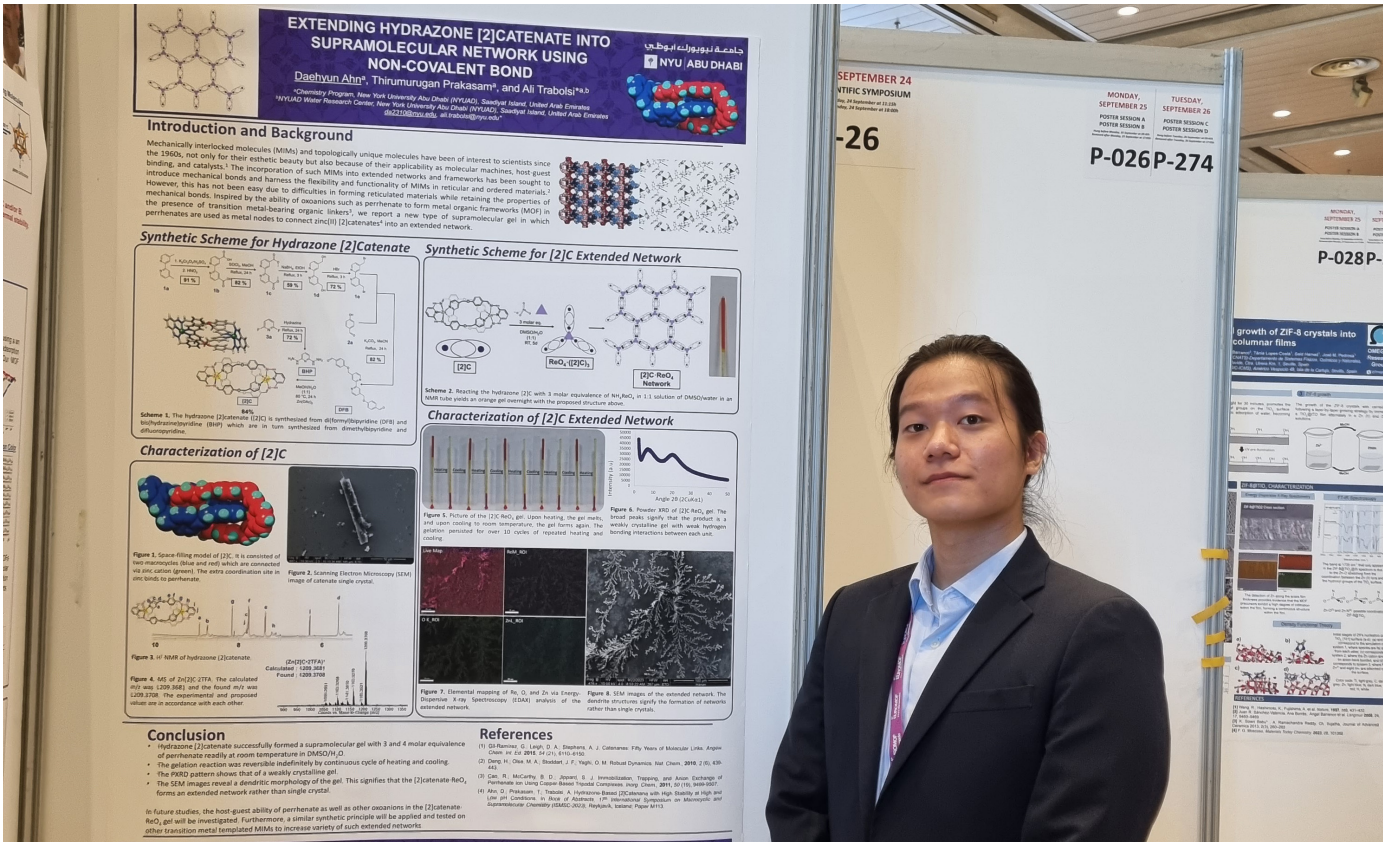
Faculty Supervisor
Ali Trabolsi

Conference: **5th European Conference on Metal Organic Frameworks and Porous Polymers (EuroMOF2023)**

Location: **Spain**

EXTENDING HYDRAZONE BASED [2] CATENANE INTO POLYMER NETWORK USING PERRHENATEION

Imine condensation has been central to the synthesis of interlocked molecules due to its abilities to perform dynamic covalent chemistry owing to its reversibility in thermal and acidic conditions. However, the reversibility of the bond also leads to easy degradation of the molecules, severely hindering its applications. Hydrazone bonds, on the other hand, can easily perform dynamic covalent chemistry, while exhibiting much higher thermal and acidic stability. In this project, I have modified a widely studied imine-based [2]catenane by changing its imine moiety to hydrazones. The resulting hydrazone-based [2]catenane is synthesized by reacting bFPB (4,4'-bis(((4-formylphenyl)oxy)methyl)-2,2'-bipyridine) and PDH (2,6-pyridine dihydrazine) in the presence of zinc acetate. The resulting [2]catenane was characterized using NMR spectroscopy, mass spectrometry, and X-ray crystallography. It was also tested for thermal and acidic stability.



MARYAM AMANULLAH

Major
Physics

Faculty Supervisor
Francesco Arneodo

Conference: **16th Pisa meeting on Advanced Detectors**

Location: **Italy**

CHARACTERISATION OF SILICON NITRIDE AND ALUMINIUM WINDOW SDD UNDER LOW PRESSURE ENVIRONMENTS

Silicon Drift Detectors (SDDs) are integral to X-Ray Fluorescence (XRF) spectrometry. They are vital for non-destructively analyzing cultural heritage samples. Traditionally, these detectors have used beryllium windows to maintain vacuum and protect the sensor. However, beryllium windows are not transparent to low energy X-rays.

This opacity restricts the ability of SDDs to measure oxygen's characteristic X-rays. Recent advancements in SDD windowing technology have led to the development of detectors featuring silicon nitride and aluminum windows. This change enhances the low energy X-ray detection capabilities of SDDs, enabling the detection of lighter elements.

However, this new type of window is not helium tight. In previous XRF studies, helium is often used to displace air, allowing for increased flux of X-rays to the sensor. Since this is not possible with the new windows, it inspired us to take XRF measurements in various low-pressure environments to study the improvement of the detection sensitivity, particularly for low energy X-rays. We performed characterization studies of these new SDDs in different vacuums, highlighting their performance in capturing low energy X-rays and comparing these results to previous SDDs. The heightened sensitivity from the silicon nitride and aluminum window in different vacuum systems increases the potential information that can be derived from non-destructive XRF analysis.

This can improve the identification and preservation of historical materials. The potential applications of this technology also extend beyond the field of cultural heritage into space exploration. The improved detection of low energy X-rays could be instrumental in deciphering the composition and geological history of astronomical surfaces, especially as the detection of oxygen can be used as a marker for water.

This advancement in SDD technology, therefore, not only enhances our ability to understand the past on Earth but also opens new frontiers in space exploration.

16th Pisa Meeting on Advanced Detectors - May 26-June 1, 2024 - La Biodola, Isola d'Elba

Photo Detectors and Particle ID (screen #3)

Maryam Manzoor Amanullah
NYUAD

[324] Characterization of light yield non-proportionality in plastic... Pierpaolo Loizzo
[140] Characterisation of Silicon Nitride and Aluminium Window SDD U... Maryam Manzoor Amanullah

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Characterizing Silicon Nitride and Aluminum Window SDD for XRFApplications

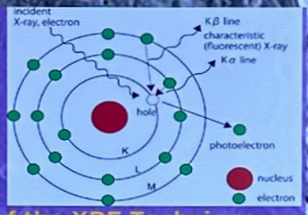
- Maryam Manzoor Amanullah (ma6056@nyu.edu), Isaac Sarnoff (ibs257@nyu.edu)

جامعة نيويورك ابوظبي
NYU ABU DHABI

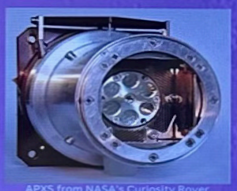
Understanding XRF

X-ray Fluorescence (XRF) is a non-destructive analytical method used to determine the elemental composition of materials.

- Materials are bombarded with high-energy particles (X-rays), exciting electrons, creating electron holes within the atoms.
- Higher energy electrons fall to fill these holes, they emit photons.
- The energy of emitted photons, indicative of the difference between high and low energy levels, is characteristic of specific elements.



Examples of use of the XRF Technique

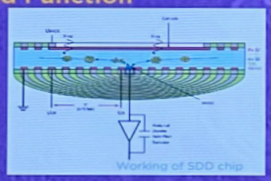


APXS from NASA's Curiosity Rover

Using a Silicon Drift Detector (SDD) we can measure and analyze characteristic X-ray emissions, providing insights into the elemental composition of a material. Alpha Particle X-ray Spectrometers (APXS) use alpha particles along with X-rays to analyze elemental composition, notably in space exploration missions like the Mars Curiosity rover. APXS uses radioactive source Curium-244 to induce emissions from a sample. Along with charecteristic X-rays, alpha particle back-scattering is used to obtain data that can help reconstruct information about elements that are too light to be detected by only XRF.

Silicon Drift Detector (SDD) Design and Function

- The SDD has p-n junctions created by the concentric circles of p-doped silicon on the n-doped silicon.
- A reverse bias voltage creates a depletion region to drive the photogenerated charge carriers.
- Photogenerated electrons are directed by a radial electric field
- These electrons are collected at a central anode



Working of SDD chip

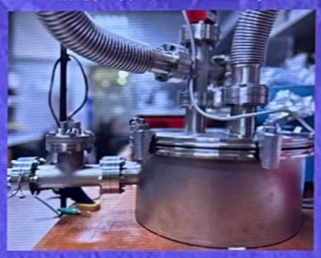
Schematic of the SDD

SDD Beryllium Window

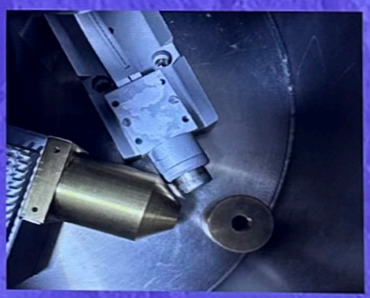
- The SDD chip is protected from the environment within a vacuum enclosure
- Beryllium windows are chosen to maintain the vacuum seal while also letting in X-rays.
- Beryllium has opacity to X-rays below 1 keV, limiting the SDD's ability to detect lighter elements like oxygen.
- Recent developments have used a combination of Silicon nitride (SiN3) and Aluminum for the window

Experimental Design

The objective of the experimental setup is to evaluate how replacing the beryllium window with silicon nitride (SiN3) and aluminum (Al) in the detector affects its ability to capture low-energy X-rays, especially those near the edge of the beryllium window detector's sensitivity.

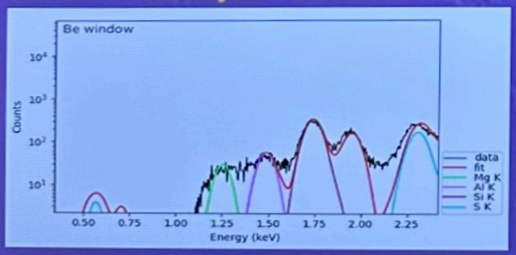


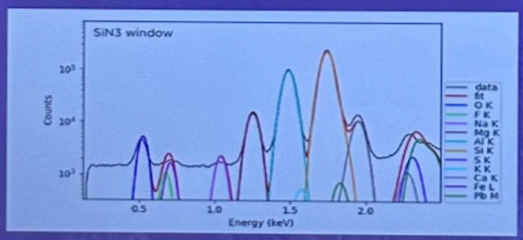
- **Use of Vacuum Chamber:** A vacuum chamber at 10e-5hPa was used in to eliminate air-induced X-ray attenuation.
- **Experimental Power Details:** A 70 kV, 12 W X-ray tube with a molybdenum target was used.
- **Testing Protocol:** Standardized conditions by operating the X-ray tube at 15 kV and 15 μA to produce reliable and comparable data.



- **Detector geometry:** Positioned the detector at a 45° angle to the X-ray source to optimize detection efficiency
- **Thermal Management:** The SDD was thermally coupled to an aluminum platform and the chamber casing to stabilize operating conditions and prevent overheating

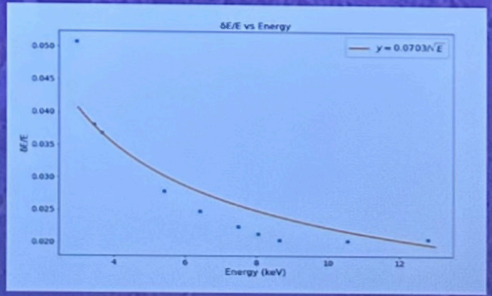
Berilliyum VS Silicon Nitride window





With the Silicon Nitride window, we detected light elements like Oxygen, identifying its Kα lines at 0.5 keV which are energies typically absorbed by the Be window

SDD resolution at 230K



TAMAYYUZ RESEARCH FELLOWSHIP PROGRAM

YOONSIK CHICO PARK

Faculty Supervisor
Aikaterini Arfara

Location: **NYU Abu Dhabi**

TEMPORARINESS: THE PERFORMATIVITY OF CHANGE

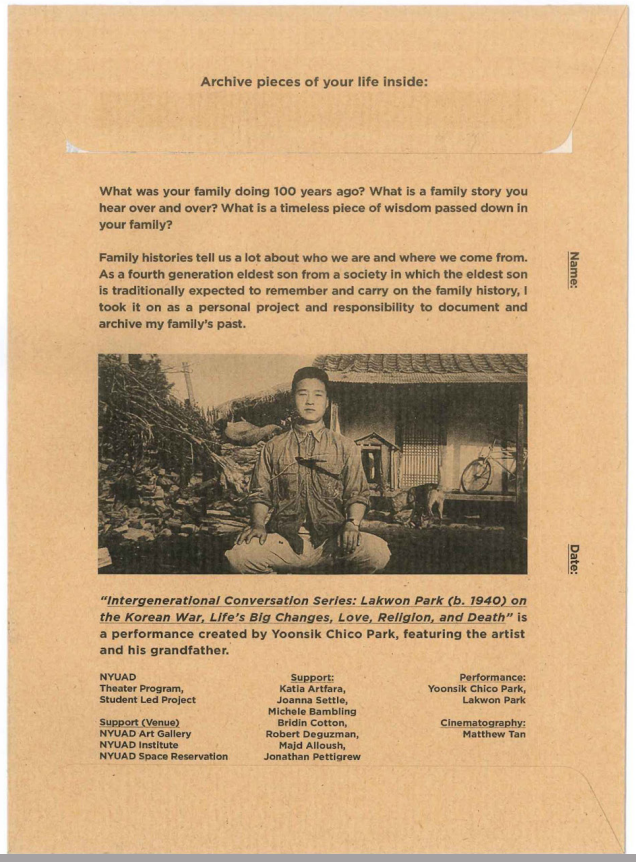
My fellowship project attempted to better understand temporariness—the fleeting nature of things marked by moments of death and birth—and to articulate how we can be more comfortable in the in-between spaces and silence that temporariness entails.

In addressing that larger focus, two methodologies were used. In the research driven by my artistic practice, I built on questions arising from my performance 'Intergenerational Conversation Series: Lakwon Park (b. 1940) on the Korean War, Life's Big Choices, Love, Religion, and Death,' (2023) to work on two research articles—one arguing that performances can be self-portraits, and the other examining how rituals for the dead act as multilayered sites of assembly. The performance and research papers were each presented at the College Art Association (CAA) and Performance Studies international (PSi) annual conferences this year.

This research subsequently informed my artistic practice, which allowed me to build on two new projects. The performance 'immortalized-ish,' (2024) used the burning of dry flowers to suggest that some things cannot be held onto forever, and the artist's book 'Clay Hut in a Concrete Jungle,' (in process) serves as both an archive for a previous performance and narration for the story of a birth following a death.

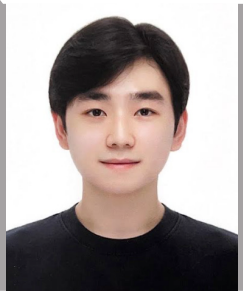
immortalized-ish, performance, April 2024, photographed by Ilya Akimov.

Intergenerational Conversation Series ... , performance, April 2023, photographed by Ilya Akimov.



Front & back scan of brochure for Intergenerational Conversation Series, inkjet on paper envelope, 7x10inch.

Q&A session with Diasporic Asian Art Network panel at College Art Association (CAA), 112th Annual Conference, Chicago, February 16, 2024.



DANIEL HYUNSEOK JANG

Faculty Supervisor
Yasir Zaki

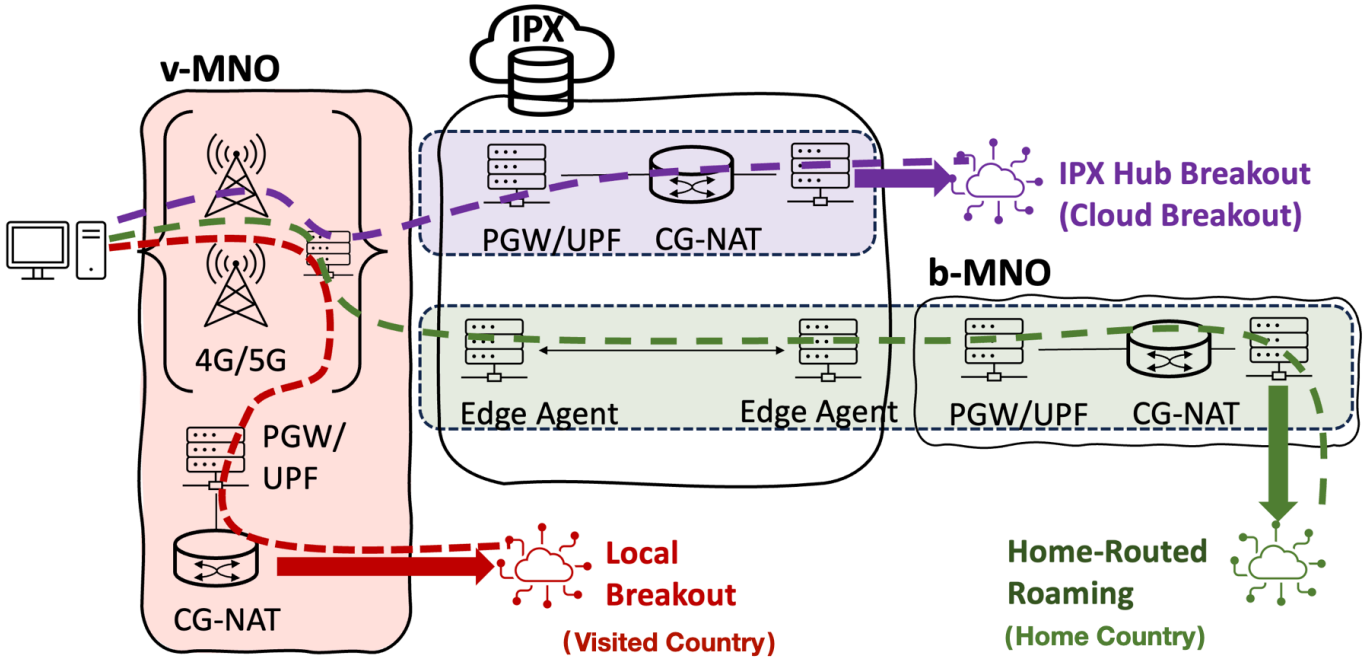
Location: **NYU Abu Dhabi**

IMPLICATIONS OF ROAMING FOR GLOBAL MOBILE CONNECTIVITY

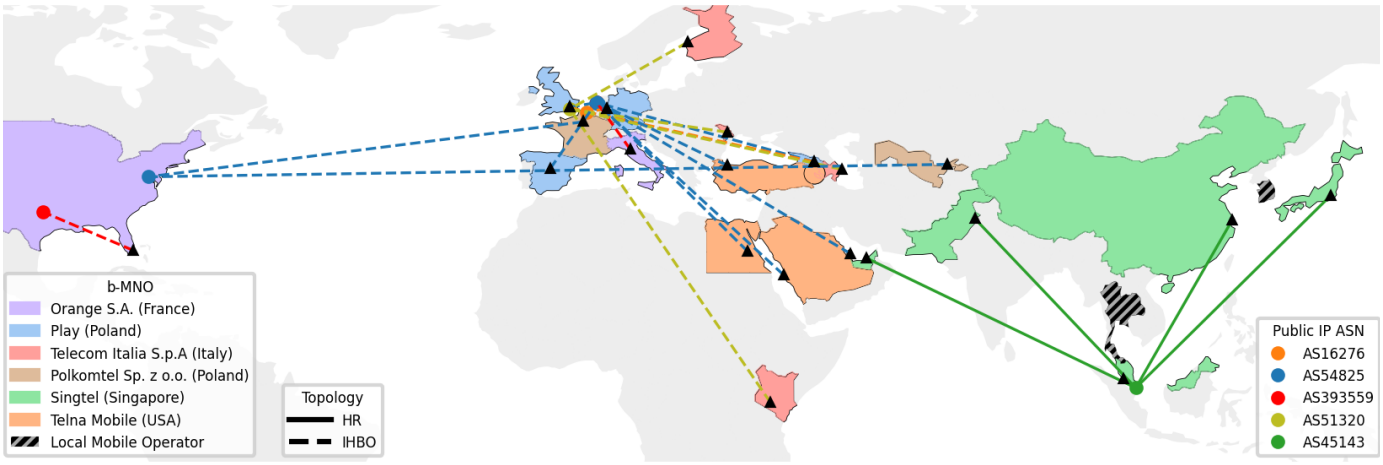
Cellular networks rely on roaming technologies to maintain user connectivity beyond home network's coverage area. My research focused on examining state-of-the art roaming solutions and their impact on global mobile connectivity.

Specifically, our work identified and explored "thick" Mobile Network Aggregators (MNAs), which leverage multiple core base operators from different regions to provide extensive global coverage. By designing a comprehensive measurement testbed deployed on web and Android platforms, we uncovered how commercial MNAs like Airalo employ unique routing techniques such as IPX Hub Breakout (IHBO) to decouple the internet gateways from base operators' infrastructure. Additionally, our research analyzed the global cellular ecosystem, addressing the fragmentation and high costs traditionally associated with data roaming. We proposed the adoption of Local Breakout (LBO), which allows user traffic to be routed directly through visited networks while bypassing home networks and third-party infrastructures, thereby reducing costs and improving network efficiency.

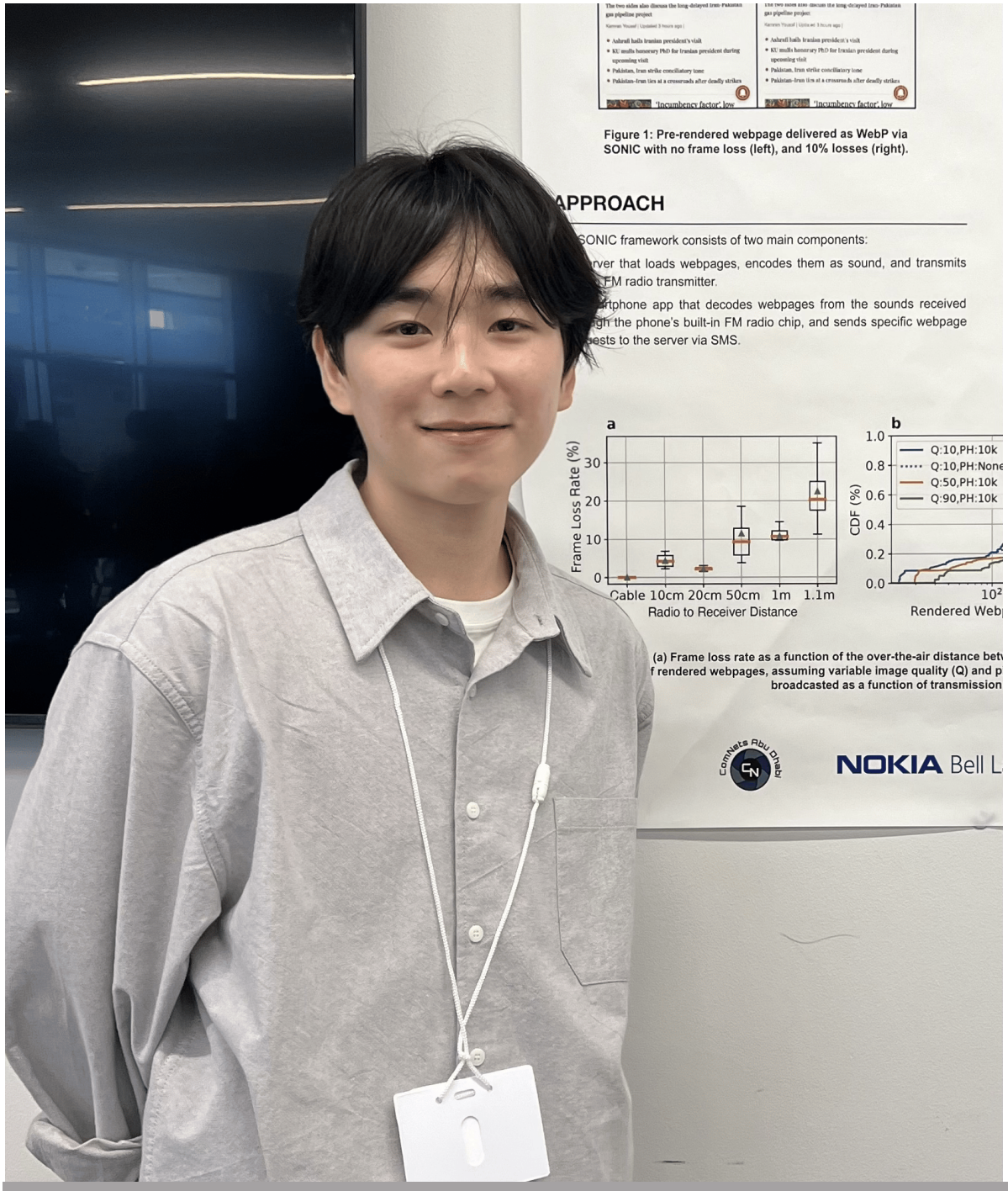
Our findings highlighted the technological and policy challenges in modern data roaming while proposing solutions for more effective and accessible global cellular services.



Architectural differences of the three main roaming topologies: Home-Routed Roaming, Local Breakout, and IPX Hub Breakout.



Tomography of Internet gateways employed by Airalo eSIMs.



Daniel presenting a research poster at ACM Special Interest Group on Data Communication (SIGCOMM).

HILINA BAYEW

Faculty Supervisor
Melina Platas

Location: **CITIES, NYU Abu Dhabi**

EMPOWERING COMMUNITIES THROUGH AIR QUALITY MESSAGING AND YOUTH ENGAGEMENT IN THE UAE

I conducted research on the impact of air quality messaging on community knowledge, behaviors, and policy preferences. The study explored whether providing local air quality information through bi-weekly summaries and critical level (AQI 200) alerts could influence the NYU Abu Dhabi (NYUAD) community. Participants, including faculty, contracted workers, and students, were randomly assigned to one of three groups: critical alerts, bi-weekly summaries, or control.

The findings revealed that while overall concern about air quality was high, bi-weekly summaries did not significantly alter participants' knowledge, behavior, or policy preferences. However, the critical alerts led to increased knowledge and a higher frequency of air quality checks before outdoor activities, indicating a positive behavioral change. Though neither intervention significantly affected policy preferences, there was strong interest in timely air quality messaging.

> **Building on this research, I collaborated with CITIESAir and external stakeholders such as the Environmental Agency Abu Dhabi and Goumbook, extending the study's reach to schools across Abu Dhabi and the wider UAE. Through campus visits, workshops, and curriculum design, I worked to engage students in air quality initiatives, leveraging their enthusiasm in sustainability clubs.**

Hilina at the Air Sensors international Community Conference, where she presented her work.

> Even after my fellowship, I am hopeful that the initiatives I have started will continue to grow, contributing to a healthier and more sustainable future in the UAE.

Attending a workshop in Lagos, Nigeria, to learn about the current contributors to poor air quality in various African cities.

WING KWAN HANNAH CHU

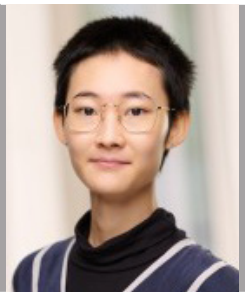
Faculty Supervisors
Bas Rokers and Kartik Sreenivasan

Location: **NYU Abu Dhabi**

THE NEURAL BASIS OF PERCEPTUAL FILLING-IN AND ITS IMPLICATIONS FOR WORKING MEMORY

Through a two-part project involving the development and programming of novel visual stimuli and extensive psychophysical testing, I investigated the behavioral effects of manipulating order of motion on the phenomenon of perceptual filling-in by artificial scotomas and its application to testing elements of cognition. The findings from the first part of the project, where the time course of motion artificial scotomas appeared to support a feedback account of perceptual filling-in, were presented at the leading international visual neuroscience meeting Vision Sciences Society (VSS) conference. These results were also compiled into a manuscript for submission. I have also found growing evidence for the ability to perturb working memory using a behavioral paradigm that may shed light on the involvement of visual areas in the storage of working memory. Moving forward, I am continuing my research in the field of neuroscience and psychology through the pursuit of a PhD in Cognition & Perception at NYU as a Global Fellow.

> **“The fellowship has been a remarkable opportunity to extend and generate research, network and further my career as a young scientist. I was able to design and complete additional experiments and research projects, some initiated during my undergraduate years and others new, that ultimately resulted in a manuscript for journal publication. Through generous funding and support granted through the Office of Student Research, I was also able to attend an international neuroscience conference, which enabled me to see the most cutting-edge and significant findings in the field, share my own ideas, and work with other leading scientists, and networking with researchers in other fields and institutions.”**



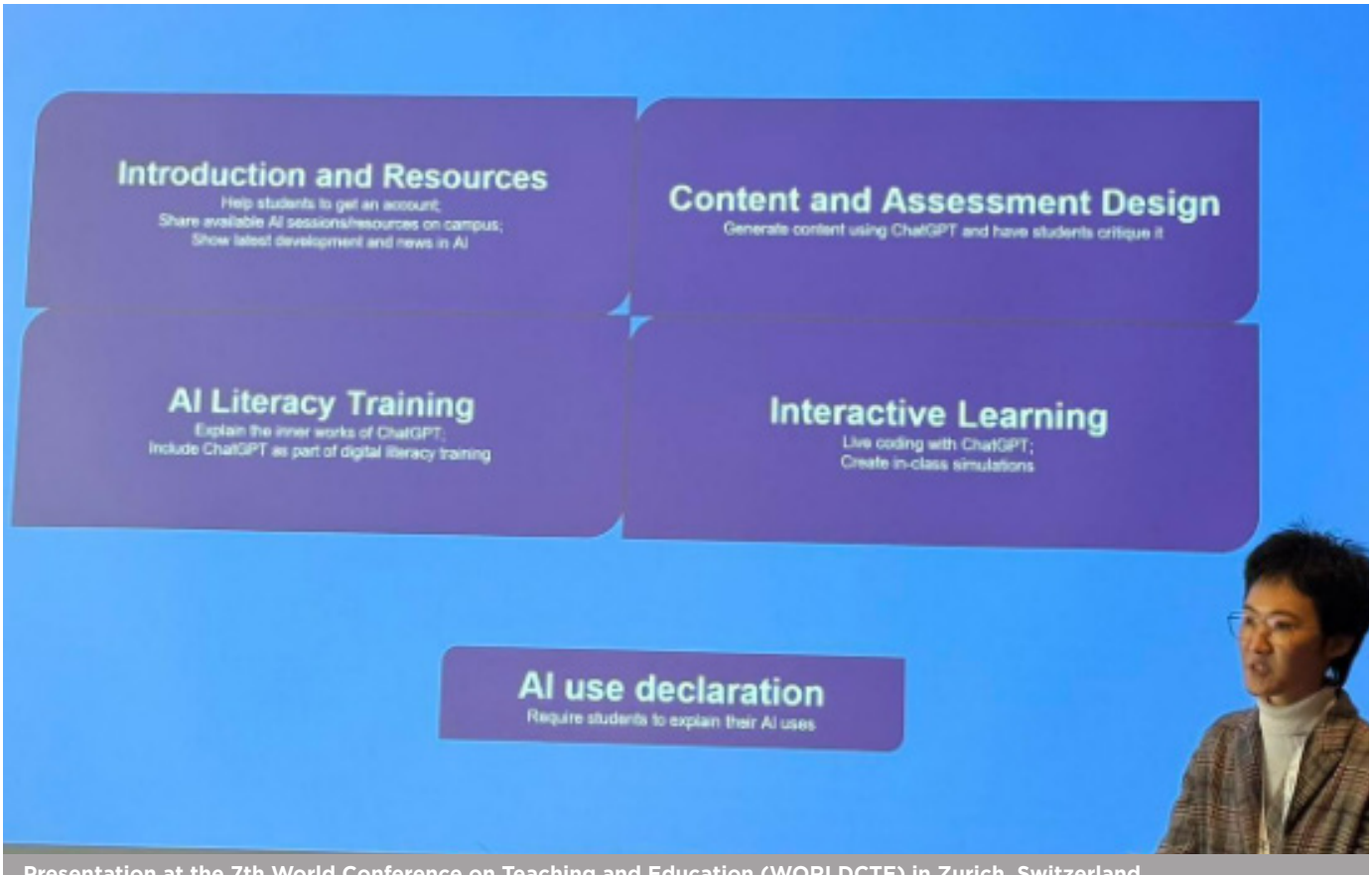
CHENYU YI

Faculty Supervisor
Nancy W. Gleason

Location: **Hilary Ballon Center for Teaching and Learning, NYU Abu Dhabi**

INTEGRATION OF ChatGPT IN UNDERGRADUATE SOCIAL SCIENCE PROGRAMS IN THE UNITED ARAB EMIRATES

As part of my 2023-2024 fellowship, I researched faculty's pedagogical use of ChatGPT in undergraduate social science programs at NYUAD to assess and timestamp AI's impact in higher education. The study included surveys with 46 faculty and semi-structured interviews with 13 faculty across four disciplines. A manuscript is currently in progress. I also earned Scholarship of Educational Leadership (SoEL) certification in January 2024 through the Hilary Ballon Center for Teaching and Learning initiative to strengthen my independent research skills.



Presentation at the 7th World Conference on Teaching and Education (WORLDCTE) in Zurich, Switzerland.

RYOJI KUBO

Faculty Supervisors
Djellel Difallah and Monica Menendez

Location: **NYU Abu Dhabi**

INTERPRETABLE, SCALABLE AND GENERALIZABLE SPATIAL-TEMPORAL GRAPH NEURAL NETWORKS FOR TRAFFIC FLOW PREDICTION

During this research fellowship, I worked on two key projects. The first focused on improving explainability for Graph Neural Networks (GNNs), which are powerful machine-learning models for graph data such as social networks, molecular structures, and traffic networks. While GNNs offer strong predictive capabilities, their outputs are often difficult to interpret, making them less suitable for critical applications. To address this, I developed a novel algorithm, XGExplainer, to provide clearer explanations for GNN predictions. This method enhances robustness by ensuring GNNs remain consistent even when graph inputs are perturbed, establishing new benchmarks in explanation accuracy.

The second project explored the use of transformer architecture for graph machine learning. GNNs often struggle with long-range dependencies, so I adapted transformers—commonly used in natural language processing—for graph tasks. Transformers excel at capturing distant relationships, and early results show promising performance, particularly in knowledge graph completion tasks.

In the future, I plan on combining the two methodologies to develop a graph machine-learning pipeline that is accurate and explainable. I am explicitly excited about its application on traffic flow data, and to be used on local datasets from the UAE.

Publication

Ryoji Kubo and Djellel Difallah

XGExplainer: Robust Evaluation-based Explanation for Graph Neural Networks. Proceedings of the 2024 SIAM International Conference on Data Mining (SDM). Society for Industrial and Applied Mathematics, 2024.

RITA FAHMY

Faculty Supervisor
Aashish Jha

Location: **Center for Genomics and Systems Biology, NYU Abu Dhabi**

COMMUNITY-ENGAGED RESEARCH ON GENE TIC HISTORIES, BASIS OF MALARIA RESISTANCE, AND EVOLUTION OF SHORTER STATURE IN LOWER-ALTITUDE HIMALAYAN POPULATIONS

A continuation of my Capstone, this project involved identifying signatures of positive selection underlying potential adaptations in indigenous, marginalized communities in the lower altitudes of the Himalaya. My work was based on running a panel of selection scans, each primed to detect a different type of selection, for a comprehensive overview. We were able to identify several signals, both previously established and novel, related to malaria resistance in populations that inhabit areas in the Terai where malaria was once endemic. We additionally identified signals related to shorter stature in Pahad (middle hills) populations that may be associated with the hunting and gathering lifestyles they led before transitioning to their current, more settled living. As part of the Genetic Heritage Group's mission to expand research on populations that have historically been underrepresented in population genomics, I also aided in a project elucidating the population histories of Jammu and Kashmir.

"This fellowship has been an invaluable experience. It's given me the opportunity to see my project, one which I've developed a special passion for over the years, come to fruition. I'm immensely grateful for how this year has allowed me to take the time to carve out a niche for myself that combines my scientific interests with my future aspirations for medicine."

AAYUSH KARNA

Faculty Supervisor
Sunil Kumar

Location: **NYU Abu Dhabi**

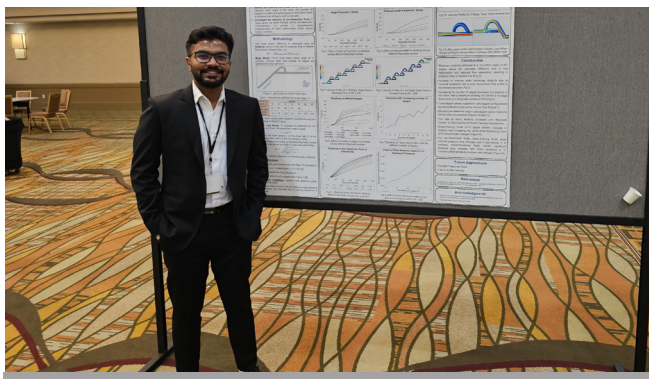
NUMERICAL ASSESSMENT AND OPTIMIZATION OF SINGLE AND MULTI-STAGE TESLA VALVES

In many applications of microfluidic circuits, valves are often needed to ensure unidirectional flow and minimize backflow within geometrical constraints. For example, current drug delivery mechanisms commonly rely on micropumps equipped with valves, such as check valves, to prevent backflow; however, these valves contain moving parts that are susceptible to breakdown. The Tesla valve, with its passive operation, offers a promising alternative by enhancing the reliability and durability of such systems without the need for moving components.

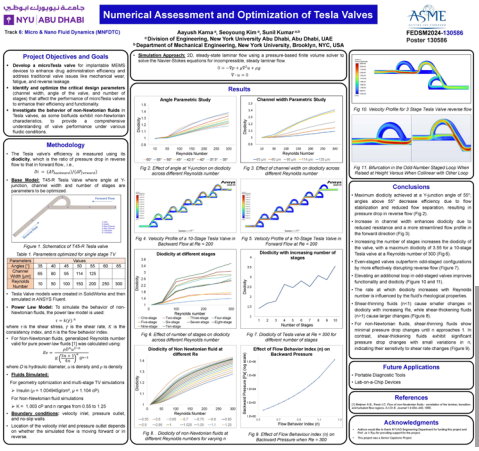
In this study, we examined how geometric parameters influence the Tesla valve's efficiency, quantified by its diodicity, using Newtonian biofluids as the working fluid. A 2D model of the Tesla valve was used to analyze the effects of varying the junction angle and channel width on diodicity within a Reynolds number (Re) range of 10 to 300, typical in microfluidics. Our findings indicate that diodicity increases with the angle up to a certain point, after which it begins to decline. Similarly, an increase in channel width leads to a corresponding increase in diodicity.

Following this parametric study, the optimized design was applied to evaluate changes in diodicity across a multistage Tesla valve setup, with up to 10 stages. An increase in the number of stages led to further improvements in diodicity, with the highest efficiency observed in the 10-stage configuration. The study also explored the valve's performance with non-Newtonian fluids by keeping the flow consistency index (K) constant and varying the flow behavior index (n). The results revealed that increasing the value of nn enhances the valve's diodicity. Shear-thinning fluids (n < 1) exhibited lower diodicity and significantly reduced pressure compared to shear-thickening fluids (n > 1).

The optimized geometric configurations of the Tesla valve achieved enhanced diodicity, which is critical for precise control and delivery of biofluids. This ensures unidirectional flow and minimizes the risk of dosing inaccuracies caused by backflow, making the Tesla valve particularly suitable for applications such as in vitro diagnostics, organ-on-a-chip systems, and other microfluidic platforms for drug delivery.



Aayush presenting at the The American Society of Mechanical Engineers (ASME) Conference.



Results of the research showcased at ASME Conference.

SUSANNE NIEMANN

Faculty Supervisor
John O'Brien

Location: **NYU Abu Dhabi**

ART, SPACE, AND THE CREATIVE ECONOMY: MAPPING NETWORKS OF CULTURAL PRACTICES IN THE UAE

Art spaces are more than sites of exhibition—they serve as meeting points that shape cultural participation and public life. This research project explored artistic and cultural practices in the UAE, focusing on the networks that connect initiatives and institutions across different levels, from grassroots initiatives to state-funded entities. By examining these spaces as semi-public and public-private environments, I was interested in the kinds of communities they foster and the diverse demographics they attract.

Grounded in anthropological methods such as ethnography and integrating experimental, multimodal, and collaborative research approaches, my study examined how cultural engagement unfolds in different settings. Over the course of the fellowship, my focus shifted from a spatial, site-specific perspective to a broader inquiry into the role of cultural production and consumption in the UAE's strategy to diversify its economy. This research engaged with the creative economy as both a policy framework and a lived reality, exploring how artists, institutions, and cultural practitioners navigate this evolving ecosystem. A key aspect of my project was experimenting with multimodal methodologies to assess their potential for knowledge production while critically reflecting on their ethical and epistemological implications.

Drawing from my media studies background, I incorporated sensory-based research methods such as sound mapping, emphasizing embodied and spatial experiences. I was particularly interested in the power dynamics between researcher and collaborator, examining how these relationships shape both process and outcome.

This project also enabled me to connect with cultural researchers across the SWANA region and Europe through my participation in the 2023 Beyond Conference on Creative Economies in London and the 2024 AIMAC International Conference on Arts and Cultural Management in Lisbon. These engagements provided opportunities to exchange insights on the intersections of culture, policy, and artistic practice, reinforcing the collaborative nature of research in this field.

GRACE SHIEH

Supervisors
Sarah AlZaabi and Fatiah D. Touray

Location: **Office of Inclusion and Equity, NYU Abu Dhabi**

UNDERSTANDING ACCENT EXPERIENCES AT NYU ABU DHABI: A DISCUSSION ON INCLUSION, DIVERSITY, BELONGING, EQUITY, ACCESS (IDBEA) AND BEST PRACTICES

My study employed an interdisciplinary approach to examine the impact of accents on the academic, social, and professional experiences of students and staff at NYUAD.

I conducted in-depth interviews and surveys with students and staff on their accent experiences at NYUAD and created a resource guide on accents for the community. Informed by the study and interviews, I designed and led workshops that introduced scholarly and cultural frameworks on accents, discussed the relationship between accents, IDBEA and areas of intersectionality, and co-created with participants best practices for accents at NYUAD. I also adapted the study to a 10-minute presentation at the Dakar Translation Symposium in Accra.

> **I hope that the study not only examined what these accent experiences mean to our diverse global liberal arts institution, but also envisioned and advocated for what we can do as a community to promote inclusion, diversity, belonging, equity, and access.**

MICHAEL XU

Faculty Supervisors
Sanjeev Goyal and Bedoor AlShebli

Location: **NYU Abu Dhabi**

FROM DIVERSE ROOMMATES TO DIVERSE SOCIAL NETWORKS: EVIDENCE FROM A UNIVERSITY DORM ROOM ASSIGNMENT POLICY

Universities have introduced several initiatives to support and facilitate diversity and inclusion among students. A prominent dimension in which universities have intervened is room assignment. This project, in collaboration with Prof. Sanjeev Goyal (Cambridge and NYUAD) and Prof. Zheng Wang (NYUAD), was contextualized in the unique setting of NYUAD with one of the most diverse student bodies globally (in terms of the number of nationalities and languages represented, as well as the composition in that there are no major/ dominating large components). We took note of NYUAD's distinctive housing assignment policy for first-year undergraduate students, which prioritizes geographic diversity as a primary variable in the assignment process. The project objective was to assess how these diversity and inclusivity-oriented room allocation policies impact students' subsequent choices of roommates in their upperclassman years, various types of friendship circles, and study partnerships throughout their undergraduatejourney.

I also worked on another more empirical project studying the influence of "top" journals. My role was mostly focused on programming: initially collecting the complete records of articles published in top-100 journals in various disciplines, then building the citation networks and identifying the citation clusters (authors belonging to a research field within a discipline).

> **Following the fellowship, I will be joining the Economics PhD program at Boston University. This research fellowship has been instrumental in preparing me for the rigors of doctoral-level research while also helping me build valuable connections with esteemed professors and researchers in the field.**

TAMAYYUZ RESEARCH FELLOWSHIP PROGRAM

NYU Abu Dhabi is pleased to congratulate the following NYUAD seniors on their successful admission to the Tamayyuz (Excellence) Research Fellowship Program. This fellowship offers an opportunity for research fellows to take part in a year of full-time intensive and independent research, from September 1, 2024 - August 31, 2025.

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Yogesh Dhungana	Sarah AlZaabi and Fatiah D. Touray
Elen Asatryan	Moza Al Nuaimi
Zuzana Lukácová	Piergiorgio Percipalle
Ella Goeckneř-Wald	Jordan Norris
Alexander Vasilis Christou	Rana Tomaira

RESEARCH TITLE
Learning to Critically Engage with Technology: A Critical Pedagogy Perspective on the Impact of Generative AI in Liberal Arts Education (HBCTL)
The Role of ß-actin in Temporal Gene Expression Regulation During Brain Development
Unearthing Heritage: Skill and Expertise in the Making of the UAE's Past
Crafting "Musical Encounters:" Inclusive Holistic Development & Early Childhood Education
Child Labor and the Agricultural Productivity Gap
Role of Mixed Nationality Physical Activity Groups in Health Promotion and Community Integration
Productivity Coach Bot: A Social Robot Coach for College Students
Casting the Future: A Versatile and Cost-effective Approach to Metallic Components
Embodied AI in Robotics: Using Foundational Models for Context-Aware Autonomous Navigation and Manipulation for Humanoid Robots
Impact of Academic and Social Interactions on Interfaith Understanding Focused on Belonging to Religion at NYU Abu Dhabi (OIE)
Cultivating Sustainability: A Circular Economy Approach to Campus Dining at NYUAD (OSS)
The Role of NM1 in Adipogenesis and Obesity (CGSB)
The Impact of Residency-by-Investment Schemes on House Prices: The Case of the UAE's Golden Visa (CITIES)
Sustainable Mobility: Investigating Urban Infrastructure Perspectives and Challenges in Abu Dhabi (CITIES)

WITH THANKS TO ALL FACULTY AND ACADEMIC STAFF WHO SUPERVISED NYU ABU DHABI UNDERGRADUATE RESEARCHERS IN ACADEMIC YEAR 2023-2024.

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