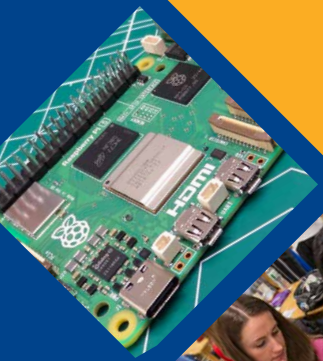
NEW YORK INSTITUTE OF TECHNOLOGY

College of Engineering
& Computing Sciences

nyit.edu/engineering

Research Labs



Do.
Make.
Innovate.
Reinvent the Future.

Message from the Dean

Long Island Campus:
Harry Schure Hall, Room 112

New York City Campus:
1855 Broadway, Room 805B

babak.beheshti@nyit.edu

516.686.7931

nyit.edu/bio/babak.beheshti

PROGRESS AND IMPACT – these principles continue to define the mission of the College of Engineering and Computing Sciences (CoECS) at New York Tech. Since our founding in 1955, we have not only evolved alongside a rapidly changing world but also helped shape it. Today, our focus extends beyond progress alone to measurable impact: advancing knowledge, transforming industries, and improving lives through innovation.

At CoECS, research has become deeply interdisciplinary, fueled by emerging fields such as artificial intelligence, data science, cybersecurity, sustainable infrastructure, and biomedical technologies. Our faculty and students collaborate across domains and with industry, government, and national laboratories to address society's most pressing challenges. From federally funded initiatives to industry partnerships and entrepreneurial ventures, our research ecosystem is both dynamic and outward-facing.

Our laboratories serve as engines of discovery and translation, spaces where ideas move from concept to application. Whether developing intelligent systems, resilient infrastructure, or next-generation materials, our researchers are pushing boundaries and redefining what is possible. Equally important, they are preparing the next generation of engineers and computing professionals to lead in an AI-driven, globally connected world.

This booklet showcases the breadth and depth of research at CoECS in 2026, from cutting-edge projects and collaborative initiatives to the faculty and students who bring them to life. I am immensely proud of our community of innovators, our doers, makers, and problem-solvers, whose work reflects not only technical excellence but a commitment to societal good. It is a privilege to lead a college where innovation is purposeful and where progress is measured by the impact we create together.

Sincerely,

Babak D. Beheshti, Ph.D.
Dean, College of Engineering and Computing Sciences
New York Institute of Technology

Contents

07 BIOMEDICAL ENGINEERING
- Biological Sciences and Bioengineering (BSB) Laboratory
- Bio-Nanotechnology and Biomaterials (BNB) Laboratory
- Integrated Medical Systems (IMS) Laboratory
- Tissue Engineering and Advanced Materials (TEAM) Laboratory
- Tissue and Immunoengineering Laboratory

10 ELECTRICAL & COMPUTER ENGINEERING
- Applied Electromagnetics Research Laboratory
- Biomedical Data Analysis Research Laboratory
- Circuits, Networks, and Systems (CNS) Laboratory
- Intelligent Sensing and Communications (ISCOM) Laboratory
- Network and Innovation Laboratory
- Network Resource and Security (NRSL) Laboratory
- Spectral Pathology Laboratory

18 MECHANICAL ENGINEERING
- Computational Mechanics and Biomechanics (CMBL) Laboratory
- Human-Robot Information (HRI) Laboratory
- Mechanics, Dynamics, and Control for Complexity (MDCC) Laboratory
- MicroSensor Laboratory
- Optical Diagnostics Laboratory
- Thermo-Fluid and Instrumentation Research Laboratory

24 ENERGY MANAGEMENT
- Energy and Green Technologies (EnTech) Laboratory

25 COMPUTER SCIENCE
- Artificial Intelligence, Data Mining, and High-Performance Computing Laboratory
- Human-Centric Data Analytics Laboratory
- Intelligent Mobile Edge (IME) Laboratory
- Laboratory for Behavioral Authentication, Machine Learning, and Privacy (LAMP)
- Medical Informatics and Data Analytics Laboratory
- Mobile Systems and Network Security (MobiSec) Laboratory

32 ENTREPRENEURSHIP & TECHNOLOGY INNOVATION CENTER (ETIC)
- Center of Academic Excellence in Cyber Defense Education
- Long Island Innovation Hotspot
- New York State Designated Business Incubator
- Prototyping Center
- Student Opportunities

CoECS Departments and Chairs

CoECS offers high-quality undergraduate and graduate programs that equip students for advanced studies and demanding roles in business, government, and industry.

Lak Amara, M.S.
Associate Professor
Dept. Chair, Electrical and Computer Engineering Technology

Manhattan Campus, EGGC 812
lamara@nyit.edu
(212) 261-1644

"The ENTECH Lab uses sophisticated methods to improve the performance of buildings. Kamel provides expert guidance to students who analyze real facilities and apply state-of-the-art technologies."

– Dr. Robert Amundsen

Robert Amundsen, Ph.D.
Associate Professor
Director, Energy Management

Long Island Campus, HSH 224A
ramundse@nyit.edu
(516) 686-7578

"The faculty in our department are committed to advancing innovation, educating the next generation of scientists and engineers, fostering collaboration, and pioneering transformative research at the crossroads of engineering and biology."

– Dr. Azhar Ilyas

Azhar Ilyas, Ph.D.
Associate Professor
Dept. Chair, Electrical and Computer Engineering, Bioengineering

Long Island Campus
HSH 217
ailyas@nyit.edu
(516) 686-7455

Degree Program Departments

Artificial Intelligence
Civil Engineering
Computer Science
Construction Engineering
Electrical and Computer Engineering
Electrical and Computer Engineering Technology
Energy Management
Mechanical Engineering

Our department's success is a testament to the dedication and collaborative spirit of our team. Your unwavering commitment has significantly enhanced our reputation and impact."

– Dr. Frank Lee

Frank Lee, Ph.D.
Associate Professor
Dept. Chair, Computer Science, Cybersecurity, Data Science, IT

Long Island Campus, HSH 218
fli@nyit.edu
(516) 686-7456

I am very pleased to witness excellent effort and accomplishment by our faculty. Your work greatly enhances the overall quality of our programs."

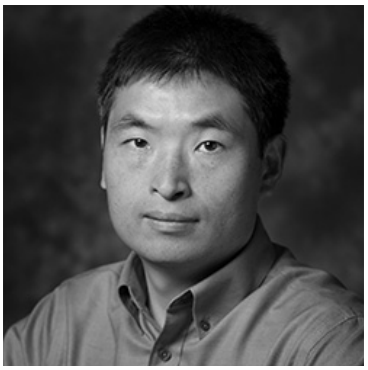
– Dr. Yoshi Saito

Yoshi Saito, Ph.D.
Associate Professor
Dept. Chair, Computer Science, Cybersecurity, Data Science, Electrical and Computer Engineering, IT, Bioengineering

Manhattan Campus, EGGC 806
ysaito@nyit.edu
(212) 261-1650

The faculty members at the Department of Mechanical Engineering are conducting cutting-edge research in a wide range of areas, including sensors, biomechanics, thermal, fluids, dynamic and complex systems. Their researches are sponsored by federal agencies such as NSF, NIH, NASA, and US Army."

– Dr. Xun Yu



Xun Yu, Ph.D.
Professor
Dept. Chair, Mechanical Engineering. Engineering Management, Construction Engineering, General Engineering, Civil Engineering

Long Island Campus, HSH 115
xyu13@nyit.edu
(516) 686-7829

Each department is managed by a faculty member serving as the Department Chair, ensuring outstanding leadership, direction, and advisement to faculty and students.

Biological Sciences and Bioengineering (BSB) Laboratory

The BSB laboratory is a living lab where our faculty train students while pursuing important interdisciplinary research that integrates engineering and biology. This integration offers tremendous opportunities for solving important problems in health sciences and medicine and enables a broad range of applications in diagnostics, sensing, therapeutics, and tissue engineering.

Long Island Campus,
Theobald Science Center

AREAS OF INTEREST

Disease Diagnostics and Structural Biomaterials for Bone Regeneration
Led by Azhar Ilyas, Ph.D.
Associate Professor,
College of Engineering & Computing Sciences

Bacteriophages and Viruses' Therapeutic Effect to Treat Bacterial Infections
Led by Bryan Gibb, Ph.D.
Associate Professor,
College of Arts & Sciences

Synthetic Biology Approaches: How Nervous Systems Encode Behaviors
Led by Navin Pokala, Ph.D.
Associate Professor,
College of Arts & Sciences

Fate Analysis of Emerging Contaminants in Water and Soil
Led by David Nadler, Ph.D.
Teaching Assistant Professor,
College of Engineering & Computing Sciences

Bio-Nanotechnology and Biomaterials (BNB) Laboratory

The BNB laboratory specializes in applying micro- and nano-scale techniques to solve problems in medicine. Researchers focus on the general areas of biomedical engineering, nanoscience, and nanotechnology, particularly on two major themes: point-of-care disease diagnostics and structural biomaterials for bone-implant systems.

Azhar Ilyas, Ph.D.
Lab Director

Long Island Campus,
HSH 217

ailyas@nyit.edu

nyit.edu/bio/ailyas

AREAS OF INTEREST

Microfabrication and 3-D printing

Microfluidics and Cell Sorting

Electrophysical Analysis of Diseased Cells

Bioactive Coatings and Bioinks

Biomaterials and Tissue Engineering

ACTIVE PROJECTS

Microfluidic Devices for Tagless Identification/Quantification of Diseased Cells

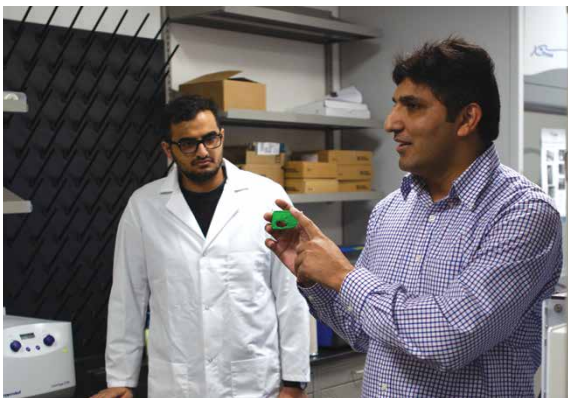
An accurate, quick, and inexpensive enumeration of blood cells, including lymphocytes, is critical for early diagnosis of various physiological disorders and has been the subject of much attention. Nanotechnology empowers us with tools to investigate fatal diseases like cancer and HIV at cellular/molecular scales. Several approaches have been used for cell sorting and identification, but most of these are limited by low throughput, need for fluorescent tags, or lack of quantitative analysis on single-cell level. Early-stage detection and precise enumeration of cells is crucial for efficient therapeutics and improved survival rate of cancer/HIV patients. There is a great clinical need to develop new inexpensive and portable point-of-care (POC) devices for early-stage diagnosis of these fatal diseases. We are developing a novel, low-cost, stabilized (refrigeration-free storage) microfluidic-based cell monitoring tool for rapid and accurate quantification from unprocessed whole blood at POC settings.

Nanofabricated and 3-D Printed Materials for Rapid Bone Healing

Traumatic fractures, age-related fragility, and disorders cause structurally unstable fracture sites, which require metal fixative devices for mechanical support. Titanium (Ti) is the most widely used material for fixative devices, but Ti is bioinert and doesn't promote osteogenesis. Bioactive glass coatings onto Ti implants show promising results by incorporating osteoinductive properties, but macroscale fabrication techniques cause inhomogeneity in the coatings and have thermal expansion mismatch with the underlying Ti, leading to delamination and instability of the coatings. 3-D printing is an additive manufacturing technique that allows fabrication of modular and patient-specific scaffolds with high structural complexity and design flexibility. The major drawback that limits the widespread acceptance of 3-D printing in biomanufacturing is the lack of diversity in "biomaterial inks." We are developing novel composite bioinks to fabricate a new class of fully degradable 3-D-printed scaffolds that can degrade at a desired rate. These 3-D-printed structural biomaterials are tested for their biomechanical properties to understand the role of surfacemorphology and chemistry in cellular attachment, surface bioactivity, and gene expressions for rapid fracture healing.

Development of Highly Sensitive Novel Biosensors for Molecular Detection

Nano-biosensors are low-cost, fast, and easy to use, and have multiple applications, including health, food, and environmental changes. They are small-scale transducers that detect the chemical specificity and sensitivity of a system using biological agents. The advent of nanotechnology permitted the development of improved, micro- and nano-scale biosensors, allowing scientists and engineers to monitor the biological and chemical interactions on the sensor surface. Nanoscale biosensors provide more accurate and sensitive measurements of biomolecules/viruses. We are developing nanofabricated, ready-to-use microchips to sense and characterize important biomarkers for various diseases, including cancer and HIV.



Integrated Medical Systems (IMS) Laboratory

The IMS Lab conducts research in Biomedical Engineering, encompassing areas such as biological system modeling and the development of wireless platforms for acquiring and processing biological signals. The lab aims to advance the next generation of implantable and wearable medical devices through innovative research.

Aydin Farajidavar, Ph.D.
Lab Director

Long Island Campus,
HSH 222

afarajid@nyit.edu

nyit.edu/bio/afarajid

AREAS OF INTEREST

Implantable/Wearable Medical Devices

Assistive Technologies

Biological Signal Processing

Modeling Biological Phenomena

Medical Cyber Physical Systems

ACTIVE PROJECTS

Smart Health and Biomedical Research (SCH): CyberGut: Cyber-Physical System for Closed-Loop Control of Gastric Motility

(Sub-award with University of Maryland, Baltimore County)

This project, funded by National Institute of Health (NIH), aims at advancing knowledge and optimizing health treatments in gastric disorders (and more broadly in different organ systems) by developing novel wireless implantable technologies for adaptive, closed-loop recording and stimulation. It overcomes invasiveness of bulky implants, lack of objective patient-in-the-loop feedback in open-loop operation, absence of an interactive model between patient and device for informed therapy decisions, and lack of adaptive intelligent algorithms. This project will develop an intelligent adaptive closed-loop system (CyberGut) that identifies and delivers optimized stimulation for restoring normal gastric motility.

Reliable Power-Efficient Miniature Bidirectional Telemetric Platforms for Acquiring Biological Signals

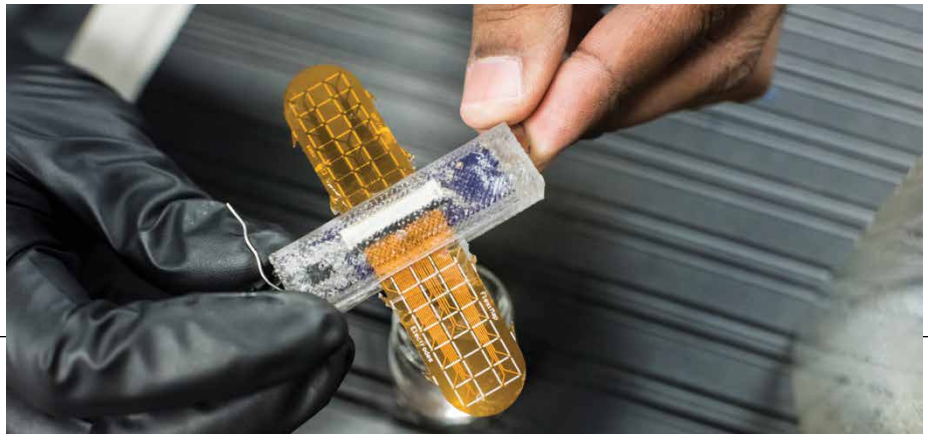
The need for implantable/wearable devices for the wireless acquisition of biological signals is emerging in various medical fields. Electrophysiological applications include: in-vivo recording of gastric electrical activity (GEA) to study dysmotility, single-unit action potentials (APs); electrocorticograms (ECoG) to study neuronal activities; and transcranial motor-evoked potentials (TcMEP) for intraoperative neurophysiological monitoring of spinal cord integrity. They require physically miniaturized devices with low power consumption and the capability of implantation. These systems should provide reliable communication in real time with sufficient data rates.

Closed-Loop System for Real-Time Recognition and Inhibition of Nociceptive Signals

Clinical studies have shown that spinal or cerebral neurostimulation can significantly relieve pain. Current neurostimulators work in an open loop, and thus their efficacy depends on the patient's or physician's comprehension of pain. We are developing a real-time automatic recognition algorithm to detect action potentials and cluster various neuronal activity levels.

Signal Processing for Analyzing APs and ECoG to Detect Nociception

The recent development of neural interfaces has enabled the extraction of a huge amount of information from the nervous system. However, understanding the message of the nervous system requires adequate signal processing. We are conducting signal acquisition (APs and ECoG) and analysis (real-time and off-line) from the nervous system (spinal cord and brain) to better understand and distinguish between various states of mind and pain circumstances.



Tissue Engineering & Advanced Materials (TEAM) Laboratory

The lab develops innovative biomaterials and technologies for tissue regeneration and translational medicine. It combines 3D bioprinting, electrospinning, and advanced fabrication with 2D/3D cancer models, bioreactors, and laser therapies to create functional tissues and advance medical devices toward clinical use.

Karrer Alghazali, Ph.D.
Lab Director

New York City Campus,
EGGC, 801A

kalghaza@nyit.edu

nyit.edu/bio/karrer-alghazali/

AREAS OF INTEREST

Tissue Regeneration and advance Biomaterials

Medical device development and transitional medicine

2D and 3D cancer modeling

Electrospinning, 3D printing, solvent-based fabrication, and 3D bioprinting

Bioreactors & Dynamic Culture

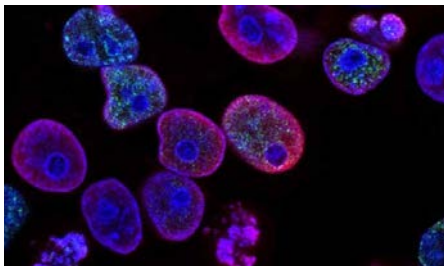
Laser Therapy for Enhanced Tissue Regeneration

ACTIVE PROJECTS

Biodegradable multi-structural fiber optic-3D scaffold as regenerative tool

Volumetric muscle loss (VML) is a debilitating condition caused by injury or disease, resulting in costs amounting to billions annually in the U.S. It poses a significant challenge within regenerative medicine. Muscle tissue has a limited regenerative capacity and typically fails to recover when more than 20% of its mass is lost. This project proposes the development of a Biodegradable multi-structural fiber optic-3D scaffold a novel platform designed to support tissue regeneration and enhance the healing process. We will aim to mimic the muscle's extracellular matrix (ECM), providing a structural framework that facilitates tissue repair. Additionally, the will aim to incorporate a localized laser therapy (LLLT) delivery system to stimulate cellular activity and accelerate muscle regeneration. By combining structural support with therapeutic enhancement, this project represents a groundbreaking approach to promoting efficient and effective healing.

Engineered extracellular matrix as 2D and 3D as tolls for drug discovery research and personalized regenerative medicine



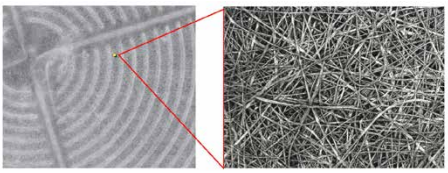
With the shift toward advanced in vitro modeling for drug discovery research and personalized regenerative medicine, our work seeks to develop next generation 2D and 3D platforms that more accurately replicate the structural, biochemical, and mechanical complexity of native tissues. These models aim to provide physiologically relevant systems for studying cell–matrix interactions, disease progression, and therapeutic response, while reducing reliance on animal testing. Ultimately, they serve as a bridge between basic research and translational applications, accelerating the discovery of effective therapies and enabling patient-specific regenerative strategies.

Advance Educational Opportunity Focus

In addition to research opportunities, Dr Alghazali is a director for new Certificate Program initiative (FDA and Medical Device Development Certificate Program), this aligns with our translational focus, bridging fundamental bioengineering with regulatory science and clinical pathways for medical device development. The following courses will be offer part of this Certificate Program initiative

- Design Controls Principles and Implementation
- FDA Submission & Regulatory Interaction for Medical Devices
- Quality Management Systems for Medical Devices

3D Mesh Design and Development for Targeted Wound Healing



Tissue and Immunoengineering Laboratory

The lab operates at the crucial intersection of immunotherapy and bioengineering, investigating the role of inflammatory factors in cancer and chronic wounds. Utilizing advanced techniques, the lab aims to enhance immunotherapy effectiveness by targeting key inflammatory pathways. It also emphasizes developing gender-specific therapies to address differences in immune responses between males and females, promoting personalized medicine to optimize treatment outcomes.

Steven Zanganeh, Ph.D.
Lab Director

Long Island Campus,
HSH, 226B

stevenz@nyit.edu

nyit.edu/bio/steven-zanganeh/

AREAS OF INTEREST

Gender-specific Immunoengineering

Cancer Immunotherapy

Tissue Engineering

ACTIVE PROJECTS

Unveiling Ferroptosis in Cancer: Implications for Immune Landscape and Therapy

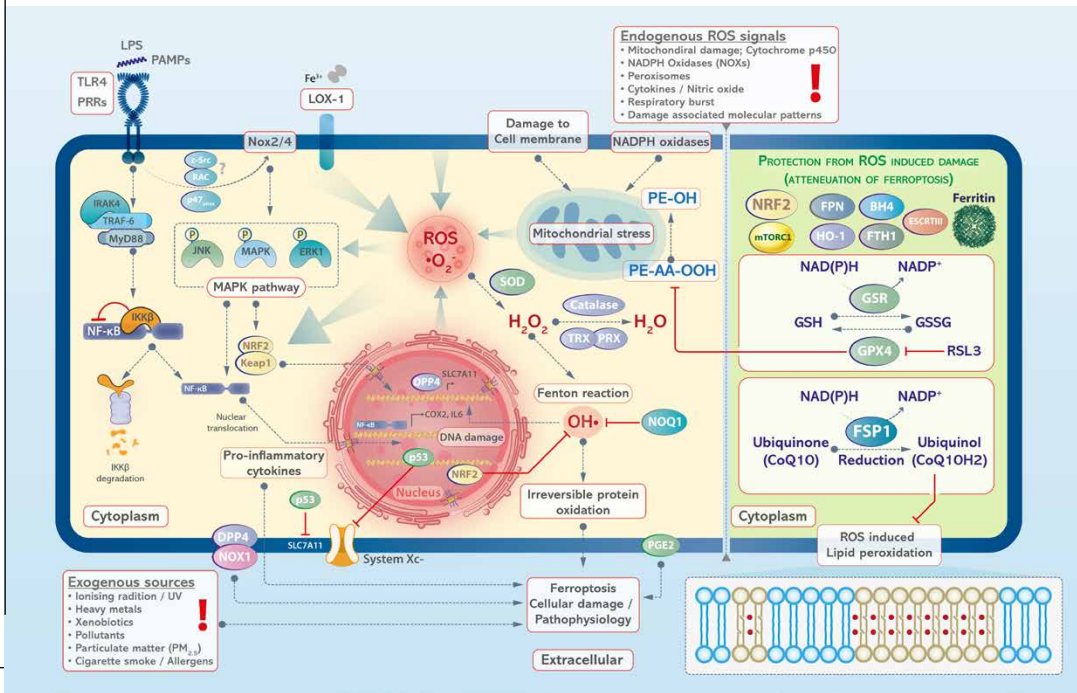
Ferroptosis is a form of programmed cell death distinct from apoptosis and necrosis, characterized by the iron-dependent accumulation of lipid peroxides. Its emerging role in cancer therapy is profound, as it influences the immune landscape of tumors, potentially enhancing the effectiveness of immunotherapies. The lab's research focuses on understanding the mechanisms through which ferroptosis can be induced in cancerous cells, aiming to disrupt tumor growth and improve patient outcomes by modulating the immune system's response to the tumor environment.

Gender-Specific Immunoengineering in Cancer Therapy

The immune system's response to cancer therapy often exhibits significant differences between males and females, influenced by the modulation of inflammatory factors within tumors. This project explores these sex-specific variations to develop targeted therapies that address the unique immune landscapes in male and female patients. By understanding these differences, the lab seeks to optimize immunotherapeutic strategies that improve treatment efficacy and patient survival rates.

Engineering Immune-Modulating Wound Patches

The fabrication of wound healing patches that modulate the immune system's response represents a frontier in medical treatment for chronic and non-healing wounds. These patches are designed to deliver targeted therapies that adjust immune activity directly at the wound site, promoting a healing environment conducive to rapid recovery and reduced scarring. This project focuses on creating bioengineered solutions that harness the body's innate healing mechanisms through precise immune modulation.



Applied Electromagnetics Research Laboratory

This laboratory conducts research on various applications of electromagnetic waves.

Reza K. Amineh, Ph.D.
Lab Director

New York City Campus,
EGGC, 801A

rkhalaja@nyit.edu

nyit.edu/bio/rkhalaja

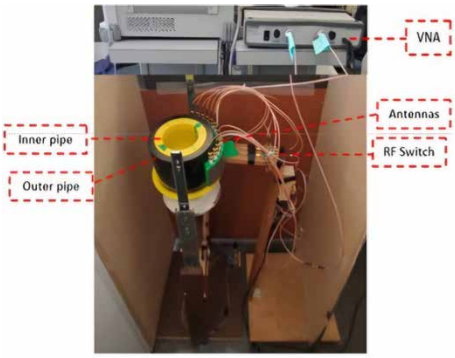
AREAS OF INTEREST

- Biomedical Imaging
- Nondestructive Testing of Materials
- Water/Soil Quality Sensing
- RF/Microwave Circuit Design
- Wireless Power Transfer
- Security Screening
- Wireless Communications
- Underground Imaging
- RF/Microwave Component Design

ACTIVE PROJECTS

Fast and Robust Nondestructive Testing of Cylindrical Composite Components Based on Microwave Measurements (supported by NSF)

This project utilizes microwave measurements and innovative holographic image reconstruction techniques to generate volumetric images of the interiors of cylindrical nonmetallic objects. These techniques are primarily applied in nondestructive testing (NDT) of nonmetallic pipes, as well as in biomedical imaging and security screening.



Human Motion Tracking With Inductive Sensors (supported by NSF)

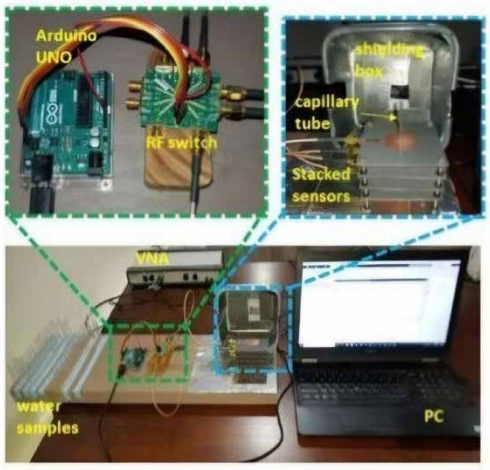
This project aims to develop various inductive sensing systems that can provide high-precision gesture recognition of the hand, elbow, and shoulder along with machine learning algorithms. This will assist in measuring motor skill performance, particularly in individuals with autism spectrum disorder and Parkinson's disease.

Autonomous Soil Nutrient Sensing System (supported by NSF)

This project, in collaboration with the faculty in Mechanical Engineering, aims to develop wireless sensing system to detect pollutant such as nitrate, phosphate, and heavy metals in the agricultural soil.

Material Characterization With a Microwave Sensor Array: Application to Water Quality Sensing (supported by NSF)

This project aims to design, fabricate, and test highly sensitive microwave sensor arrays for material characterization; in particular, for water quality testing. The fabricated sensors are tested with a set of water samples with pollutants including: nitrate (NO3); phosphate (PO4); ammonium (NH4); chromium (Cr+6); lead (Pb); and mercury (Hg).



Biomedical Data Analysis Research Laboratory

This laboratory performs research on signal processing, machine learning, and brain-computer interface systems to aid individuals with severe motor disabilities and mental/neurological disorders.

Maryam Ravan, Ph.D.
Lab Director

New York Campus,
EGGC, 605A

mravan@nyit.edu

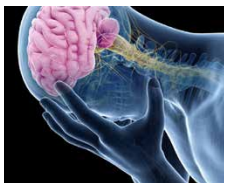
nyit.edu/bio/mravan

AREAS OF INTEREST

- Epilepsy
- Schizophrenia
- Major Depression Disorder
- Autism Spectrum Disorder
- Bipolar Disorder
- Amyotrophic Lateral Sclerosis
- Stroke
- Cerebral Palsy
- Spinal Cord Injury

ACTIVE PROJECTS

Developing Deep Learning Algorithms to Diagnose Subtypes of Depression



This project, in collaboration with the Department of Psychiatry and Behavioral Neuroscience, McMaster University, explores a novel deep learning algorithm (DLA) based on effective connectivity between brain regions that are extracted from resting electroencephalography (EEG) data to diagnose different subtypes of depression including major depressive disorder, depressive episode of bipolar disorder, manic episode of bipolar disorder, atypical disorder, and psychotic disorder as well as schizophrenia.

Developing Quantitative Sensing Technologies to Measure the Fine Motor Skills and Evaluate the Efficacy of Therapeutic Interventions for Autistic Children

(Supported by NSF)

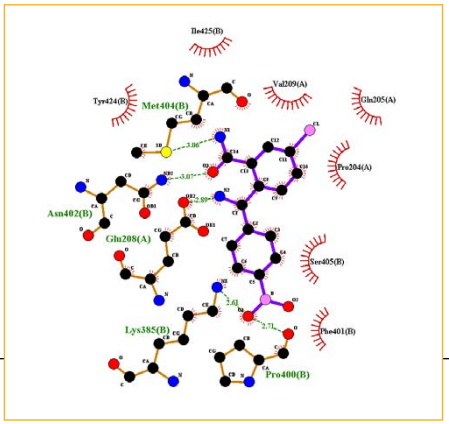
In this study, in collaboration with the Department of Occupational Therapy, New York Tech, researchers are developing sensing technologies that can quantitatively measure the patterns of the fine motor activities that can be used to 1) improve fine motor skills and 2) evaluate the efficacy of the outcomes of the therapeutic intervention. The inexpensive, non-invasive, and accessible tools, designed through this technology, can assist ASD children to improve their motor skills and help the clinician to better evaluate the efficacy of the intervention.

Developing and Evaluating an Earbud EEG System for ADHD

In this project, in collaboration with the Department of Occupational Therapy and Niura, we are developing novel wearable EEG systems in the form of a headband and earbuds designed to monitor cognitive and mental states, particularly targeting individuals with Attention-Deficit/Hyperactivity Disorder (ADHD). These systems can 1) capture event-related potential and neural activity, 2) enable continuous, real-time brain monitoring, and 3) provide a compact, wearable solution for home and school settings. The goal is to integrate this tool into feedback-based behavioral interventions and digital therapeutics for ADHD and related disorders.

Design and Synthesis of Small Molecule Hepatocyte Growth Factor (HGF) Mimetics

Hepatocyte growth factor (HGF) is a potent mitogen for hepatocytes that is required for liver development and regeneration. Therefore, identifying the most effective strategies to administer its biological effects in injured tissues is of high priority. In this research, in collaboration with the Department of Pharmaceutical Sciences at the University at Buffalo, our focus is on developing small-molecule HGF mimetics that are more efficient and can be produced at lower cost than current protein- and peptide-based compounds.



Circuits, Networks, and Systems (CNS) Laboratory

The CNS Laboratory specializes in the hardware and software design for medical and AI applications.

Nabi Sertac Artan, Ph.D.
Lab Director

New York Campus,
EGGC, 803A

nartan@nyit.edu

nyit.edu/bio/nartan

AREAS OF INTEREST

Smart Health

Wearable and Implantable Medical Devices

Near-Infrared Spectroscopy (NIRS)

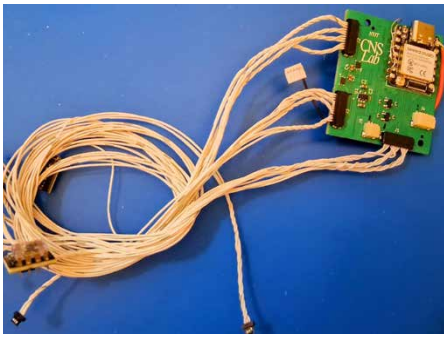
Sports Data Analytics

Low-Power AI Accelerator Chip Design

ACTIVE PROJECTS

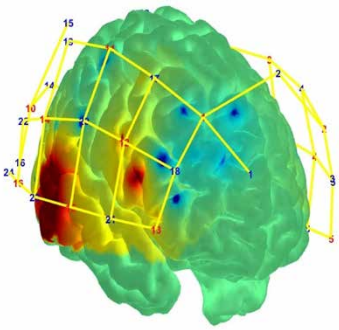
Wearable Mental Fatigue Monitoring

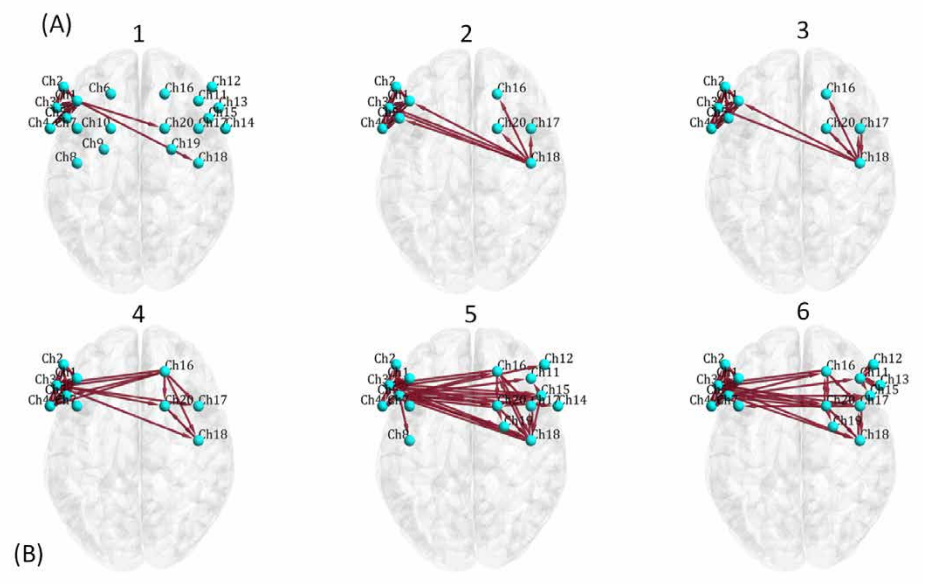
Mental fatigue affects emotional and physiological states and can lead to unforced errors in safety-critical professions like airline pilots and surgeons, as well as contribute to car accidents. The lab studies mental fatigue and brain activity using wearable devices, focusing on advanced AI-based models to better understand brain signals. Using functional Near-Infrared Spectroscopy, a non-invasive method that monitors brain activity with light pulses, the project aims to develop robust, low-cost devices that can recognize stages of mental fatigue and support mitigation strategies. Student researchers are involved in building medical devices and working with real-world data at the intersection of AI, electronics, and healthcare.



Efficient Circuits for Low-Power AI Accelerators

As neural networks become more complex, and the demand for large AI systems such as Foundational Models increase, the power needs of these systems become unattainable. This is especially challenging for edge devices such as phones and weearables. This research focuses on reducing power consumption of AI hardware by introducing novel arithmetic approaches such as stochastic computing. Our student researchers design and test microchips for AI workloads.





Intelligent Sensing and Communications (ISCOM) Laboratory

The Intelligent Sensing and Communications (ISCOM) lab focuses on developing signal processing, optimization, and machine learning techniques for sensing and communications in future radar systems and 6G communications. The lab also focuses on developing physical layer security and authentication methods for wireless networks.

Batu Chalise, Ph.D.
Lab Director

Long Island Campus,
HSH 226B

bchalise@nyit.edu

nyit.edu/bio/bchalise

AREAS OF INTEREST

Distributed Sensing and Communications

Joint Radar and Communications

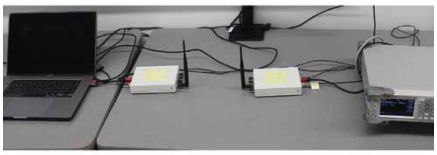
Wireless Spectrum Management

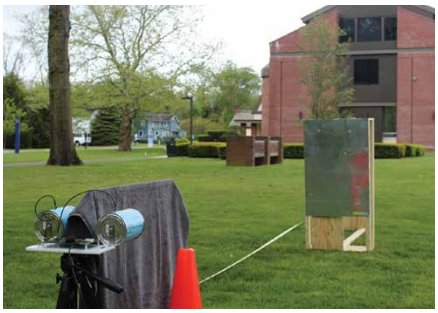
Next Generation Wireless Communications

Machine Learning for Radar and Communications

ACTIVE PROJECTS

Distributed Radar Sensing and Communications (supported by ARL and NRL)





The main objective of this project is to develop both model-based and deep learning techniques to enhance detection, parameter estimation, and tracking capabilities of a distributed radar network by optimizing bandwidth allocations for both radar and communications. The developed techniques will be tested on over-the-air data collected with a software defined radio (SDR) platform.

Wireless Spectrum Management (supported by ARL-SMART Hub Program)

Due to an ever-increasing number of wireless devices and networks, there is a need to dynamically allocate available radio frequency (RF) spectrum and optimize its utilization. This demands each wireless system to be capable of sensing the dynamic RF environment and making decisions based on such sensing, often leveraging adaptive and reconfigurable hardware. The key objective of this project is to develop multi-dimensional resource (e.g., bandwidth, antennas, time slots) allocation algorithms and protocols for a network radar so that radar performance is enhanced while maintaining desired communications performance.

Workforce Development for Wireless Spectrum Management (supported by NSF)

This project is a collaboration between Baylor University, Virginia Tech, New York Institute of Technology (New York Tech), and Colorado State University to conduct undergraduate workshops on electromagnetic spectrum science and engineering in summer 2025 at each of the four campuses. With great challenges created by wireless spectrum congestion and the ongoing emergence of new technologies, policies, and spectrum sharing approaches, a nationwide effort is needed to develop the future spectrum workforce. This project supports such workforce development, providing funds for a four-day residential workshop, the Spectrum Sizzle, on each campus. In the Spectrum Sizzle, undergraduate students participate in hands-on activities related to spectrum policy, communication systems, radar systems, passive systems, and circuits.

Quantum Radar Research (supported by NYIT-ISRC)

This research overcomes the limitations of microwave entangled quantum radar (QR) through photonic-assisted QR that utilizes optical to microwave and microwave to optical conversions. The microwave is used for probing targets and collecting their reflections and the optical domain is used for generating entanglement and correlation. The modeling, simulation, and experiments are proposed for realizing such a QR. Its performance will be quantified with receiver operating characteristics, signal-to-clutter and noise ratio, range-Doppler maps, and resolutions.

Network and Innovation Laboratory

This research group focuses on research on communication networking and innovative technologies, such as autonomous sensing, unmanned vehicles, and blockchain to solve problems in optimizing the sustainable use of resources.

Ziqian (Cecilia) Dong, Ph.D.
Lab Director

New York Campus,
EGGC, 802B

ziqian.dong@nyit.edu

nyit.edu/bio/Ziqian.Dong

AREAS OF INTEREST

High-Performance Computer Networks and Wireless Sensor Networks

Network Security and Forensics

Assistive Medical Devices

Innovation For Sustainability and Resilience of Both Natural and Built Environment

ACTIVE PROJECTS

RAPID: Acquisition and Curation of time-sensitive Field Data from Severely Flooded Neighborhoods in New York City from Tropical Storm Ophelia for Environmental Sustainability Study

The objective of this project, funded by NSF, is to collect perishable data in neighborhoods that were severely flooded, including images of the high-water marks of flooded neighborhood post-flooding events and the forecasted and recorded precipitation to help stakeholders assess their design guidelines for future flooding events and mitigation plans.

Food, Energy, and Water Nexus for Sustainable and Resilient Urban Development

This NSF funded project, in addition to establishing a Research Coordinated Network (RCN), explores the relationships between food, energy, and water systems at different scales in an urban environment. Through generating machine learning models to study the interaction of inter-connected systems, developing visualization tools to help stakeholders in decision-making process and using case studies to examine best practices for sustainable urban development.

Signals in the Soil

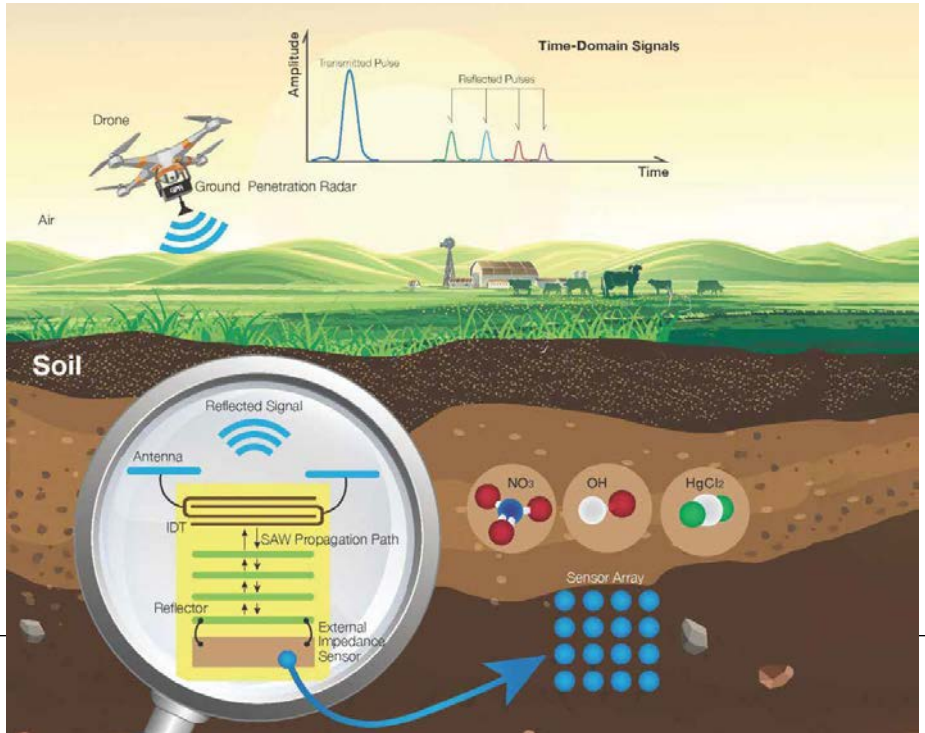
This collaborative project with faculty from CoECS and CAS, funded by NSF, focuses on the development of a passive, low-cost, pervasive, maintenance-free sensor that can be interrogated wirelessly and provide measurements of soil water content, temperature, pH, and nutrient concentration for precision agriculture and environmental monitoring.

Assistive Medical Devices

This collaborative project with faculty from CoECS, NYITCOM, and SHP investigates innovative devices using sensors, autonomous walkers, and wireless networks to assist rehabilitation for patients with Parkinson's disease.

Geolocation Project

This project explores measurement-based IP geolocation to find a suitable model for anchor nodes to locate an unknown IP, based on delay measurements. The project is also seeking novel approaches through ultra-wideband systems, machine learning, and multilateration of WiFi access point signals for accurate localization in the absence of GPS.



Network Resource and Security Lab (NRSL)

The NRSL laboratoryconducts research in the areas of network services and resource management and associated security vulnerabilities.

Anand Santhanakrishnan, Ph.D.
Lab Director

New York Campus,
EGGC, Room 803A

asanthan@nyit.edu

nyit.edu/bio/asanthan

AREAS OF INTEREST

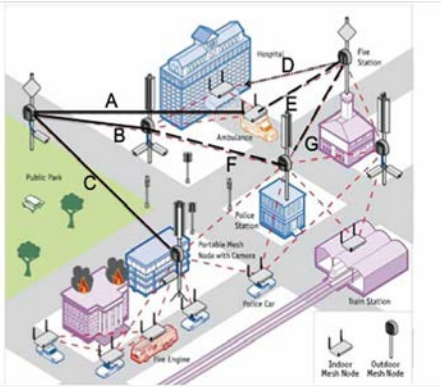
- Blockchains for 5G Spectrum and Power Management
- Impact of Net Neutrality Repeal and Its Impacts
- Communication Infrastructure for Connected Vehicular Networks
- Data Reliability in Internet of Things (IoT)
- Rumor Spread in Social Media and Influence on Pandemics
- Dynamics of Information Consumption in Internet Media

ACTIVE PROJECTS

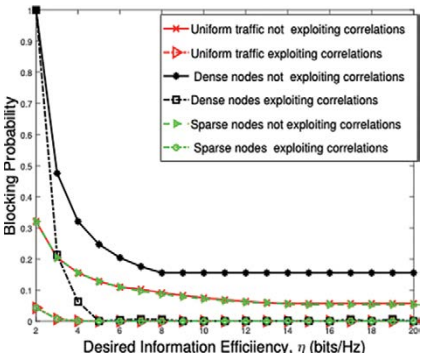
Spectrum Management for Successful Mission Completion in Tactical Networks

(supported by the Air Force Research Laboratory)

Mission completion in tactical networks depends on assigning spectrum for different missions, so that packets reach the destination without being lost and are error-free. This project develops distributed algorithms for spectrum allocation that exploits correlation in the information transmitted by different sources (e.g., multiple CCTV cameras may transmit the same video content). The proposed algorithms result in almost 100 percent mission success (0 percent mission failure).



Correlated videos from multiple cameras



Blocking or Mission Failure Probability

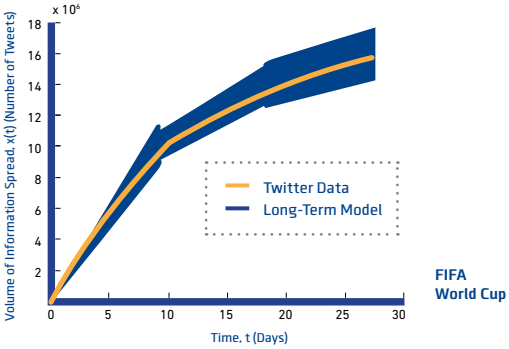
Geolocation of IP Hosts in Large, Congested Computer Networks

(funded by NSF REU)

Geolocation has found increasing importance in detecting malicious activity in the Internet, like suppression of speech, vandalism, cyber crimes, and localizing and blocking content while managing websites. IP address-based geolocation was found to be erroneous, laden with numerous vulnerabilities. Measurement-based geolocation without accounting for network traffic congestion is equivalent to predicting the estimated arrival time in a GPS navigator without accounting for road traffic congestion. This research proposes geolocation algorithms that yield up to 97 percent accuracy when tested on various nodes in the Internet distributed across the world.

Role of User Interaction in Information Spread in Social Media

More than 67 percent of Americans obtain news from social media. Since many people share information without verifying facts, this leads to wrong public opinions and confusion, with those in the age group of 18 to 34 being most susceptible. This research project develops a tool to collect social media data (from Twitter) to study spread of information on various current topics. Stochastic control theoretic "short-term" and "long-term" models are developed to study the spread of rumors. Results show that rumors mainly spread due to "interactions between users" on a topic and not just the number of users actively spreading the news, particularly for subjective topics like sports (e.g., FIFA World Cup) and policies (e.g., immigration).



Computational Mechanics & Biomechanics Laboratory (CMBL)

The CMBL laboratory is dedicated to exploring the mechanics and physics of biological systems and materials by developing and applying computational methods and tools. Our researchers create innovative computational techniques and utilize advanced commercial algorithmic packages to tackle a wide array of scientific and engineering challenges.

Wei Zeng, Ph.D.
Lab Director

Qin Liu, Ph.D.
Associate Lab Director

Long Island Campus,
HSH, Room 212

wzeng03@nyit.edu
qliu20@nyit.edu

nyit.edu/bio/wzeng03

ACTIVE PROJECTS

Computational Methods for Hierarchical Modeling of Active Muscles
(sponsored by NSF)

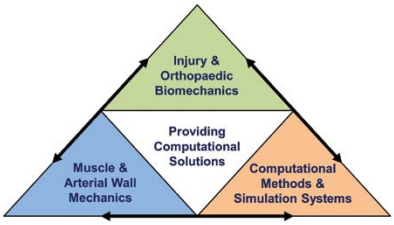
Skeletal muscles possess a highly organized hierarchical structure, making predictive modeling a cutting-edge multiscale challenge. This project aims to develop a comprehensive computational framework for the hierarchical modeling of active skeletal muscles. The focus is on state-of-the-art computational methods and finite element (FE) models that can elucidate the mechanical roles of microstructures and provide predictive simulations across different length scales.

Biomechanics of Fixation Implants for Proximal Femur Fractures (sponsored by NYIT-ISRC)

Computational modeling has become essential in orthopedic biomechanics, particularly for studying implant mechanics and bone fracture healing, without the ethical concerns of in vitro or in vivo clinical studies. Our project focuses on evaluating the biomechanical performance of widely used internal fixation implants for femoral neck, intertrochanteric, and subtrochanteric fractures. We develop models of femur-implant systems to analyze the biomechanical advantages and drawbacks of each implant option under realistic physiological loading conditions. Our findings aim to optimize orthopedic device design and aid clinical decision-making in the surgical treatment of proximal femur fractures.

Numerical Simulations of the Nonsymmetric Growth and Remodeling of Arteries Under Axial Twisting

Blood vessels experience forces such as axial tension, twisting, and pulse pressure. Sustained stress can lead to remodeling, such as wall thickening. This study aims to understand how mechanical stress influences the growth and remodeling of vessel walls, particularly the extracellular matrix, under sustained tension and twisting. Using simulations and experiments, we seek to improve the prevention and treatment of vascular diseases like stenosis, thrombosis, hypertension, and calcification.



Fracture Analysis for Brittle Materials by FEM and Machine Learning
(sponsored by DOE)

Fractures in brittle materials propagate rapidly with minimal elastic deformation, often resulting in sudden and catastrophic failure. This project introduces a novel approach to fracture analysis by integrating advanced FEM with machine learning techniques to predict fracture and simulate crack propagation. The goal is to enhance predictive capability and better understand fracture behavior.

AREAS OF INTEREST

- Injury and Orthopedic Biomechanics
- Large-Scale Computer Modeling and Simulation
- Human Body Modeling
- Computational Mechanics and Finite Element Methods
- Cardiovascular Mechanics
- Vehicle Crashworthiness

Human-Robot Information (HRI) Laboratory

The HRI lab focuses on robotics, humans, and information-related research. Information and machine learning significantly change the way how to interpret robot dynamics and behavior. However, humans are still the most intelligent "robot". Using machine learning to connect humans and robots helps to achieve robust and advanced planning and control strategies, with guaranteed performance.

Feng Han, Ph.D.
Lab Director

Long Island Campus,
HSH 121B

fhan03@nyit.edu

nyit.edu/bio/fhan03

AREAS OF INTEREST

Machine Learning

Robotics

Mechatronics

ACTIVE PROJECTS

Physics-informed Machine Learning of Underactuated Balance Robot Control)

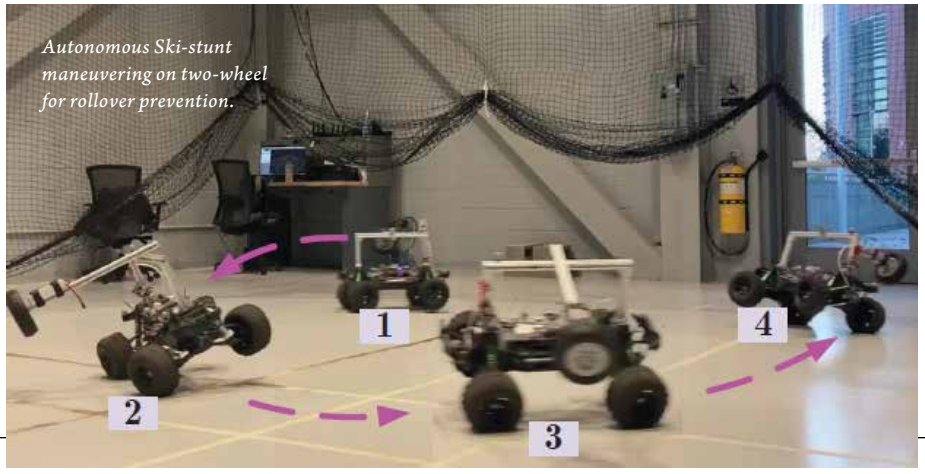
Underactuated balance robot (autonomous bicycle, bipedal walker robot) is a special class of mechanical system that requires simultaneous tracking control of actuated subsystem and maintaining of unactuated subsystem. Given the complexity of the dynamics, model-based control involved large uncertainties, which causes poor performance, and the unactuated subsystem would deviate from its balance equilibrium. The leaning-based approach can extract system dynamics from experimental data. With prior physics and knowledge involved, physics-informed machine learning achieves data-efficient learning by reducing the training data needed. Furthermore, the model learning errors can be shown as bounded in the sense of probability. Combined with existing model-based motion planning and control algorithms, performance-guaranteed control (i.e., convergence rate, final error bound) strategies can be designed. Such a physics-informed model can further be combined with reinforcement learning for underactuated balance robot motion planning to reduce the sim-to-real gap.

Robot Motion Planning and Control at Extreme Operation Conditions

Operating a robot platform at extreme conditions is considered dangerous and therefore avoided, resulting in the limited workspace and motion capability. For instance, an autonomous bicycle robot would avoid running on off-road terrain conditions, and motion strategies are designed to avoid any possible obstacles rather than crossing obstacles. However, modern actuators allow different operation modes. A DC motor that outputs a small amount of torque can generate times large of torque in a few milliseconds. Such a property allows the design of advanced structure and motion planning strategies that operate the robot in extreme conditions. We will work on underactuated robots (which have fewer control inputs than the degree of freedom). By designing the motion planning strategies at different operation modes, the workspace can be significantly enlarged.

Human-Robot Interaction with Advanced Intelligent Sensor

With intelligent sensors, human activities during human-robot interaction and cooperation can be sensed and predicted. With the learning-based dimensionality reduction method, we can build a latent dynamics model to predict high-dimensional motion activity in real-time. Such a scheme can be integrated with human-robot interaction in rehabilitation and healthcare.



Autonomous Ski-stunt maneuvering on two-wheel for rollover prevention.

Mechanics, Dynamics and Control for Complexity (MDCC) Laboratory

The MDCC lab integrates solid and fluid mechanics with dynamics and control to better understand and engineer complex physical, natural, and social systems.

Alain Boldini, Ph.D.
Lab Director

Long Island Campus,
HSH 119B

aboldini@nyit.edu

nyit.edu/bio/aboldini

AREAS OF INTEREST

- Complex Systems
- Dynamics and Control
- Multiphysics
- Soft Materials
- Mathematics Modeling
- Mechanics

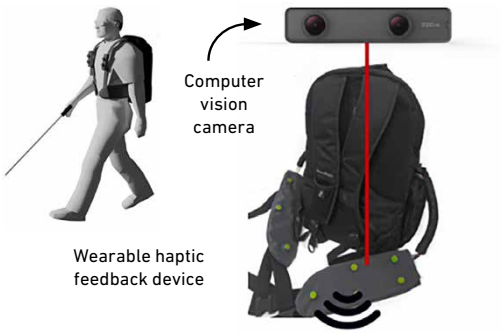
ACTIVE PROJECTS

Mechanics and Electrochemistry for Artificial Muscles and Deformable Electrochemical Systems

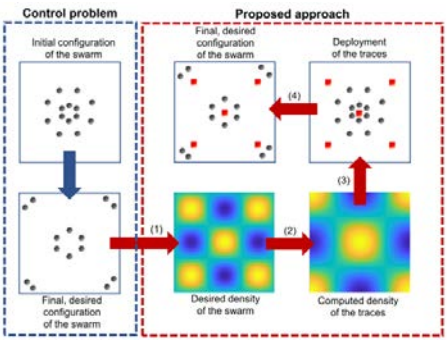
Electrochemical systems are everywhere, from our cellular membranes to batteries and fuel cells. While we recognize the basics of how these systems behave, we still lack a complete understanding of how mechanical deformations affect electrochemical fluxes and how, in turn, electrochemical fluxes can generate mechanical deformations. This research seeks to develop models to understand this interaction between mechanics and electrochemistry, through fundamental physics-based models at the microscopic and macroscopic level. These models can then be applied for the development of artificial muscles based on electroactive materials and deformable batteries.

Haptics for Sensory Substitution and Augmentation

Haptics refers to all the information that we can transmit through the skin. For example, our phone can vibrate to get our attention on a call or notification. I am interested in how we can utilize haptics to map much more complex information, especially for substituting or augmenting other senses. I seek to create models to understand how haptic actuators interact with the skin, in order to maximize mechanosensation. Further, I aim at understanding how to transmit complex information to humans through haptic stimulations. These advances can be utilized for applications in human-computer interactions, including health systems, avionics, and support to emergency responders.



Dynamics and control of large-scale systems for robotics and biology



As we witness the use of more and more automated systems and robots in our daily lives, a question arises on how we can control such large-scale systems. I seek to advance mathematical models and techniques to control systems made of a very large amount of interacting units. Drawing inspiration from physics, I work on microscopic and macroscopic descriptions of the dynamics and control of these systems. In addition to have large swarms of robots or drones perform complex operations, these techniques can be applied for the control of biological swarms, such as bacteria and cell aggregates.

MicroSensor Laboratory

This laboratory is dedicated to the development of novel microsensors for biomedical, environmental monitoring, and aerospace applications.

Fang Li, Ph.D.
Lab Director

Long Island Campus,
HSH, B19B

fli08@nyit.edu

nyit.edu/bio/fli08

AREAS OF INTEREST

Acoustic Wave Sensors

Piezoelectric Transducers

Stretchable Electronics

Lab-on-a-Chip Devices

ACTIVE PROJECTS

Stem Cell Maturity Evaluation and Promotion with An Intelligent Lab-on-Chip Framework (NSF)

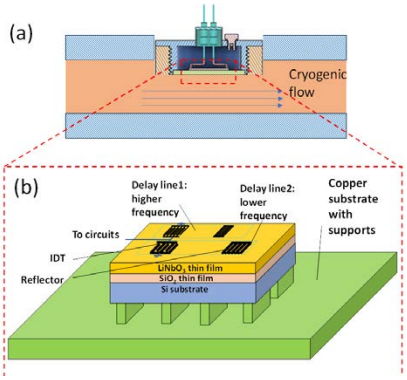
As compared with years of developmental process needed for the conversion of a fetal cardiomyocyte (CM) into an adult CM, the differentiation/maturation of human pluripotent stem cells (hPSCs) in the in vitro culturing tools can be achieved much faster than in vivo in an individual.

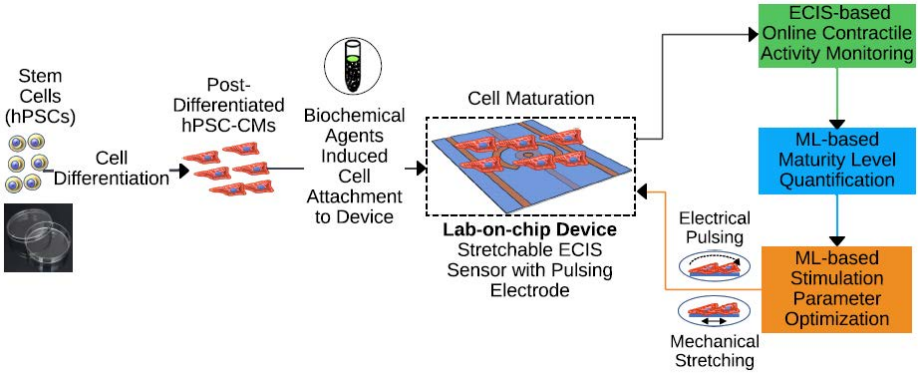
To reach the full potential of hPSC-CMs, this stem cell maturity evaluation and promotion with an intelligent lab-on-chip framework (SAVIOR) project aims to use the data-driven technique to understand the maturation process of hPSC-CMs in vitro and then leverage the gained insights to guide the promotion of cardiomyocytes maturity with unprecedented properties.

A probabilistic graphical model will be designed to evaluate the maturation stage of the hPSC-CMs, based on the beating activities recorded online by the electric cell substrate impedance spectroscopy (ECIS) technique. A lab-on-chip device, integrating the ECIS sensing and stimulation functions, will monitor the cell maturation process in real-time and apply mechanical and/or electrical stimulation on the hPSC-CMs. The biological stimulation, following the GiWi protocol, will remain fixed during the entire differentiation and maturation process. Reinforcement learning techniques will be used to analyze the information obtained from ECIS measurements and select the electrical and mechanical biophysical stimulation strategies.

A Wireless, Embedded Sensor System for Rocket Propulsion Test Applications environment (NASA STTR)

This project aims to develop a novel wireless dual-frequency surface acoustic wave (SAW) sensor system for simultaneous measurements of fuel temperature and pressure inside rocket propulsion supply lines. The proposed sensor system features a compact sensor unit designed for integration into the cryogenic fuel supply pipeline. This unit houses a SAW sensor mounted on a diaphragm, capable of conducting both temperature and pressure readings.





Optical Diagnostics Laboratory

This laboratory conducts research and development in advanced optical diagnostics.

James Scire, Ph.D.
Lab Director

Long Island Campus,
HSH B14A

jscire@nyit.edu

nyit.edu/bio/jscire

AREAS OF INTEREST

Pulsed Digital Holography

Thermal Imaging

Active and Passive Infrared Spectral Measurements

ACTIVE PROJECTS

High-Speed Digital Holography of Acoustic Levitation

Acoustic levitation uses sound waves to suspend and manipulate objects. It finds applications in containerless material processing. Here, researchers study solid and liquid objects in air, using pulsed digital holography to visualize and measure the acoustic field, including high-speed phase variations, object shape, and object position. These measurements contribute to fundamental studies of liquid droplet behavior and of nonlinear acoustics.

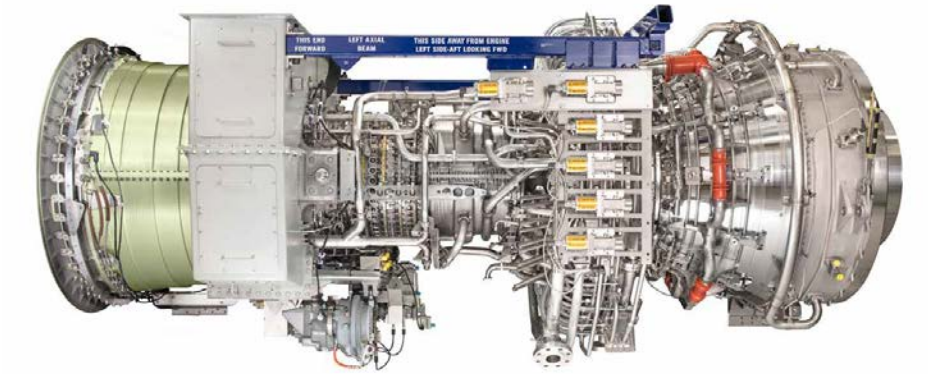
Point-Diffraction Interferometer for Digital Holography

This recently awarded NASA project, in collaboration with NASA co-investigator, is to develop a new optical system to advance current research.

The project outcomes will provide a strong foundation for future collaboration, as the expertise and hardware developed during this work can be used not only for studying acoustic levitation, but also for other fluid mechanics experiments and for precise metrology work. This research benefits the NASA mission of the Ultrastable Structures Laboratory and the Astrophysics Division.

Infrared Imaging of In-Service Turbine Blades

Gas turbine engines are the prime movers for a diverse range of applications, including aircraft propulsion and stationary power generation. As engine designs advance, increasing gas temperatures require greater attention to turbine-blade cooling schemes. This lab has contributed to an ongoing effort by Advanced Fuel Research and Pratt and Whitney to develop imaging pyrometry systems to evaluate these cooling schemes. These systems are installed on test engines and capture thermal images of the moving turbine blades while the engines run on test stands. The lab has contributed by developing hardware for synchronizing image capture and continuously refining designs to meet new challenges.



OUR EQUIPMENT

- Custom-Built Pulsed Digital Holography System
- Photron FASTCAM Mini UX100 High-Speed Camera
- Sofradir PV640LW Microbolometer Thermal Camera

APPLICATIONS OF TECHNIQUES

- Acoustic Levitation
- On-Engine Monitoring of Turbine Blade Temperatures
- Optical Gas Temperature Measurements

Thermo-Fluid and Instrumentation Research Lab

This laboratory conducts research on thermal fluid science, laser diagnostics, and microsensors, utilizing mathematical analyses, computations, and experiments to develop and demonstrate prototypes across various physical disciplines including thermal fluid science, photonics, and mechanics, and shares a common practical focus on fluid dynamics and its applications.

Tindaro Ioppolo, Ph.D.
Lab Director

Long Island Campus,
Theobald Hall Room 411

tioppolo@nyit.edu

nyit.edu/bio/tioppolo

AREAS OF INTEREST

Dynamics of Unsteady Separated Turbulent Boundary Layer

Development of Skin Friction Sensors for Low Speed and Hypersonic Speed

Shock Wave Induced by Laser Pulses for Flow Control

Dynamics of Air Bubble Formation During Water Entry of Objects

Laser-Based Diagnostic

The lab is equipped with a research-grade wind tunnel and state-of-the-art equipment to carry out fundamental and applied research in advanced thermo-fluid dynamics.

ACTIVE PROJECTS

Characterization of Turbulent, Unsteady Separation Using Photonic Micro-Skin Friction and Wall Pressure Sensors (Army Research Office)

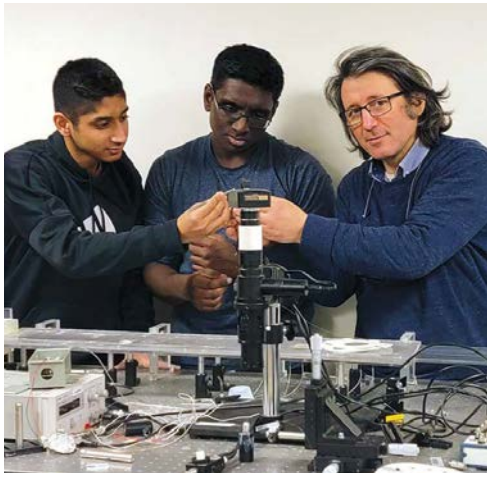
The goal of the proposed research is to study the structure and dynamics of separated turbulent boundary layers for Reynolds numbers in the range $4x103 < Re_{\theta} < 1.4x104$. The uniqueness of this study is the direct measurement of the streamwise and spanwise fluctuating skin friction and wall pressure simultaneously and at the same spatial location. Up-to-date, simultaneous direct measurements of skin friction and wall pressure at the same spatial location have never been carried out due to the lack of instrumentation. At the same time, detailed high-fidelity measurements of velocity and high-order moments will be measured and analyzed. The ultimate goal is to analyze the data in order to understand the physics beyond turbulent flow separation and the prediction of the onset and extent of stall in transient separated turbulent boundary layer.

Fabrication of Skin Friction Sensors Based on the Morphology Department Optical Resonances (Army Research Office)

The main goal of the project is to fabricate and test in a low-speed wind tunnel a photonic sensor for skin friction measurements. The sensing approach is based on the whispering gallery mode (WGM) of dielectric micro-cavities. In optics, the WGM phenomenon arises from total internal reflection of light at the internal surface of a high index of refraction dielectric resonator embedded in a surrounding medium of lower refractive index. The skin friction is measured by tracking the WGM shift. A key factor that makes this phenomenon attractive for sensor applications is the extremely high measurement resolution. For example, for a resonator of radius R ~100 μm, one obtains a "measurable" radius change of R = 10-11 m, which is smaller than the size of an atom.

Designing and Building a Low Speed Wind Tunnel (Army Research Office)

In this project, researchers are designing and building a hypervelocity wind tunnel for studying high speed and high-temperature gases as well as shockwaves for aerospace and energy applications.



Energy and Green Technologies (ENTECH) Laboratory

This laboratory, which opened in April 2019, represents a real-world environment providing students with hands-on experiences to create new knowledge in the energy and green technology disciplines. Researchers work in different energy generation, storage, and conservation methods.

Ehsan Kamel, Ph.D.
Lab Director

Long Island Campus,
HSH 103

ehsan.kamel@nyit.edu

nyit.edu/bio/ehsan.kamel

AREAS OF INTEREST

Physics-Based Building Energy Modeling (BEM) Using Computer Simulation Tools and Building Information Modeling

Urban-Scale Physics-Based Building Energy Modeling to Evaluate Energy Conservation Measures

Campus-Scale Buildings Digital Twins for Real-Time Energy Monitoring And Analysis

ACTIVE PROJECTS

Urban-Scale Physics-Based Building Energy Modeling

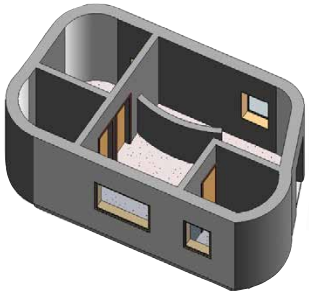
This project creates energy models for over 300,000 buildings in New York to evaluate their energy performance and predict how their energy consumption will be affected by climate change by the year 2099. The outcomes are used to better understand electricity loads in the building sector in the future and evaluate the most effective energy conservation measures.

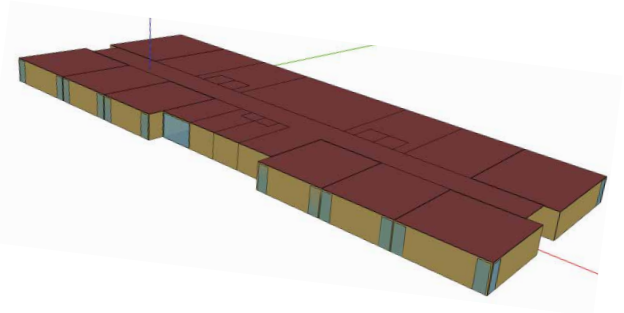
Building Energy Modeling in 3D-Printed Buildings

This project focuses on facilitating and improving the energy performance modeling and simulation process in 3D-printed buildings. Such buildings are designed and built through a more automated process that enables integrating energy evaluation into the design process.

Physics-Based Building Energy Model – Campus Buildings

These campus building are located at New York Tech's Old Westbury. We collect different building data using wireless sensors and energy audit tools to develop a computer energy model. Revit, OpenStudio, and BIM files (gbXML) are used in this project. The goal is to study different data exchange scenarios, calibrate the building energy model, propose a zero-net-energy (ZNE) retrofit package, and provide a hands-on experience opportunity for students.





Artificial Intelligence, Data Mining, and High-Performance Computing Lab

This laboratory focuses on developing signal processing, optimization, and machine learning techniques for sensing and communications in future radar systems and 6G communications. The lab also focuses on developing physical layer security and authentication methods for wireless networks.

Jerry Cheng, Ph.D.
Lab Director

Manhattan Campus
Edward Guiliano Global Center,
Room 807

jcheng18@nyit.edu

nyit.edu/bio/jcheng18

AREAS OF INTEREST

Data Science

Artificial Intelligence

Data Mining

High Performance Computing

Machine Learning

Probability and Stochastic Processes

ACTIVE PROJECTS

Collaborative Research: CCRI: New: Nation-wide Community-based Mobile Edge Sensing and Computing Testbeds
National Science Foundation (NSF)

The proposed research infrastructure includes three organically connected functionalities to provide repeatable experimental environments, facilitate data/model-sharing, and join separated research groups on a national scale. In particular, this project develops mobile sensing functionalities for supporting compelling research in low-effort large-scale sensing data collection, robot-enabled experimenting, and privacy-preserved learning on mobile edge devices.

Small: Efficient and Robust Multi-model Data Analytics for Edge Computing

This NSF funded collaborative project with Rutgers University, addresses two major problems: 1) the gap between the data complexity and limited computing resources on edge devices and 2) the gap between the robust performance requirement and the multi-dimensional data and complex data modeling from heterogeneous edge devices and environments. The project develops an efficient and robust edge computing framework to provide correctness guarantees on heterogeneous edge computing hardware across different environments.

Human-Centric Data Analytics Laboratory

This laboratory aims to advance the field of human-centered data analysis using signal processing, machine learning, and data mining with emphasis on developing computational methods, algorithms, and models for speech recognition and natural language processing.

Houwei Cao, Ph.D.
Lab Director

New York Campus,
EGGC 810

hca002@nyit.edu

nyit.edu/bio/hca002

AREAS OF INTEREST

- Data Science
- Machine Learning
- Multi-modal Affective Computing
- Speech and Natural Learning Processing

ACTIVE PROJECTS

Towards Adaptive and Robust Multimodal Emotion Recognition In-the-Wild (supported by NSF)

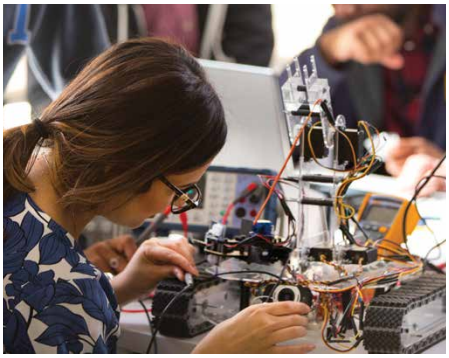
Emotions are essential to human life. They directly influence human perception and behaviors and have big impacts on people's daily tasks, such as learning, social interaction, and decision-making. Automatic emotion recognition has found applications in many domains, such as human-computer interaction, human-robot interaction, multimedia retrieval, social media analysis, and healthcare. Emotional states are expressed through a variety of channels, including facial expression, voice prosody, spoken words, and body gestures. Automatic emotion recognition in real-world applications is a challenging task. Real-world emotions involve subtle expressive behaviors, different degrees of expressiveness in different channels, and the imperfect conditions, such as background noise or music, poor illumination, and uncontrolled head poses. This research project aims to address the challenges of spontaneous emotion expressions and imperfect audio and video signals in the wild and develop a novel multimodal emotion recognition system for real-world applications. The research will lead to advances in data collection, algorithm design, and bench-marking for the next generation of affective computing.

Sequential Recommender System Based on Content Analysis and User Behavior Study (supported by New York Tech ISRC)

In the big-data era, users are increasingly overwhelmed by the information and choices available to them, the so-called "information overload" problem. Recommender systems (RSs) efficiently address the information overload problem by automatically suggesting to users items likely of their interests. Most traditional RSs predict user preferences by static analysis of user data and/or content information of the items. However, in real-world scenarios, both content and users are highly dynamic: New content is constantly added to the catalog and user interests are fast moving. As a result, the content popularity presents strong and complicated temporal variations. We propose a novel sequential recommender system based on multiscale dynamic content analysis and user behavior.

Data-Driven Approaches to Edge Caching

Today's online services, ranging from web hosting, video streaming, social media, and gaming to virtual, augmented, and mixed reality (VR/AR/MR) are increasingly dependent on the timely delivery of rich media content over the global internet. Modern content delivery systems are facing unprecedented challenges. One one hand, emerging new content requires significantly higher bandwidth. On the other hand, some new content also involves live interaction between users. In this collaborative project, we propose research on data-driven caching designs for deep-shallow cache networks. The core idea is to dig deeper into content and user data to learn long-term and short-term patterns in content and user interactions using machine learning models. We further develop hybrid dynamic caching polices and cooperative mining and caching designs for hierarchical cache networks. This is a collaborative project with faculty from New York University.



Intelligent Mobile Edge (IME) Laboratory

The IME laboratory focuses on research on the security and efficiency problems at the cloud-enhanced wireless mobile edge for the Internet of Things (IoT) applications, such as crowdsourced video generation and medical cyber-physical systems.

Xueqing (Summer) Huang, Ph.D.
Lab Director

Long Island Campus, HSH 226A

xhuang25@nyit.edu

nyit.edu/bio/xhuang25

AREAS OF INTEREST

- Algorithm Design
- Internet of Things (IoT) Applications
- Mobile Edge Computing
- Data Analysis
- Mathematical Programming
- Data-Driven Optimization

ACTIVE PROJECTS

Stem Cell Maturity Evaluation and Promotion with an Intelligent Lab-on-Chip Framework (NSF)

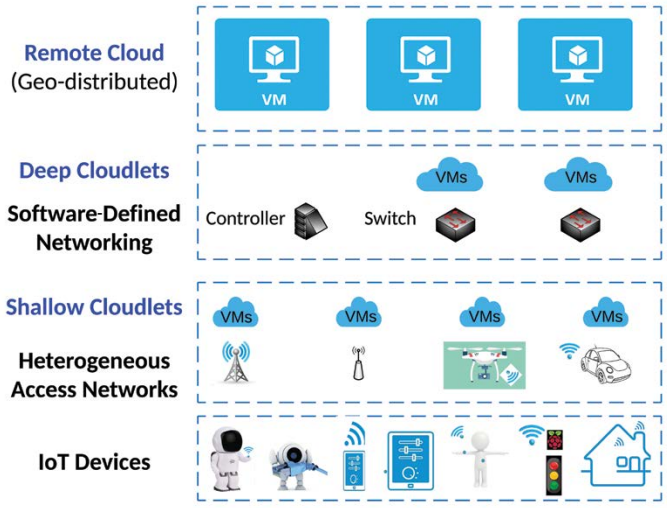
Principal Investigators (PIs)/Co-Investigators: Xueiqng Huang (New York Tech), Fang Li (New York Tech), Ioana Voiculescu (The City College of New York), and Diego Fraidenraich (Rutgers University)

Cardiovascular disease is the leading global cause of death. Future heart regeneration relies on mature cardiomyocytes (CMs) from stem cells that will improve heart function when transplanted in the heart. A major problem of the existing stem cell-derived heart tissues is that the cells remain immature, beat more rapidly, and when transplanted into adult failing hearts will eventually provoke lethal arrhythmias. The primary goal of this research is to design and develop an intelligent device that will non-invasively monitor the maturity stage of stem cell-derived CMs in real-time, and adaptively stimulate the cells toward full maturation with electric pulsing and mechanical stretching. The research has the potential to revolutionize the generation of mature CMs.

Entrepreneurship in Sustainable Transportation: Renewable Energy Harvesting and Management (VentureWell)

Principal Investigators (PIs)/Co-Investigators: Xueiqng Huang (New York Tech), Fang Li (New York Tech), Michael Nizich (New York Tech)

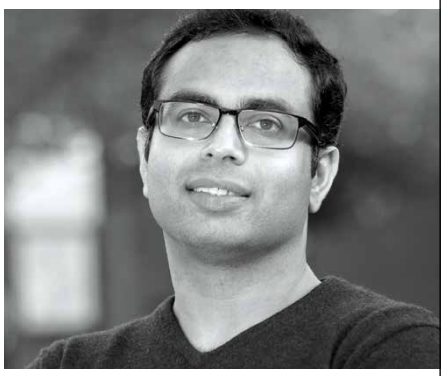
This project, funded by VentureWell, presents a new collaborative course on establishing and testing innovative solutions for the national sustainable issue of clean energy generation and management for smart transportation. Supported by the Entrepreneurship and Technology Innovation Center, this course fuses two disciplines: Computer Science and Mechanical Engineering. It will enhance the existing entrepreneurial resources by supporting a student learning and prototyping facility that integrates 1) software in terms of energy management algorithm design, 2) hardware in terms of energy harvester design and fabrication, and 3) a full lifecycle analysis approach that considers smart transportation across manufacturing, operation, and disposal.



Behavioral Authentication, Machine Learning, and Privacy (LAMP) Laboratory

The LAMP is a group of faculty, students, and visitors who enjoy doing research in machine learning and cryptography applied to privacy and authentication.

Paolo Gasti, Ph.D.
Lab Co-Director



Kiran Balagani, Ph.D.
Lab Co-Director

New York Campus, EGGC, 808;
Long Island Campus, HSH 212

pgasti@nyit.edu
kbalagan@nyit.edu

nyit.edu/bio/pgasti
nyit.edu/bio/kbalagan
nyit-lamp.com

ACTIVE PROJECTS

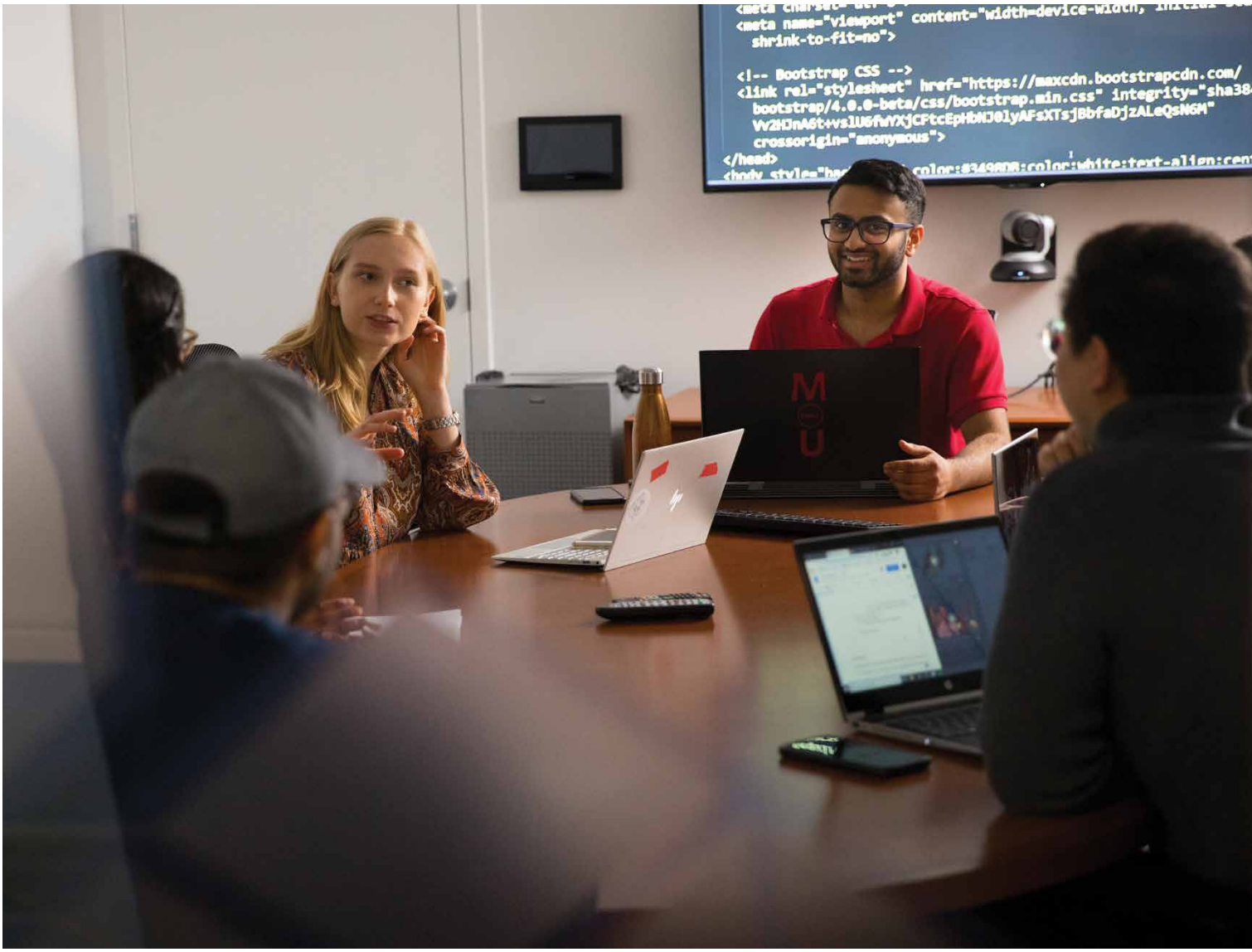
Leveraging Movement, Posture, and Anthropometric Contexts to Strengthen the Security of Mobile Biometrics (sponsored by NSF)

Active authentication is emerging as a promising way to continuously and unobtrusively authenticate smartphone users post-login. Although research in this area has shown that behavioral traits, such as touchscreen gestures and device movements, can be used to distinguish a legitimate user from an attacker, fundamental questions about these traits still remain unanswered. These include: how, and to what extent, do posture and movement impact behavioral traits; what is the impact of human variability (anthropometric properties, age, gender, and health conditions) on behavioral traits; to what extent can these traits be spoofed using posture and movement observations; and how can we strengthen these traits against spoofing attacks. In this project, an interdisciplinary team of investigators from the Computer Science, Biomedical Sciences, Physical Therapy, and Art and Media Technologies at New York Tech will leverage capabilities in 3-D motion capture, behavioral biometric authentication research, and motor control research to address these questions.

Toward Energy-Efficient Privacy-Preserving Active Authentication of Smartphone Users (sponsored by NSF)

Common smartphone authentication mechanisms such as PINs, graphical passwords, and fingerprint scans offer limited security. They are relatively easy to guess or spoof and are ineffective when the smartphone is captured after the user has logged in. Multimodal active authentication addresses these challenges by frequently and unobtrusively authenticating the user via behavioral biometric signals, such as touchscreen interaction, hand movements, gait, voice, and phone location. However, these techniques raise significant privacy and security concerns because the behavioral signals used for authentication represent personal identifiable data and often expose private information, such as user activity, health, and location. This research advances the state-of-the-art of privacy-preserving active authentication by devising new techniques that significantly reduce the energy cost of cryptographic authentication protocols on smartphones. Further, this

(continued on next page)



research takes into account signals that indicate the user has lost possession of the smartphone, in order to trigger user authentication only when necessary. The focus of this project is in sharp contrast with existing techniques and protocols, which have been largely agnostic to energy consumption patterns and to the user's possession of the smartphone post-authentication. Current neurostimulators work in an open loop and thus their efficacy depends on the patient's or physician's comprehension of pain. We are developing a real-time automatic recognition algorithm to detect action potentials and cluster various neuronal activity levels.

HMOG: Hand Movement, Orientation, and Grasp (sponsored by DARPA)

Hand Movement, Orientation, and Grasp (HMOG) is a set of behavioral features to continuously authenticate smartphone users. HMOG features unobtrusively capture subtle micromovement and orientation dynamics resulting from how a user grasps, holds, and taps on the smartphone. In this project, we evaluated authentication and biometric key generation (BKG) performance of HMOG features on data collected from 100 subjects typing on a virtual keyboard. Data was collected under two conditions: sitting and walking. We achieved authentication EERs as low as 7.16 percent (walking) and 10.05 percent (sitting) when we combined HMOG, tap, and keystroke features. We performed experiments to investigate why HMOG features perform well during walking. Our results suggest that this is due to the ability of HMOG features to capture distinctive body movements caused by walking, in addition to the hand-movement dynamics from taps. With BKG, we achieved EERs of 15.1 percent using HMOG combined with taps. In comparison, BKG using tap, key hold, and swipe features had EERs between 25.7 percent and 34.2 percent. We also analyzed the energy consumption of HMOG features extraction and computation. Our analysis shows that HMOG features extracted at 16Hz sensor sampling rate incurred a minor overhead of 7.9 percent without sacrificing authentication accuracy.

Medical Informatics and Data Analytics Laboratory

This laboratory is devoted to research on biomedical ontology extraction and abstraction techniques, biomedical ontology quality assurance methodologies, and data analysis.

Huanying Gu, Ph.D.
Lab Director

New York Campus,
EGGC, 811

hgu03@nyit.edu

nyit.edu/bio/hgu03

AREAS OF INTEREST

Biomedical Ontology

Medical Informatics

Data Analytics and Data Mining

Object-Oriented Modeling

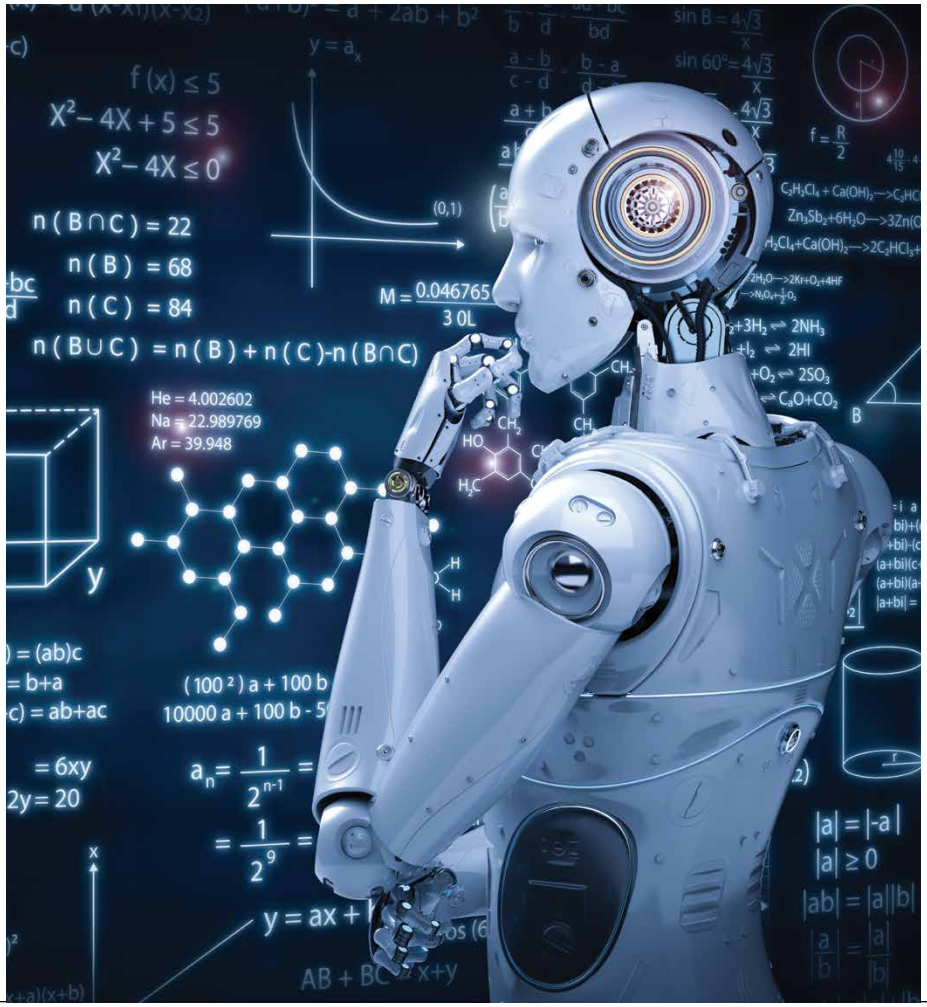
ACTIVE PROJECTS

Use of Machine Learning and NLP Techniques for Biomedical Informatic Knowledge Graph Construction and Enhancement

Biomedical terminologies have become an essential tool for research and health information systems. The goal of this research is to use the most current state-of-the-art machine learning and NLP techniques to construct and/or enhance biomedical ontologies. The Systematized Nomenclature of Medicine Clinical Terms (SNOMED CT) is used in the project.

Digit Pathology Application

In this project, we study how to use machine learning and image process techniques to help pathologists predicting clinical behaviors, integrating automated diagnosis into frozen section, identifying elements of interest from frozen sections, and virtual staining.



Mobile Systems and Network Security (MOBISEC) Laboratory

The MOBISEC laboratory focuses on applying machine learning and data analytics techniques to enhance the security and trust of mobile and wireless systems and networks.

Wenjia Li, Ph.D.
Lab Director

New York Campus,
EGGC, 807

wli20@nyit.edu

nyit.edu/bio/wli20

AREAS OF INTEREST

Security, Trust and Policies for Wireless Networks/Applications
Vehicular Networks, Internet of Things,

Cyber-Physical Systems Security of Mobile Devices/Systems
Malware Detection for Android Systems, Particularly in Presence of Machine Learning Attacks

Security/Trust for Blockchain and Applications

ACTIVE PROJECTS

Secure and Trustworthy Data Management for Intelligent Transportation System

In Intelligent Transportation Systems (ITS), traffic data is generally exchanged during the inter-vehicle communication. Embedded vehicle sensors can report their observations of abnormal road conditions, such as traffic jams, road construction, and accidents to other vehicles, as well as infrastructure-based ITS components. This helps not only in individual route planning, but also overall in traffic optimization. However, the sensor data received from other vehicles might be imperfect due to some environmental factors. For instance, two vehicles traveling in opposite directions might have traveled out of communication range before they successfully finish data exchange.

In this case, the received traffic data may be incomplete and meaningless. To make things worse, vehicles controlled by malicious entities may intentionally propagate fake traffic data so as to disturb the whole transport system and even cause crashes by feeding onboard controllers false information about the speed or movement of the vehicles ahead. Similarly, traffic updates from human sensors (for example, smartphone users) such as new tweets or Facebook status updates for real-time traffic status may also be imperfect due to both environmental factors and malicious intents.

Malware Detection for Mobile System Against Adversarial Machine Learning Attacks

As one of the key components for smart cities and its applications, mobile devices such as smartphones and tablet computers have made our daily lives much more convenient and enjoyable. Among various mobile operating systems, Android has become the leading operating system in terms of the percentage of mobile devices that are based on it. However, at the same time, Android devices are more susceptible to various security threats, including mobile malware, because of the large quantity of mobile users, as well as diversified mobile applications. In recent years, researchers have explored different means, including various machine learning algorithms, to successfully detect malicious applications in Android devices. However, many of the existing malware detection systems have suffered from adversarial machine learning attacks, such as data poisoning attacks and evasion attacks, which are designed by malware authors to ensure that malware remains undetected by the traditional machine learning-based approaches.

Entrepreneurship and Technology Innovation Center (ETIC)

The ETIC is a business accelerator that brings together industry, government, and academia to foster economic development across Long Island and the New York City metropolitan region. The center provides support for start-up businesses, including early phase prototyping, entrepreneurial and high-tech training, commercialization guidance, networking opportunities, and staff recruitment.

Michael Nizich, Ph.D.
ETIC Director

Long Island Campus,
HSH 107

mnizich@nyit.edu

nyit.edu/engineering/etic
nyit.edu/bio/mnizich

STUDENT OPPORTUNITIES

Students gain practical experience and develop entrepreneurial skills and professional networks that help them grow their careers after graduation. They learn to apply the theoretical knowledge they gain in the classroom to real-world, open-ended design projects with the guidance of industry experts and advisors.

NASA Prototyping Program

NASA has contracted with New York Tech for 5 consecutive years to have ETIC student employees build technology prototypes based on existing NASA patents and create professional materials to market them. "The purpose of this agreement is to provide an operational structure and framework for NASA to move various unrealized and undeveloped intellectual property further towards commercialization through prototyping and production services available at (the ETIC)," said Kris Romig, the commercialization services lead at the NASA Johnson Space Center in Houston. Student employees are working to fulfill the terms of the contract with NASA. Selected students pursuing computer science, mechanical engineering, and electrical and computer engineering degrees are working to build the prototypes based on NASA patents, and Digital Arts students assist in developing instructional and marketing videos to help present the products to investors.

iNTEREST Series

The iNTEREST lecture series introduces attendees to technologies that are in high demand and have dedicated career paths. Attendees gain a theoretical background of the technologies, participate in live demos, and learn how to download them to start learning on their own and moving towards a new career.

Session topics include:

- Designing Computer Networks with Cisco Packet Tracer
- Creating Web Applications With C#
- Introduction to Cybersecurity as a Career
- Programming With Java
- Introduction to Raspberry Pi
- Introduction to Command Line Usage in Windows and Linux
- Introduction to Blockchain Technology
- Developing Applications with Microsoft Visual Studio
- Creating and Managing Databases Using Microsoft SQL Server
- Programming With Python
- Introduction to Kali Linux
- Introduction to Quantum Computing and Introduction to Data Science

For more information:
nyit.edu/tag/interest-sessions.

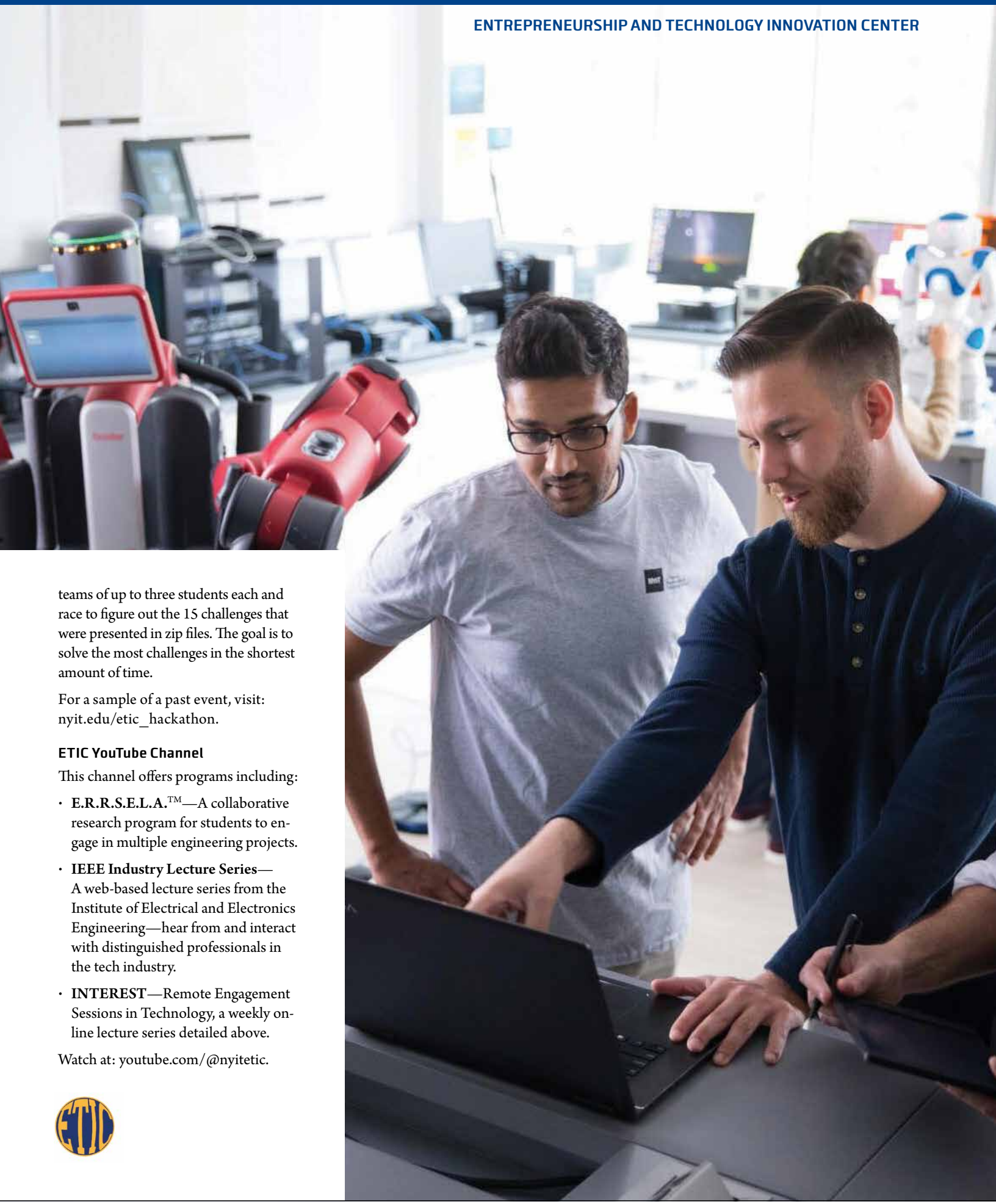
ETIC Cybersecurity Hackathon

At the Cybersecurity Hackathon, undergraduate and graduate students from the New York City, Long Island, and Vancouver B.C., campuses roll up their sleeves to take part in a six-hour competition. Also, students compete against participating teams from other regional colleges and universities. This virtual event introduces them to the fields of cybersecurity and cryptography. It is open to all skill levels and begins with an explanation of the challenge and ground rules. Participants then form

ACCELERATE LONG ISLAND

CAE IN CYBERSECURITY COMMUNITY

NYSTAR
Empire State Development
Division of Science, Technology & Innovation



teams of up to three students each and race to figure out the 15 challenges that were presented in zip files. The goal is to solve the most challenges in the shortest amount of time.

For a sample of a past event, visit: nyit.edu/etic_hackathon.

ETIC YouTube Channel

This channel offers programs including:

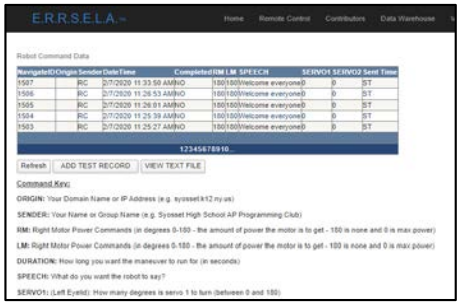
- **E.R.R.S.E.L.A.**™—A collaborative research program for students to engage in multiple engineering projects.
- **IEEE Industry Lecture Series**—A web-based lecture series from the Institute of Electrical and Electronics Engineering—hear from and interact with distinguished professionals in the tech industry.
- **INTEREST**—Remote Engagement Sessions in Technology, a weekly online lecture series detailed above.

Watch at: youtube.com/@nyitetic.

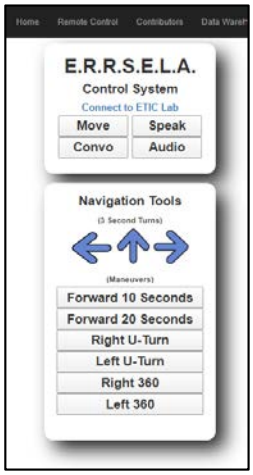
E.R.R.S.E.L.A.™

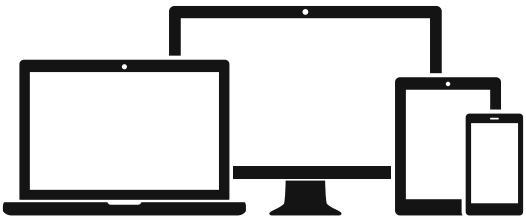
ETIC Research Robot for Student Engagement and Learning Activities

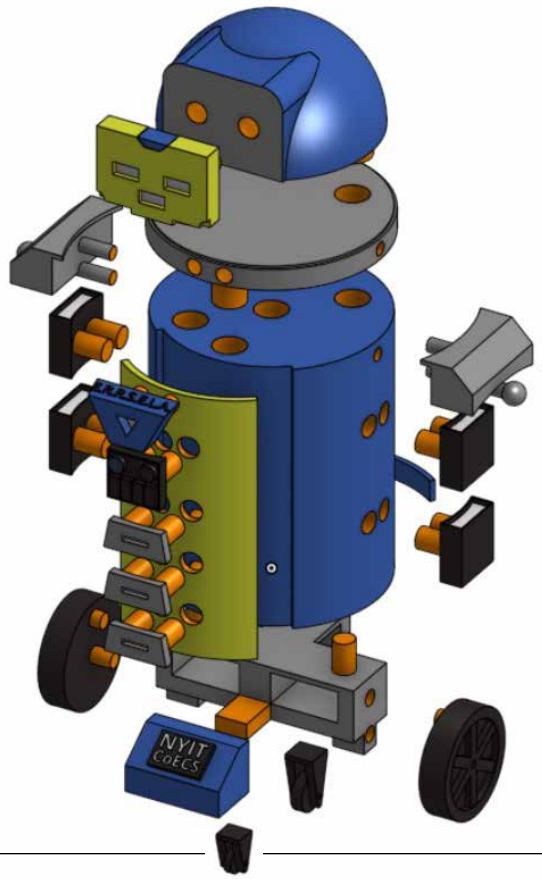
E.R.R.S.E.L.A.™ is a collaborative research and student engagement program founded by Dr. Michael Nizich. The program enables students from multiple disciplines and with varied skill levels to collaborate and participate in the robot's design and functionality. Students from New York Tech as well as students from various high schools and other regional colleges can participate in the design project to gain real-world experience in various areas of engineering and computer science. The program is available to all K-12 teachers in New York State to remotely engage their students in their own classrooms. E.R.R.S.E.L.A.™ Engagement sessions are designed to fulfill the newly required Computer Science Digital Fluency Standards for all K-12 students in New York State.



Web and mobile interfaces allow control from any device on a global basis.







Programming languages such as Java, Python, C#, ASP.NET, and SQL enable ETIC students to SQL enables ETC students stay engaged in various research projects.

API enables student projects to work from anywhere.

Internet

A SQL Server database stores data for use in machine learning algorithms.

Basic machine learning algorithms allow ERRSELA to learn.

E.R.R.S.E.L.A.™ OS controls movement, speech, sensor operation, and data collection.

Raspberry PI Motor & Servo Controllers

1855 Broadway
New York, NY 10023-7692

Northern Blvd
P.O.Box 8000
Old Westbury, NY 11568-8000

nyit.edu

23-4693/100