SUNY Polytechnic Institute Summer Undergraduate Research Program 2027

Project Description



Project List: College of Arts and Sciences

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2a	Pallavi Gupta-Bouder	Community project: A. Creating an open garden space around the greenhouse. B. Growing various vegetables and fruits in the newly-developed greenhouse
3a	Pallavi Gupta-Bouder Nick LeJeune	Testing beta model for S3M kits (Self-sufficient and sustaining microgreens kit) to produce microgreens using 3D printing techniques.
4a	Shing Chi Leung	Impact of Neutron Star Explosion on Cosmic R-Process Element Enrichment
4b	Shing Chi Leung	Forest Fire Model and Forest Trail Planning
4c	Shing Chi Leung	Atmospheric circulation model and convective mixing
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5a	Nick LeJeune	Game Development for Learning and Engagement: A Gamification Research Project
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6a	Margarita Orlova	Impact of toxicants on pollinator behavior and physiology: understudied risks and strategies for detection
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7a	Vijay Ramalingam	Sustainable Monitoring of Toxicant Exposure in Bees by Non-Destructive Analytical Methods

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18a	Priangshu Sen	Measurement of the near and far-field channel profiles for rough surfaces, such as outdoor vegetation, to understand the channel propagation characteristics
18b	Priangshu Sen	Optimizing the next-generation single-carrier waveform design for terahertz and mmWave ISAC applications
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College of Arts and Sciences

Dr. Asela Abeya

abeyaa@sunypoly.edu
Mathematics
Lecturer

Project Title: (1a) From Unstructured to AI-Ready Data: Developing and Evaluating an AI Harness Component

This project investigates how to turn information from documents, images, spreadsheets, audio, or video into reliable data that AI systems can use. Working with the faculty mentor and a graduate student, the undergraduate researcher will focus on one file type and develop a conversion tool or plugin for a broader AI harness, the tools and controls that help an AI model work reliably. The student will compare existing tools, integrate or extend promising approaches, and test the resulting component for accuracy, completeness, and processing speed. The research will examine how well these tools preserve important information and identify where they make errors or lose details. The student will produce a working prototype, reproducible evaluation results, and a research poster.

Student Skills/Requirements: Basic programming experience, preferably in Python, and an interest in AI, data processing, or software development. Students should be willing to learn new tools, troubleshoot problems, and document their work carefully.
Experience with AI agents, AI harnesses, Linux, or Docker is a plus but not required.

Dr. Pallavi Gupta-Bouder

guptabp@sunypoly.edu
Biology and Chemistry
Lecturer

Project Title: (2a) Community project: A. Creating an open garden space around the greenhouse. B. Growing various vegetables and fruits in the newly-developed greenhouse.

Last summer, our students successfully inaugurated the small greenhouse facility on-campus. We grew many vegetable crops, such as tomatoes, peppers, and other leafy herbs. This was a small-scale initial trial, which we would like to expand this year. We look forward to work with students who wish to participate in a community project and learn about urban farming and agriculture. We welcome students who are interested in exploring local community outreach initiatives. We also would like to create a garden adjacent to the greenhouse to showcase a pollination garden and a native plant garden.

Student Skills/Requirements: N/A

Dr. Pallavi Gupta-Bouder and Mr. Nick LeJeune

guptabp@sunypoly.edu
Biology and Chemistry
Lecturer

lejeunc@sunypoly.edu
Interactive Media and Game Design
Associate Professor

Project Title: (3a) Testing beta model for S3M kits (Self-sufficient and sustaining microgreens kit) to produce microgreens using 3D printing techniques.

Microgreens are nutrient-dense baby plants that are versatile and effective diet supplements. Most of the current methods use soil for seed germination and growth of these microgreens, which makes them prone to soil-borne diseases. Our research last summer successfully demonstrated the germination of microgreen seeds on a paper-based matrix. These results open the possibilities to minimize waste products such as plastic and soil needed for cultivation of microgreen crops. Our goal for this project is to create innovative, user-friendly, and self-contained designs that can be used at home. Last summer, our students successfully created 3D printed designs for the kit and paper-based matrix for seed germination. This summer, we would like to complete this project by testing light resources for seed germination and growth.

Student Skills/Requirements: Must have completed at least two 100-levels courses in Biology, Chemistry or Physics.

Dr. Shing Chi Leung

leungs@sunypoly.edu
Physics
Assistant Professor

Project Title: (4a) Impact of Neutron Star Explosion on Cosmic R-Process Element Enrichment

An isolated neutron star is stable to exist. But if a primordial black hole passes through the neutron star, it could traps the black hole, where the accretion of neutron star by the black hole could lead to the disruption and possibly a temporary mass outburst. Such outburst matter is a robust candidate for forming rare elements such as gold and uranium, but its impact remains unstudied. In this project, the participating student will modify existing galactic chemical evolution code in Fortran and study how this explosion channel could affect how these elements build up in the cosmic evolution. The student will perform numerical analysis using Python and develop constraints on this model.

Student Skills/Requirements: Python, Fortran, curiosity, interest in astrophysics

Project Title: (4b) Forest Fire Model and Forest Trail Planning

Forest fires could result in major environmental loss in the forest area and living habitat for animals, and financial loss in terms of housing. Planting trees strategically, including choosing fire-resistant trees, could play an important role in suppressing fire growth. In this project, the participating students will use Python (or any relevant programming language) to model the forest fire under the influence of fire-resistant trees. The student will study the impact of the tree zoning plans to the propagation of the forest fire and evaluate its effectiveness. The student will build the optimal solution for a sustainable forest structure.

Student Skills/Requirements: Python, differential equation, zoning

Project Title: (4c) Atmospheric circulation model and convective mixing

Convection is an ubiquitous phenomena for energy transfer, to be found in ocean, atmosphere and stars. Correctly modeling the convection and its mixing effect is important for making precise predictions on the temperature and chemical profile of a system. In this project, the participating students will experiment with modifying the existing convection recipe and test it in the context of stellar evolution. The students will study how convection changes the stellar and chemical composition profile. Then the students will study the parameter dependence. Participating students will need to install and run the local code MESA (Modules for the Experiment in Stellar Astrophysics).

Student Skills/Requirements: Fortran or C-type programming experience (upper-intermediate), PHY 201 or above, Python (Intermediate)

Project Title: (4d) Quantum Circuit Design

Quantum Computing makes use of the quantum superposition which allows a qubit to store any number between 0 and 1 with a single bit, known as the qubits. How to harness this flexibility becomes the next generation challenge to design efficient algorithms which could massively speed up computational power and hence the domain of what computers can solve within human lifetime.

In this project, the participating student will use the Python code to develop a simulation code for constructing the quantum neuron (standard Hopfield type neuron and recursive type neurons). The student will train with typical database and time-series data and verify the accuracy and computing efficiency in comparison with classical neural networks.

Student Skills/Requirements: Python (proficient), PHY 201 or above

Mr. Nick LeJeune

lejeunc@sunypoly.edu
Communications + Humanities Department
Associate Professor

Project Title: (5a) Game Development for Learning and Engagement: A Gamification Research Project

This project builds on an earlier game about Bernoulli's equation, part of a gamification research program that won Best Poster in Engineering Education at IMECE 2026, and asks what makes a game engaging enough that people keep learning from it. A small multidisciplinary team of students, spanning art and asset creation, programming, marketing and production, and engineering content expertise, will design, build, and playtest a short follow-up game that teaches undergraduate engineering students core fluid mechanics principles, such as how fluid moves through pipes, when flow stays smooth or turns turbulent, and how much energy is lost along the way. Students will review existing research, turn findings into design goals, build prototypes in short sprints, and gather playtest feedback to investigate which gamification features (such as level progression, real-time visual feedback, and scored challenges) most affect engagement. Along the way, they will learn professional studio practices, including documentation, project planning, version control, and team meetings. The project is open to all majors, and mechanical engineering students are especially encouraged to apply; no prior research experience is needed, and students in their first or second year are strongly welcomed. The summer concludes with a playable prototype and a research poster presented at the SURP poster session.

Student Skills/Requirements: Open to all majors; mechanical engineering and IMGD students are especially encouraged. Experience in at least one area is helpful; skills in others are a plus, not a requirement. Art/Asset: Blender, 2D/3D asset creation, digital art, raster and vector editing; Programming: Unreal Engine (preferred), Godot, or Unity, and general programming experience; Marketing/Production: graphic design, video/audio editing, sound design, copywriting, PR, and content creation; Engineering Content: completed or current coursework in fluid mechanics or thermodynamics. All students: willingness to collaborate, document work, and participate in research activities.

Project Title: (5b) Balancing the Books: A Gamification Research Project in Accounting Education

This project builds on an ongoing gamification research program, including work on games for accounting and fluid mechanics education, that won Best Poster in Engineering Education at IMECE 2026, and asks what makes a game engaging enough that people keep learning from it. A small multidisciplinary team of students, spanning art and asset creation, programming, marketing and production, and accounting content expertise, will design, build, and playtest a short game that teaches introductory

accounting students core principles, such as the accounting equation, how debits and credits work, and how transactions flow into financial statements. Students will review existing research, turn findings into design goals, build prototypes in short sprints, and gather playtest feedback to investigate which gamification features (such as level progression, real-time visual feedback, and scored challenges) most affect engagement. Along the way, they will learn professional studio practices, including documentation, project planning, version control, and team meetings. The project is open to all majors, and accounting students are especially encouraged to apply; no prior research experience is needed, and students in their first or second year are strongly welcomed. The summer concludes with a playable prototype and a research poster presented at the SURP poster session.

Student Skills/Requirements: Open to all majors; mechanical engineering and IMGD students are especially encouraged. Experience in at least one area is helpful; skills in others are a plus, not a requirement. Art/Asset: Blender, 2D/3D asset creation, digital art, raster and vector editing; Programming: Unreal Engine (preferred), Godot, or Unity, and general programming experience; Marketing/Production: graphic design, video/audio editing, sound design, copywriting, PR, and content creation; Engineering Content: completed or current coursework in fluid mechanics or thermodynamics. All students: willingness to collaborate, document work, and participate in research activities.

Dr. Margarita Orlova

orlovam@sunypoly.edu
Biology and Chemistry
Assistant Professor

Project Title: (6a) Impact of toxicants on pollinator behavior and physiology: understudied risks and strategies for detection

Our society increasingly relies on automation to detect, analyze, and interact with the physical and biological environment. In our quest to build simple and cost-effective machines ready for the complex world's challenges we have a lot to learn from social insects – animals with small and simple brains efficiently solving complex tasks and demonstrating impressive collective behavior. This project seeks to understand how social bees learn complex signals and make decisions based on ambiguous information and perception of context. This work can not only deepen our

understanding of animal cognition but become the first step to building bio-inspired machines with improved capabilities for perception, interpretation and decision making.

Student Skills/Requirements: Basic background in biology preferred, absolutely NO fear of insects or allergies to venom, pollen or other materials.

Project Title: (6b) Sustainable Monitoring of Toxicant Exposure in Bees by Non-Destructive Analytical Methods

The current project seeks to develop methods for non-destructive detection of toxicant residues and markers of toxic stress in live pollinators and to analyze behavioral and physiological effects of exposure by different routes to several ubiquitous but poorly studied toxicants: neonicotinoids, pyrethroids and perfluoroalkyl substances (PFAS) at field-realistic concentrations. The ultimate goal of this project is to deepen our understanding of toxic risks to pollinators and to develop a marketable technique that could be widely used for toxicant monitoring in commercial bee stocks and wild pollinator populations by agricultural professionals and conservationists.

Student Skills/Requirements: Basic background in biology and chemistry preferred, absolutely NO fear of insects or allergies to insect venom or pollen

Dr. Vijay Ramalingam

orlovam@sunypoly.edu
Chemistry
Associate Professor

Project Title: (7a) Sustainable Monitoring of Toxicant Exposure in Bees by Non-Destructive Analytical Methods

The decline in managed and wild pollinators over recent decades is a well-documented problem worldwideThis stems from lack of sustainable methods for toxicant monitoring and from the dearth of knowledge on the impact of specific routes of exposure to toxicants and their physiological and behavioral effects that fall short of acute poisoning. The current project seeks to address these gaps in our knowledge by developing and optimizing methods for non-destructive detection of toxicant residues

and markers of toxic stress in live pollinators and by comprehensively analyzing behavioral and physiological effects of exposure by different routes to several ubiquitous but poorly studied toxicants: neonicotinoids, pyrethroids and perfluoroalkyl substances (PFAS) at field-realistic concentrations.

Student Skills/Requirements: Chemistry course

Project Title: (7b) Exploring Photocatalytic C–H Functionalization and Dynamic Mechanically Interlocked Molecular Systems

Objective 1: Visible-Light Photocatalysis for C(sp^3)–H Bond Functionalization

Develop visible-light-activated transition-metal photocatalytic systems for the formation of new carbon–carbon and carbon–heteroatom bonds through C(sp^3)–H bond functionalization. The project will explore single-electron transfer (SET) pathways to activate otherwise inert C(sp^3)–H bonds under mild reaction conditions. Students will investigate photocatalyst design, reaction optimization, substrate scope, and mechanistic aspects of the catalytic process, with the goal of developing sustainable and efficient synthetic methodologies.

Objective 2: Synthesis and Dynamic Mechanical Behavior of Unsymmetrical Rotaxanes

Design and synthesize unsymmetrical rotaxane molecules and investigate their dynamic mechanical behavior. The project will focus on understanding the movement of macrocyclic components along threaded linear molecular axles and examining how molecular structure, noncovalent interactions, and recognition sites influence their mechanical motion. Students will gain experience in multistep organic synthesis, supramolecular chemistry, molecular characterization, and the investigation of mechanically interlocked molecular systems.

Student Skills/Requirements: Chemistry course

College of Engineering

Dr. Ahmed Abdelaal

abdelaal@sunypoly.edu
Engineering Technology
Assistant Professor

Project Title: (10) Development and Experimental Evaluation of a Smart Sensor-Based Anti-Icing System

This project focuses on the development and experimental evaluation of a smart sensor-based thermal anti-icing system designed to prevent ice accumulation while minimizing energy consumption. The system will integrate temperature and ice-detection sensors with an automated heating mechanism that activates only when icing conditions are detected. The student will participate in prototype design, sensor integration, control programming, and experimental testing to evaluate heating performance, ice prevention effectiveness, and energy efficiency. Students from Mechanical Engineering, Mechanical Engineering Technology, Electrical Engineering, or related fields are encouraged to apply. Basic knowledge of Arduino and Python programming is preferred, and experience with sensors, electronics, or heat transfer is beneficial but not required.

Student Skills/Requirements: Basic knowledge of Arduino and Python programming is preferred. Familiarity with sensors, electronics, heat transfer, and experimental testing is beneficial but not required. Students from Mechanical Engineering, Mechanical Engineering Technology, Electrical Engineering, or related fields are encouraged to apply.

Dr. Asif Ahmed

ahmeda3@sunypoly.edu
College of Engineering
Associate Professor

Project Title: (11) Climatic Vulnerability Assessment of New York Roads

In this project, we will be looking at the historical climatic data of New York state and determine the impact of it on the road network. The work includes analysis of historical climatic data, analysis of hazard assessment, using geospatial tools to determine mapping etc. The student needs to be familiar with python and javascript.

Student Skills/Requirements: Python, Javascript

Dr. Zahid Akhtar

akhtarz@sunypoly.edu
Electrical and Computer Engineering
Assistant Professor

Project Title: (12a) Exposing Digital Deception: Intelligent Deepfake Detection

The rapid advancement of generative AI has made it increasingly easy to create highly realistic fake images, videos, and audio. These deepfakes pose serious challenges to digital security, privacy, and the reliability of online information. This project aims to develop and evaluate AI-based techniques for detecting deepfake media, with a particular focus on identifying manipulated facial images and videos.

Student Skills/Requirements: Python

Project Title: (12b) Cybersecurity: Threat Detection and Digital System Protection

Cybersecurity is essential for protecting computers, networks, digital information, and online services from cyber threats. This project will explore current cybersecurity challenges and investigate techniques for identifying, analyzing, and preventing cyberattacks. Students will gain exposure to areas such as network security, malware analysis, intrusion detection, data privacy, and vulnerability assessment. Through hands-on experiments and practical exercises, students will explore cybersecurity tools and develop a better understanding of how digital systems can be protected against emerging threats.

Student Skills/Requirements: Basics of Computers, Basics of Cybersecurity

Dr. Tabiri Asumadu

asumadt@sunypoly.edu
Civil and Mechanical Engineering Dept
Assistant Professor

Project Title: (13a) AI-Assisted Cancer Biomarker Discovery Using Gene Expression and Histopathological Image Analysis

This work will focus on developing a comprehensive machine-learning database and predictive models using gene-expression data to identify key molecular features relevant to cancer detection and treatment. The study will also evaluate model predictions and analytical performance while providing hands-on laboratory experience in cancer drug delivery techniques. Additionally, the work will develop skills in scientific communication through the presentation of research findings to professional audiences.

Student Skills/Requirements: Machine Learning, Python and basic lab knowledge

Project Title: (13b) Evaluate bioactivity and tribological effect on surface engineered titanium alloys for biomedical implants

This work will focus on investigating the bioactivity of titanium alloys for biomedical implant applications, with an emphasis on understanding their potential to enhance osteointegration. It will also focus on evaluating the tribological properties of dental materials through hands-on wear and friction testing. The work will also provide opportunities to develop scientific communication skills by presenting research findings to professional audiences.

Student Skills/Requirements: Basic lab skills and knowledge in Biology

Project Title: (13c) Artificial Intelligence and the Future of Healthcare delivery: A Machine Learning–Based Assessment

This work aims to develop a comprehensive machine-learning database for healthcare delivery and apply machine-learning models to assess professional skills, competencies, and job-related tasks. The study will also validate model predictions and analytical findings using structured questionnaires to evaluate their accuracy and relevance. Additionally, the student will strengthen their scientific communication skills by presenting research findings to professional audiences.

Student Skills/Requirements: Machine Learning, Python and basic research skills

Project Title: (13d) Integration of Agentic AI in Advanced Manufacturing

This work aims to develop a comprehensive machine-learning database for healthcare delivery and apply machine-learning models to assess professional skills, competencies, and job-related tasks. The study will also validate model predictions and analytical findings using structured questionnaires to evaluate their accuracy and relevance. Additionally, the student will strengthen their scientific communication skills by presenting research findings to professional audiences. The student will strengthen their scientific communication skills by presenting research findings to professional audiences.

Student Skills/Requirements: Basic Machine Learning and Python

Project Title: (13e) Investigating friction and wear phenomenon on carbon coated Metallic surfaces

In this work the friction and wear properties of carbon coated metals are evaluated. It combines tribological test and materials characterization to investigate failure mechanisms of engineered surfaces. This is important to understand lubrication in mechanical systems and the design of next generation advanced materials. The student will also learn how to communicate their research findings to professional audiences.

Student Skills/Requirements: Basic lab skills, preferably Mechanical Engineering, Physics or Mechanical Engineering Technology backgrounds

Dr. Mahmoud Badr

badrm@sunypoly.edu
Cybersecurity
Assistant Professor

Project Title: (14a) Detecting and Mitigating Security Threats in Large Language Models

Large Language Models (LLMs) are increasingly integrated into real-world applications, raising important concerns about their security, reliability, and trustworthiness. This project aims to investigate emerging security threats targeting LLMs and explore innovative approaches to enhancing their security and resilience. Undergraduate researchers will gain hands-on experience working with open-source LLMs, conducting security experiments, and evaluating potential defense strategies. Through this research, students will develop practical skills in artificial intelligence, machine learning, cybersecurity, and experimental research while contributing to ongoing efforts to build more secure and trustworthy AI systems.

Student Skills/Requirements: Python

Dr. Abolfazl Karimpour

karimpa@sunypoly.edu

Civil and Mechcnical Engineering
Assistant Professor

Project Title: (15a) Development of an Interactive Educational Game for Traffic Safety Awareness

This project aims to develop an interactive, game-based learning platform to educate children and young road users about traffic safety. Students will design and develop engaging scenarios that demonstrate real-world safety challenges, such as bicycle and e-scooter safety, pedestrian interactions, and the effects of vehicle speed on stopping distance and crash risk. The game will allow users to make decisions, experience simulated traffic situations, and receive immediate feedback to reinforce safe behaviors. Students will explore game development, interactive visualization, and basic traffic safety principles while creating an educational tool that makes learning about road safety engaging and accessible. Basic programming skills and an interest in game design, simulation, or transportation safety are preferred. If successfully developed, the educational game will be presented to the Herkimer-Oneida Transportation Council (HOTC) and the New York State Department of Transportation (NYSDOT) for potential adoption and broader implementation in traffic safety education initiatives.

Student Skills/Requirements: Basic programming skills (e.g., Python, JavaScript, or C#) and familiarity with game development platforms such as Unity, Godot, or web-based tools is a plus but not required.

Project Title: (15b) LiDAR-Based Road User Detection and Safety Analysis

This project aims to develop a LiDAR-based traffic monitoring framework that uses 3D point-cloud data to identify and track road users, including vehicles, pedestrians, and cyclists. As part of the project, students will explore the deployment of a LiDAR sensor at a signalized intersection to collect real-world traffic data. Students will investigate point-cloud processing, object detection, tracking, and visualization techniques to transform raw LiDAR data into meaningful traffic information. The project will also examine how the movements and interactions of road users can be analyzed to identify potentially unsafe situations, such as close encounters, sudden braking, and near-miss events. Students will gain hands-on experience with LiDAR technology, Python programming, field data collection, and 3D data analysis while contributing to the development of intelligent traffic safety monitoring tools.

Student Skills/Requirements: Basic programming skills (preferably Python) and an interest in working with 3D point-cloud data, LiDAR technology, and real-world traffic datasets are preferred. Familiarity with data processing, computer vision, machine learning, or 3D visualization tools is beneficial but not required.

Dr. Xinrui Niu

niux@sunypoly.edu
Civil and Mechanical Engineering
Professor

Project Title: (16a) 3D-printing of Tough Bi-polymer Interphases for Soft Robotic Hands

Soft robotic hands (SRHs) are important tools for industries such as semiconductors, agriculture, healthcare, medicine, and so on. To provide non-destructive yet firm gripping, many SRHs are made by multilayers of polymers controlled by air pressure. Mimicking human fingers, they usually consist of a soft yet rigid enough core as a supporting skeleton and at least one ultra-soft skin outer layer that gently contact the object to be touched and/or gripped. Under large working deformation, though soft core and ultra-soft skin both stay intact, their interface often fails due to poor interfacial toughness, which, subsequently, leads to air leakage and malfunction of SRHs.

This project is to fabricate tough bi-polymer interphases for SRH with a 3D-printing facilitated manufacturing method invented by Niu's. The integration of different polymer materials requires modifying the 3D-printing method in Niu's work or inventing a new 3D-printing method. To conduct this project, researchers are expected to search for an effective 3D-printing method to integrate two different types of polymers, build a manufacturing platform for 3D-knotted bi-polymer hybrids, measure interfacial toughness of the hybrids through mechanical testing, and investigate failure mechanisms with mechanics of materials knowledge and state-of-the-art material characterization tools.

Student Skills/Requirements: Mechanical Engineering/Civil Engineering/Mechanical Engineering Technology/Civil Engineering Technology students with experience in 3D

printing, engineering drawing, mechanical testing and with a minimum grade of B in ESC 230 Mechanics of Materials and an overall CGPA not less than 3.0

Dr. Xinrui Niu and Dr. Fan Liu

Dr. Xinrui Niu
niux@sunypoly.edu
Civil and Mechanical Engineering
Professor

Dr. Fan Liu
liuf1@sunypoly.edu
Civil and Mechanical Engineering
Research Assistant Professor

Project Title: (16b) Nature-inspired Design of Tough and Durable Polymer-based Dental Restorative Composites

Polymer-based dental restorative composites (DRCs) are important materials to restore/improve people's oral health. Yet, due to medical and safety restrictions, durability and toughness of modern DRC are far from excellent. This project is to develop a tough and durable DRC by altering DRC's materials distribution instead of composition.

Student Skills/Requirements: A grade B or above for Mechanics of Materials; Experience in 3D-printing, polymer fabrication, mechanical testing; Experience in scanning electron microscope (SEM) and/or atomic force microscope (AFM) is a plus.

Dr. Aarthi Sekaran

sekaraa@sunypoly.edu
College of Engineering
Assistant Professor

Project Title: (17a) Computational Investigation of Convective Boundary Mixing in Stellar Astrophysics

Convection and turbulent mixing play a critical role in stellar evolution, influencing the transport of heat and chemical elements within stars and ultimately affecting their evolution and supernova explosions. However, accurately predicting mixing across the boundaries between convective and stable regions remains a significant challenge in astrophysics.

This undergraduate research project will investigate the fundamental fluid dynamics of convective boundary mixing (CBM) using computational simulations. The student will use ANSYS Fluent to model buoyancy-driven convection, the development of flow instabilities, and the interaction of convective plumes with stably stratified fluid layers. The work will contribute to a broader interdisciplinary research effort aimed at improving our understanding of turbulent mixing in stellar interiors.

Student Skills/Requirements: Undergraduate students in Mechanical Engineering, Physics, Applied Mathematics, or related disciplines are encouraged to apply. A basic understanding of fluid mechanics and heat transfer is desirable. Prior experience with CFD, ANSYS Fluent, or scientific programming is beneficial but not required. The project provides hands-on experience in numerical simulation, computational research, scientific visualization, and interdisciplinary applications of fluid mechanics.

Dr. Priyangshu Sen

senp@sunypoly.edu
Engineering
Assistant Professor

Project Title: (18a) Measurement of the near and far-field channel profiles for rough surfaces, such as outdoor vegetation, to understand the channel propagation characteristics

The terahertz (THz) band wireless system is an essential technology that maximizes the potential of joint communication and sensing systems. In agricultural field scenarios, this technology can facilitate communication between machine-to-machine devices,

and the same waveform can be utilized to monitor vegetation growth. Accurate channel information is vital at THz frequencies, as channel characteristics can change dramatically with even slight environmental variations. In this project, undergraduate students will work under the supervision of a professor to measure and characterize the properties of the THz band channel. They will estimate metrics by considering the reflection properties of signals interacting with rough surfaces similar to those found in vegetated environments.

Student Skills/Requirements: Second, third or higher year ECE student with prior experience in MATLAB, familiarity with the software-defined radio technology

Project Title: (18b) Optimizing the next-generation single-carrier waveform design for terahertz and mmWave ISAC applications

Research for Credit

Upper mmWave and Terahertz (THz) band communication is considered a crucial technology for next-generation communication systems (6G and beyond), as it addresses the issue of limited bandwidth and enhances data rates. However, utilizing high-frequency bands presents challenges such as significant path loss, small wavelengths, and the limitations of existing device technologies. To establish reliable communication and facilitate the development of next-generation systems, innovative solutions for both the physical and medium access control layers are essential. Current research places great emphasis on developing a new waveform capable of functioning effectively at THz and mmWave frequencies, thereby ensuring a reliable communication link. In this project, the undergraduate student will focus on designing and optimizing next generation single-carrier waveforms using Amplitude Phase Shift Keying (APSK) under the supervision of the professor.

Student Skills/Requirements: Second, third or higher year ECE student with prior experience in MATLAB, familiarity with the software-defined radio technology

Dr. Jiayue Shen

shenj@sunypoly.edu
Engineering
Associate Professor

Project Title: (19a) EMG-Triggered Soft Pneumatic Knee Exoskeleton

This project involves developing a low-cost, wearable soft pneumatic exoskeleton designed to assist individuals with lower limb mobility impairments. Students will design a 3D-printed rigid backing and integrate a pneumatic circuit controlled by an Arduino microcontroller to inflate an assistive airbag based on the user's muscle electromyography (EMG) signals. The primary goal is to assemble a functional physical prototype and conduct benchtop mechanical testing to quantify the device's assistive output force and system latency. Required skills include basic SolidWorks (CAD), 3D printing experience, and fundamental Arduino programming, though highly motivated students eager to learn these hands-on mechatronics skills are strongly encouraged to apply.(Suggested Figure to email Shing Chi Leung: A CAD rendering of the 3D-printed leg bracket or a block diagram of the EMG pneumatic control circuit.)

Student Skills/Requirements: Basic proficiency in SolidWorks (CAD) and hands-on experience with 3D printing are required. Familiarity with Arduino programming and basic electronic circuits is highly desirable.

Project Title: (19b) EMG-AI Multi-Modal Assistive Retrieval Robot

This robotics project merges wearable bio-signal sensing with edge-AI computer vision to create an autonomous object-retrieval robotic system for users with limited mobility. The research team will integrate a user-triggered EMG wearable sensor with a low-code smart vision camera and an omnidirectional robotic chassis equipped with a micro-manipulator arm. Students will assemble the hardware and conduct standardized human-robot interaction (HRI) testing to evaluate the robot's target-retrieval success rate and response time under various environmental conditions.

Student Skills/Requirements: Proficiency in basic Python and Arduino programming is required. Students should have a strong interest in hardware-software integration. Prior

exposure to computer vision tools (e.g., OpenCV, HuskyLens) or introductory mechatronics is a strong plus.

Project Title: (19c) Capillary Flow in Micro-Architected Liquid Metal TIMs

This project explores next-generation thermal management solutions for high-performance semiconductor packaging by investigating liquid metal containment within 3D micro-architected elastomeric shells. Students will utilize 2D CAD modeling to design and construct macro-scale physical channel models to experimentally observe how different geometric pore shapes influence the capillary flow and retention of conductive fluids during simulated thermal expansion. The empirical data collected from these physical flow experiments will directly support and validate computational fluid dynamics (CFD) two-phase flow models.

Student Skills/Requirements: A strong foundation in 3D solid modeling (e.g., SolidWorks) is required to design the physical testing channels. Prior coursework in Fluid Mechanics or Heat Transfer is a plus, but not strictly required. Applicants do not need prior simulation experience; however, they must be highly motivated to conduct hands-on physical experiments and possess a strong willingness to learn basic fluid simulation tools (such as ANSYS) during the project.

Dr. Arjun Singh

singha8@sunypoly.edu
ECE Engineering
Assistant Professor

Project Title: (20a) THz Wireless Near-field

The students will work on developing their skills in SDR and wireless with effort dedicated to experimental characterization of high frequency wireless systems in the radiating near-field.

Student Skills/Requirements: MATLAB

Dr. M. Jasim Uddin

uddinm3@sunypoly.edu
Civil and Mechanical Engineering
Professor

Project Title: (21a) Advanced functional materials for green energy generation

Advanced functional materials play a critical role in enabling sustainable and efficient green energy generation through innovative material design, engineering, and functionalization. Our research focuses on developing high-performance piezoelectric, triboelectric, , photovoltaic, and multifunctional nanomaterials for harvesting renewable energy from mechanical, solar, and environmental sources. These advanced materials offer promising pathways toward self-powered devices, sustainable energy systems, reduced environmental impact, and next-generation energy technologies. We accept any science and engineering UG students.

Student Skills/Requirements: We accept any science and engineering UG students.

Dr. Joseph Wasswa

wasswaj@sunypoly.edu
Civil and Mechanical Engineering
Assistant Professor

Project Title: (22a) PhotoGraphRAG: A Graph-Enhanced Retrieval-Augmented Generation Framework for Mechanistic Intelligence in DOM Photochemistry

This study will develop PhotoGraphRAG, a domain specific GraphRAG framework for mechanistic knowledge synthesis and question answering in aquatic photochemistry. Specifically, this work aims to: (1) build a large-scale DOM photochemistry knowledge graph that draws on more than 1,100 literature sources to integrate ROS formation pathways, DOM optical and compositional properties, pollutant classes, water matrix conditions, and underlying photochemical mechanisms; (2) evaluate whether graph-enhanced retrieval meaningfully improves how well the system answers mechanistic environmental chemistry questions compared to vector-based and no-retrieval baselines, including ablation experiments to isolate the contribution of individual components; (3) combine literature-grounded retrieval with established QSPR

models to support prediction of ROS quantum yields and second-order reaction rate constants; and (4) make the resulting framework openly accessible as a practical intelligence platform for environmental photochemistry research.

Student Skills/Requirements: Python, LLM, Angetic AI

Project Title: (22b) Interpretable Machine Learning and High Resolution Mass Spectrometry for Characterizing Halogenated Organic Compounds

The overarching goal of this project will be to determine whether chemically meaningful information embedded in mass spectra from the high resolution mass spectrometry (MS1, and MS2) can be integrated to enable reliable halogen organic compound detection (HOC), halogen class assignment, and motif level characterization. The project will have two objectives: (1) assemble and standardize an MS1/MS2 reference spectral database and develop a two-stage interpretable machine learning (ML) framework for HOC detection, halogen class assignment, and motif level annotation; and (2) evaluate the transferability and analytical limits of this framework using independently generated HOCs from controlled laboratory experiments and field collected environmental samples. The project will integrate curated reference spectra, chemically interpretable MS1 and MS2 features, chemical similarity aware model development, calibrated probabilities, applicability domain analysis, and environmental validation.

Student Skills/Requirements: Python, Machine learning, Chemistry

College of Health Sciences

Dr. Hadar Hazan

hazanh@sunypoly.edu
Psychology
Assistant Professor

Project Title: (30a) Mapping Representations of Psychosis in Social Media Videos Using Machine Learning

How is psychosis represented on social media, whose narratives dominate, and which representations attract the greatest audience engagement? This interdisciplinary project will use machine learning and large-scale computational analysis to examine short-form videos from platforms such as TikTok, YouTube Shorts, and Instagram Reels. Moving beyond previous research focused primarily on information accuracy and stigma, the study will investigate competing representations of psychosis, including medical explanations, lived experiences, personal identity, treatment, and recovery. Undergraduate researchers will develop a dataset, implement computational methods to identify recurring narratives, and validate their findings against human evaluations of selected videos. The study will examine how representations differ across content creators and platforms and how they relate to audience engagement. Students will gain experience conducting interdisciplinary research, with the goal of producing findings suitable for presentation at the Schizophrenia International Research Society (SIRS) and publication in a peer-reviewed journal.

Student Skills/Requirements: Students majoring in Computer Science, Data Science, Artificial Intelligence, Psychology, or related disciplines are encouraged to apply. Experience with Python programming and data analysis is required for students undertaking computational tasks; familiarity with machine learning, natural language processing, or large datasets is strongly preferred. Students will be responsible for developing and implementing the computational methods, organizing and analyzing the data, and evaluating the results under faculty supervision. Psychology students may contribute to developing the coding framework and interpreting the representations of psychosis. Strong independent research skills, attention to detail, and an interest in interdisciplinary collaboration are essential.