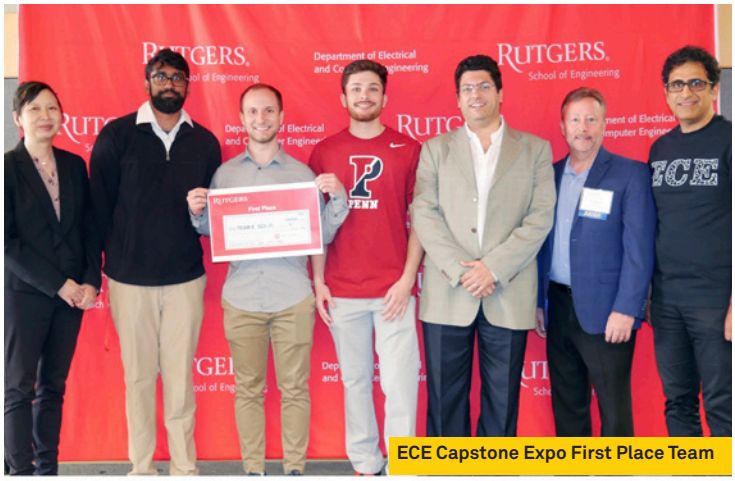
RUTGERS
School of Engineering

ecenews

Rutgers University School of Engineering | Department of Electrical and Computer Engineering | 2023



ECE Capstone Expo First Place Team

#1st place


M. Javanmard and Rutgers University President Holloway


A. Cuitiño, A. Sarwate, Y. Chen


K. Dana, E. Wengrowski

ECE Admitted Student Tours

contents

ECE News is an annual publication of Rutgers ECE.

Editors: Yingying Chen

Assistants: Pamela Heinold, John Scafidi, Sheng Wei, Daniel Burbano Lombana

Photography: James De Salvo, Bill Cardoni Photography, Roy Groething, Don Hamerman, Nick Romanenko, J Somers Photography LLC

Design: Bart Solenthaler

ECE News is also available at **www.ece.rutgers.edu** or can be received by mail by sending a request to **ece-help@soe.rutgers.edu**

Visit us at **www.ece.rutgers.edu**

message f

Y. Chen

ECE Numbers

36
Faculty

9
Lecturers

806
Undergraduate Students

212
Graduate Students

104
PhD Students

108
MS Students

New Research Grants:
$12,000,000

Celebrating 120 years:
1903-2023

rom the chair

Welcome to the Electrical and Computer Engineering (ECE) Department at Rutgers University. We are thrilled to announce that this year marks a historic milestone for Rutgers University. Our institution has achieved remarkable progress in the prestigious U.S. News & World Report college rankings. As a testament to our unwavering commitment to academic excellence, Rutgers-New Brunswick has earned a distinguished position as the #15 top public university in the nation. Furthermore, for the first time in the ranking's illustrious 40-year history, all three of our university's campuses, located in Newark, Camden, and New Brunswick, have earned places among the top 100 national universities. Notably, Rutgers-New Brunswick has maintained its prominent standing at 40th place among all national universities. Additionally, among the 14 Big Ten Conference universities, Rutgers-New Brunswick proudly holds the 4th position in the public universities ranking, reinforcing our reputation for consistently delivering exceptional education and impactful research.

What's equally thrilling is the progress within our own department. In recent data from ASEE, Electrical and Computer Engineering (ECE) housed in the School of Engineering (SoE) at Rutgers is ranked third in the United States in terms of the number of undergraduate degrees granted. This reflects our commitment to providing quality education. Our department has become a vibrant hub of learning and research, thanks to the dedicated efforts of our faculty and students. This vibrancy fosters a sense of community that champions excellence in both education and research. Consistent with this excellence, our student enrollment has grown dramatically with the undergraduate student class size at around 1,000 students and the graduate student class size at around 225 students. In May 2023, our department reached a milestone by hosting a record-high of 75 Capstone student teams with entrepreneuring and exciting senior projects under the mentorship of ECE faculty and industry sponsors.

Our department offers a variety of academic programs, including B.S. degrees with options in Computer Engineering and Electrical Engineering, alongside M.S. and Ph.D. degrees. Our distinguished faculty specializes in cutting-edge fields like nano electronics, optical materials, bioelectrical devices, machine learning, cybersecurity, computer vision, cyber-physical systems, neuroimaging, signal processing, computer networks, human-computer interaction, virtual reality, high-performance computing and quantum computing. Additionally, the department provides a Certificate Graduate Program in Machine Learning and Cyber Security. Our curriculum spans from theory to practical hardware and software, supporting diverse applications in computing, communications, commerce, energy, medicine, safety, and transportation. We're excited to introduce a new Master's concentration in machine learning starting from Fall 2023, reflecting our commitment to offering a cut-edging education and research experience with interdisciplinary opportunities for our students.

We offer excellent research facilities that foster collaboration with local industries through our nationally recognized centers, including the Wireless Information Network Laboratory (WINLAB), the Micro-nanofabrication and Characterization Facility, and the Center for Advanced Infrastructure and Transportation (CAIT). Additionally, there are various established collaboration opportunities at Brookhaven National Laboratory and with clinicians at Rutgers Biomedical and Health Sciences (RBHS).

Our distinguished senior faculty members consistently earn prestigious national and international honors, including Fellow of the Institute of Electrical and Electronics Engineers (IEEE), Fellow of the National Academy of Inventors (NAI), and ACM Distinguished Memebers. Currently, our department is home to 13 IEEE Fellows, 1 AAAS Fellow, 1 NAI Fellow, 1 PFF Award recipient, 18 NSF Career Award recipients, 3 DARPA Faculty Fellows, 1 ONR YIP recipient, and 1 ARO YIP recipient. Our faculty members demonstrate remarkable success in securing investigator awards from notable organizations like NSF, NIH, DARPA, ARL, ARO, ONR, PNNL, MxD, and many other research agencies. In particular, our faculties are among one of the five teams selected by NSF $25 million Investment to Secure 5G Technologies in communication infrastructure and operational challenges and also one of the teams receiving NSF investments of $35M in future manufacturing in 2023. With an annual research expenditure exceeding $12 million, our work attracts significant media attention, featuring in outlets such as Rutgers News, Science Advances, Fortune Magazine, the Wall Street Journal, and CNN news. Furthermore, our faculty members have received prestigious competitive honors, including the Rodkin-Weintraub Chair, Presidential Outstanding Faculty awards, and Susman Award, recognizing their excellence in research and teaching.

Throughout the year, our faculty and graduate students have garnered many Best Paper and Competition Awards at highly reputed conferences and professional organizations. Just to name a few, Stephen O. Rice Prize from the IEEE Communications Society, N2Women Stars Award in Networking and Communications, IEEE Technical Committee on Secure and Dependable Measurement (TCSDM) Early-Career Award, Best AI Innovation prize in the TE AI Cup, and IEEE Communications Society Phoenix ISS Award. After a two-year absence, ECE Research Day was finally back on campus with a great success. This event was an excellent opportunity for ECE students and ECE Postdoc Associates to present their research projects, share their creative ideas, and network with their peers. The 52 posters were presented by graduate and undergraduate students (including summer research, internships, and co-ops), covering a diverse range of research topics.

The department promotes a 5-year BS/MS program, which gains increasing interests in the past year. Our graduate and undergraduate students have the opportunities to receive the Ashok & Yohavalli Sethu Electrical and Computer Engineering Annual Scholarships and Puri Memorial Scholarships. The high-quality of the department's undergraduate education is attested by a number of awards resulting from national and regional competitions, e.g., First Place in Mid-Atlantic Collegiate Cyber Defense Competition, presentation in 7x24 Exchange National Conference, and Finalists for Qualcomm Innovation Fellowship.

Our ties with the industry have deepened significantly, with numerous companies offering student internships and engaging in partnerships to mentor our ECE senior capstone design program. Furthermore, ECE continues to be a highly sought-after major among employers across various industries. The foundational knowledge and skills our ECE students acquire make them exceptionally versatile and productive employees right from the start. The ongoing success of our alumni, whether they excel as scholars, industry leaders, or entrepreneurs, serves as a constant source of inspiration for both our students and faculty alike. I take great pride in the accomplishments showcased in the following pages. Judging by our department's trajectory, I am confident that we are poised for even greater achievements in the years ahead.

Yingying (Jennifer) Chen
Department Chair and Associate Director of WINLAB
Electrical and Computer Engineering

ecefaculty

Waheed U. Bajwa
Professor and Graduate Director
NSF Career Award, ARO YIP Award
Research Interests: statistical signal processing, high-dimensional statistics, machine learning, and networked systems.

Daniel Burbano Lombana
Assistant Professor
Research Interests: Dynamical systems and control theory with an emphasis on distributed network systems, collective animal behavior, swarm intelligence, and robot autonomy.

Yingying (Jennifer) Chen
Professor & Department Chair
Peter D. Cherasia Faculty Scholar, Associate Director of WINLAB, IEEE Fellow, Fellow of National Academy of Inventors, ACM Distinguished Scientist, NSF Career Award, Google Faculty Research Award, NJ Inventors Hall of Fame Innovator Award
Research Interests: Smart healthcare, internet of things (IoT), smart safety systems, cyber security and privacy, applied machine learning, hardware-software co-design.

Kristin Dana
Professor
NSF Career Award
Research Interests: Computer vision, robotics, pattern recognition, machine learning, convex optimization, novel cameras, camera networks, computer graphics, computational photography, illumination modeling.

Salim El Rouayheb
Associate Professor
NSF Career Award, Google Faculty Research Award
Research Interests: Information theory, distributed storage systems and networks, distributed coded data, data secrecy and wireless networks.

Zoran Gajic
Professor
Research Interests: Power control of wireless networks.

Sasan Haghani
Associate Teaching Professor and Undergraduate Director
Research Interests: Applied signal processing with applications in biomedical and environmental domains, network science, smart cities, renewable energy and smart grid, microgrids, home automation systems for smart grid, wireless sensor networks, and broadband communications.

Umer Hassan
Assistant Professor
Research Interests: Biosensing, point of contact medicine, microfluidics, global health.

Shirin Jalali
Assistant Professor
NSF Career Award
Research Interests: High-dimensional inference and inverse problems, computational imaging, machine learning, information theory, statistical signal processing

Mehdi Javanmard
Professor and Paul S. & Mary W. Monroe Endowed Faculty Scholar
NSF Career Award
Research Interests: Nanobiotechnology, BioMEMS, point of care diagnostics, biomarker detection, microfluidics, electrokinetics, applications of nanotechnology to medicine and biology.

Shantenu Jha
Professor
NSF Career Award
Research Interests: High-performance and distributed computing, computational and data-intensive science and engineering, large-scale cyberinfrastructure for science & engineering.

Dov Kruger
Associate Teaching Professor
Research Interests: High performance computing, high security networking, re-engineering software, more efficient programming models, explicit control of local data storage, innovative data compression, 3D manufacturing and engineering education.

Demetrios Lambropoulos
Instructor
Research Interests: Machine learning in wireless communications, mobile password security, wireless communications systems, and human-computer interaction.

Hang Liu
Assistant Professor
NSF Career Award, IEEE CS TCHPC Early Career Researchers Award for Excellence in High-Performance Computing
Research Interests: High-Performance Computing, Graph Analytics, Machine Learning, Numerical Methods

Yao Liu
Assistant Professor
NSF Career Award
Research Interests: Immersive streaming, mobile/cloud and edge computing, and distributed systems.

Narayan Mandayam
Distinguished Professor and Acting Director of WINLAB
Peter D. Cherasia Faculty Scholar, IEEE Fellow, Distinguished Lecturer of IEEE
Research Interests: Cognitive radio networks and spectrum policy radio resource management for smart city, privacy in IoT.

Ivan Marsic
Professor
Research Interests: Mobile computing, software engineering, computer networks.

John McGarvey
Associate Teaching Professor
Research Interests: Design and simulation of power electronic systems, control system modeling via both the classic and modern state-space techniques, and the design and testing of motor control systems.

Laleh Najafizadeh
Associate Professor
Research Interests: Functional brain imaging, brain connectivity, diffuse optical brain imaging, electroencephalography, cognitive rehabilitation, circuit design and microelectronics, ultra-low-power circuits for biomedical applications, data converters, system on chip, wireless IC design.

Jorge Ortiz
Assistant Professor
Research Interests: Machine Learning for cyber-physical systems, Intelligent infrastructure systems, smart health applications.

Athina Petropulu
Distinguished Professor
IEEE Fellow, NSF Presidential Faculty Fellow, Distinguished Lecturer of IEEE
Research Interests: Statistical signal processing, blind source separation, cooperative protocols for wireless networks, physical layer security, MIMO radar, compressive sensing.

Dario Pompili
Professor
IEEE Fellow, ACM Distinguished Scientist, Rutgers-NB Chancellor's Scholar, NSF Career Award, ONR Young Investigator Award, DARPA Young Faculty Award Research
Interests: Wireless networking, underwater communications, mobile edge computing, Internet of things, distributed robotics/autonomy.

Shriram Ramanathan
Professor & Rodkin Weintraub Chair in Engineering
NSF Career Award, DoD Young Investigator Award
Research Interests: Oxide quantum materials and devices; electromagnetic materials; brain-inspired electronics

Dipankar Raychaudhuri
Distinguished Professor
IEEE Fellow
Research Interests: Future network architectures and protocols, wireless systems and technology, dynamic spectrum access and cognitive radio, experimental prototyping and network research testbeds.

Anand D. Sarwate
Associate Professor
NSF Career Award, A Walter Tyson Award, Rutgers Board of Trustees Research Fellowship for Scholarly Excellence
Research interests: Machine learning, distributed systems and optimization with a focus on privacy and statistical methods.

Deborah Silver
Professor & Executive Director PSM Program
Research Interests: Scientific visualization, computer graphics.

Emina Soljanin
Distinguished Professor
IEEE Fellow and Distinguished Lecturer
Research Interests: Efficient, reliable, and secure storage and transmission networks, coding, information, and queuing theory

Predrag Spasojevic
Professor
Research Interests: Communication and information theory, signal processing and representation, cellular and wireless systems, Ad Hoc and sensor networks.

Maria Striki
Assistant Teaching Professor
Research Interests: analysis/design/optimization of data algorithms, statistical analysis, mathematical modeling, big data, data analytics, social networks, information systems, cybernetics, wireless-mobile-ad-hoc-cellular networks, (secure) routing, mobile computing, network-computer security.

Wade Trappe
Associate Dean for Academic Programs,
Professor & Associate Director of WINLAB
IEEE Fellow
Research Interests: Multimedia security, wireless security, wireless networking and cryptography.

Matteo Turilli
Assistant Research Professor
Research Interests: Parallel and distributed computing, software design for distributed infrastructures, computer science computer ethics.

Sheng Wei
Associate Professor
NSF Career Award
Research Interests: Hardware and system security, multimedia systems

Chung-Tse (Michael) Wu
Associate Professor and Associate Undergraduate Director
NSF Career Award, DARPA Young Faculty Award
Research Interests: Microwave and millimeter wave components and circuits, passive and active antennas and arrays, electromagnetic metamaterials, wireless sensors and RF systems.

Guosong Yang
Assistant Professor
Research Interests: Switched and hybrid systems, networked control systems, learning in game theory, cyber-physical systems (CPS), and network security.

Bo Yuan
Assistant Professor
NSF Career Award
Research Interests: Algorithm and hardware co-design, machine learning, signal processing systems, embedded and IoT systems.

Yuqian Zhang
Assistant Professor
Research Interests: Computer vision, machine learning, signal processing.

Zhao Zhang
Assistant Professor
Research Interests: High Performance Computing, Deep Learning, Distributed Systems, Cyberinfrastructure, Scientific Applications.

FAULTY EMERITUS

Sophocles Orfanidis
Associate Professor Emeritus
Retired 2023
Research Interests: Statistical and adaptive signal processing, Audio signal processing, Electromagnetic waves and antennas.

Hana Godrich
Associate Teaching Professor
Retired 2022
Research Interests: Distributed power systems, energy resources management and storage, energy efficiency, statistical and array signal processing, resource allocation optimization, distributed detection and estimation with application to smart grid, microgrids, and active sensor networks.

Yicheng Lu
Distinguished Professor Emeritus
Retired 2022
NSF Initiation Award, Rutgers Monroe Faculty Scholar, Faculty of the Year Award (2019)
Research Interests: Micro- and nano-electronics multifunctional oxides - based devices.

Roy Yates
Distinguished Professor Emeritus
Retired 2022
IEEE Fellow
Research Interests: Resource management in wireless systems, dynamic spectrum access and spectrum regulation, information theory for wireless networks and future internet architectures.

Richard Mammone
Professor Emeritus
Retired 2021
National Academy of Inventors
Research Interests: Communications pattern recognition, neural networks, signal processing, technology commercialization, processes involved with the innovation of new technology.

Jian Zhao
Professor Emeritus
Retired 2021
IEEE Fellow, NSF Initiation Award
Research Interests: Silicon Carbide (SiC) semiconductor devices, SiC JFETs, BJTs, MOSFETS, GTOs, high efficiency smart power integrated circuits, SiC sensors, UV and EUV detectors, SiC inverters/converters.

Grigore Burdea
Professor Emeritus
Retired 2020
NSF Initiation Award
IEEE Virtual Reality Career Award
Research Interests: Virtual rehabilitation, telerehabilitation, haptics virtual reality.

Sigrid McAfee
Associate Professor Emeritus
Retired 2019
Research Interests: Defects in semiconductors, nanotechnology, financial engineering.

Peter Meer
Distinguished Professor Emeritus
Retired 2018
IEEE Fellow, AMiner Most Influential Scholar
Research Interests: Statistical approaches to computer vision.

Peddapullaiah Sannuti
Professor Emeritus
Retired 2017
IEEE Fellow
Research Interests: Simultaneous internal and external stabilization of linear time-invariant systems in the presence of constraints.

Lawrence Rabiner
Distinguished Professor Emeritus
Retired 2016
IEEE Fellow, National Academy of Engineering, National Academy of Sciences, IEEE Kilby Medal, IEEE Piore Award, IEEE Millennium Medal
Research Interests: Digital signal processing, digital signal processing, speech recognition, speech analysis, speaker recognition, and multimedia.

David Daut
Deceased Professor, 2015
Research Interests: Comminications and information processing, stochastic processes in communication, detection and estimation theory, multidimensional digital signal processing, optical communication systems

Michael Bushnell
Professor Emeritus
Retired 2013
IEEE Fellow
Research Interests: computer aided design (CAD) of very large scale integrated (VLSI) circuits

Paul Panayotatos
Deceased Professor, 2013
Research Interests: solar cells and optical interconnects

Michael Caggiano
Professor Emeritus
Retired 2010
Expertise: Electrical packaging, microwave packaging, analog circuit design, digital circuit design, digital circuit and logic design.

studentnews

ECE team won Best AI Innovation prize in the TE AI Cup 2022-23

The Electrical and Computer Engineering (ECE) Department at Rutgers is proud to announce that five of our doctoral students have been awarded the prestigious Best AI Innovation prize in the TE AI Cup 2022-23. The team, consisting of 5 ECE doctoral students—**Yung-Ting Hsieh, Chuanneng Sun, Zhuoran Qi, Khizar Anjum** (all from Prof. **Dario Pompili**'s CPS Lab), and **Ke Xia** from Prof. **Sheng Wei**'s lab—made significant contributions to real-world Artificial Intelligence (AI) applications, impressing the TE jury and earning recognition among their international peers.

The Rutgers team proposed novel neural network architectures and designed signal pre-processing methods to predict Channel Operating Margin (COM) parameters based on IEEE standards, which was a time-consuming process when using traditional model-based MATLAB scripts. Their work demonstrated significant potential savings in tester time and capital expenditure in high-speed tests, estimated at $12.5 million.

The team's success in the TE AI Cup, an international event hosted by TE Connectivity—an American Swiss-domiciled technology company specializing in connectors and sensors—underscores the excellence of our students and their ability to apply advanced AI practices in a competitive environment. The competition engaged 40 teams from 25 universities globally.

ECE Admitted Student Tours

Admitted Student Days offer an enriching experience to newly admitted students, providing them with a comprehensive overview of the school, as well as in-depth information about the curriculum, student life, and their departments of interest. In Spring 2023, the ECE department organized a series of engaging events exclusively for admitted students. These included in-person admitted student days, a special admitted women's day, an open house, captivating lab tours, and virtual admitted student showcases with department info sessions.

The Admitted Women's Day was a remarkable occasion, providing female engineering students with a unique set of activities aimed at giving them a taste of what it is like to be part of the engineering community. Through interactive breakout sessions, engaging tours, networking lunches, and a resource fair, the students got valuable insights into their potential future at the university. Parents were also welcome to join the resource fair and anticipate in an alumni panel.

During the open house events, which encompassed all majors, schools, and programs for admitted students across Rutgers, the diverse opportunities available were showcased. This included research prospects, extracurricular activities, and the vibrant campus life. Families had the opportunity to gain a deeper understanding of the university's culture, values, and unwavering dedication to academic excellence.

In particular, the ECE department went above and beyond during the open house, conducting parallel lab demonstrations on fascinating topics such as microcontrollers, wireless power transfer, neural networks/machine learning, and virtual reality. Additionally, the IEEE Student Chapter presented three captivating demos. Moreover, the day was enriched with three informative departmental information sessions, open to both students and parents, providing invaluable insights into the department's offerings.

These events proved to be a fantastic chance for students and their families to explore our campus's vibrancy, our state-of-the-art facilities, and our engaging academic programs. Participants had the opportunity to interact with esteemed faculty, friendly staff, and current students who shared their experiences and offered valuable perspectives. Overall, the Admitted Student Days and open house events left attendees inspired and excited about the boundless opportunities that await them at Rutgers.

Rutgers Team Wins First Place in Mid-Atlantic Collegiate Cyber Defense Competition

A team of 12 Rutgers Security Club students made up of eight competition members and four alternates bettered 32 teams in February's virtual Mid-Atlantic Collegiate Cyber Defense Competition (MACCDC) qualifiers.

"We believe this is the first time a New Jersey team has won first place in the qualifiers for MACCDC, which is huge," says electrical and computer engineering major **Harris Ransom**.

"The universities we beat, many of which have dedicated and established cybersecurity programs, included Penn State, Virginia Tech, University of Virginia and the University of Maryland."

On March 30-April 1 Rutgers team advanced to the in-person MACCDC finals. The winning team moved on to the national CCDC competition.

To compete in the six-hour contest, the students were given seven servers to manage and protect against a team of hackers that was working to breaking the servers and shut them down.

Putting Rutgers on the Map as a Cybersecurity Contender

"The fact that we came in first puts us in a good position for the regional finals, but we're still going to be putting in a lot of work studying and preparing for the finals to give us the best chance of moving on to nationals," Harris explains.

"Our win also increases the opportunities for Rutgers students to explore cybersecurity and develop their skillsets. By progressing in this competition, we've also put Rutgers on the map for employers in the Mid-Atlantic – the nation's most concentrated cybersecurity job market."

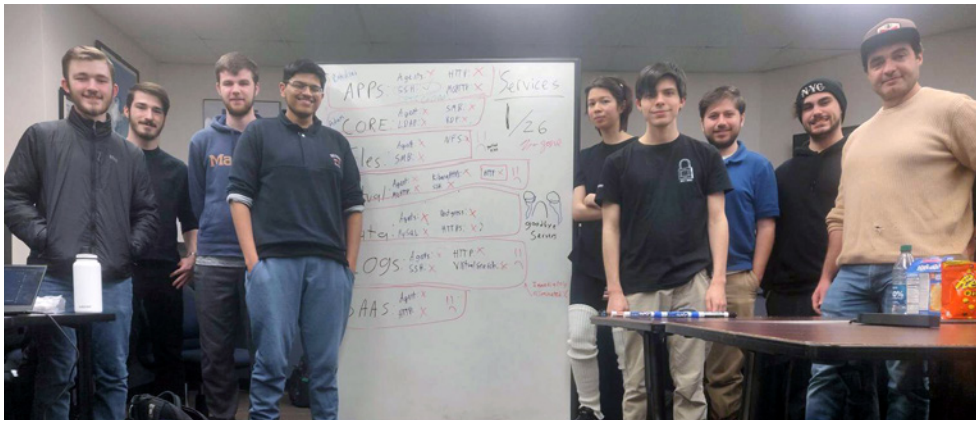
The win also earned the team an invitation to a selective job fair with recruiters from competition sponsors such as Palo Alto Networks, Battelle Institute, Raytheon National Cyberwatch Center, Cisco Networking, CrowdStrike, and the CIA.

Learning about Cyber Defense

The primarily self-taught team, according to Harris, enjoyed drawing on theoretical cybersecurity knowledge as well as practical real-word systems security in the competition.

"It's a great way to take what you've learned through studying and apply it to actual time-sensitive situations. The competition simulates a business environment, which is great not only for career experience, but also for personal learning," he notes.

"Finding new ways to defend computer systems and network infrastructure is not only interesting and exciting, but it's also a valuable 21st-century skill to have. Our win was truly a team effort and we're all looking forward to seeing what we can do at the MACCDC finals," he adds.

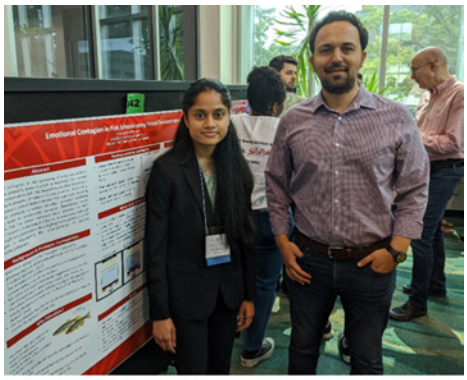


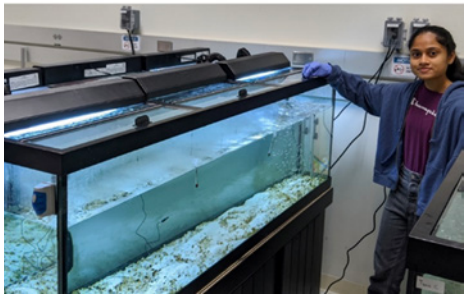
Rutgers Capstone Team attends 7X24 Exchange National Conference

The 7x24 Exchange National Conference, The leading knowledge exchange for Data Center, IT and Mission Critical professionals was held in Orlando, FL, this year in June. For the first time, a team of Rutgers students attended this conference, where they presented their poster on "Implementation of Thermoelectric Generators Within Mission Critical Facilities". This was a Capstone project conducted by students **Ashwin Gokhale, Ashwin Anand** and **Jonathan Golba** under the supervision of Prof. **Wade Trappe** and Mr. **Don Bachman** in Spring 2023. The project was very well received by attendees at the conference. This provided great visibility of Rutgers ECE and largely motivated our undergraduate students. Congratulations to the students and **Sasan Haghani** who led the student team to attend the conference!

The ECE Department at Rutgers wishes to acknowledge the support of the 7x24 Exchange Metro NY Chapter with special thanks to **Don Bachman** and **Heather Bacci** for their continued support.

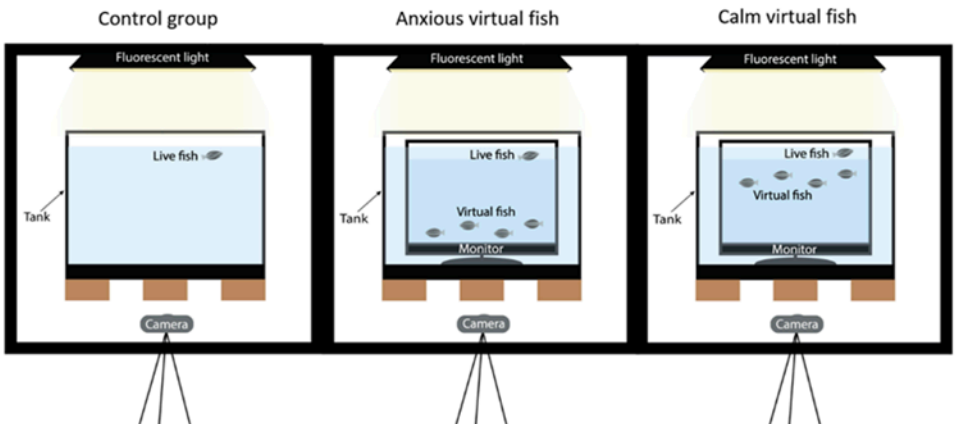
Diving into Emotions: An Undergraduate Student's Exploration of Emotional Contagion in Zebrafish





When someone smiles at us, it elicits a natural and instinctive response to smile back, as we are inclined to mirror the emotions of the other person. This phenomenon is known as emotional contagion and is considered one of the most ancient forms of empathy. The transmission of emotions can be as contagious as the spread of a virus, and its impact on individuals can vary depending on the nature of the emotion and the social context. For instance, positive emotions within human groups have been found to foster cooperation and reduce conflict in workplaces. Conversely, studies have shown that burnout is more likely to spread among teachers who frequently share work-related problems with each other. Despite being a pervasive phenomenon across different species, the mechanisms underlying emotional contagion remain elusive. Emotional contagion has predominantly been studied in mammals, leaving fish relatively unexplored, as they are often considered to have fewer cognitive and sentient capacities than other species. However, recent findings have unveiled a fascinating aspect— oxytocin, a neurohormone known for its role in social bonding and empathy in mammals, also plays a role in fear transmission in fish. This discovery suggests that the mechanism of emotional contagion may have evolved earlier in the evolutionary tree, considering that even fish, one of the most ancient groups, can exhibit such responses. **Sahana Senthilkumar**, a freshman student from the School of Arts and Sciences Honors Program, has been investigating the propagation of emotions in fish schools. Through the 2023 Aresty Summer Science Program, Sahana spent ten weeks in the Swarm Intelligence Lab in the ECE department, led by Assistant Professor **Daniel Burbano**. To understand emotional contagion, Sahana has been conducting experiments with live fish, utilizing signal processing tools and tracking methods, statistical analysis, and information-theoretic tools for causal analysis. The main hypothesis guiding her work has been that fish possess the ability to transmit emotions to one another. To test this, she has utilized a virtual demonstrator fish approach, in which virtual fish shoals exhibiting anxiety-like behavior are shown to live zebrafish. Anxiety in zebrafish is quantified in terms of geotaxis, an innate behavioral response whereby fish prefer to swim at the bottom of the tank (see Figure). Zebrafish, a tropical freshwater species, has become an invaluable model organism in various scientific fields. In translational neuroscience, researchers utilize zebrafish to unravel the complexities of brain function and dysfunction. Moreover, it has shown great promise in biomedical research, facilitating the study of human diseases and drug discovery. Zebrafish's popularity stems from its easy maintenance, rapid reproduction rate, and cost-effectiveness, making it efficient for diverse studies. Additionally, its high similarity to humans and the availability of a fully sequenced and annotated genome enables valuable comparative research with implications for human health. We hypothesize that emotional contagion within zebrafish schools will lead to a noticeable influence on the behavior of live fish, mirroring the behavior observed by the virtual stimulus. Our data-analysis of time-series data of fish position, speed, turn rate, and acceleration, strongly suggest that the virtual demonstrators effectively transmit their emotional state to bystander zebrafish. Our results lead to a recent publication in the journal Behavioural Processes [1] and they highlight the potential of fish research in elucidating the underpinnings of complex spreading processes that can be extrapolated to study other systems such as social networks (how news or viral videos propagate in a population) and power grids (how instabilities propagate in a power grid, causing blackouts).

[1] Burbano, Daniel, Sahana Senthilkumar, and M. Chiara Manzini. "Exploring emotional contagion in zabrafish: A virtual-demonstrator study of positive and negative emotions." Behavioural Processes 213 (2023): 104961



Meet an ECE Student

Adam D'Souza

I'm **Adam D'Souza**, and I'm an ECE junior on the electrical engineering track, pursuing a minor in math. I'm the current Co-President of Rutgers IEEE and a research assistant in the CORE computer vision lab, with an interest in robotics hardware and software.

As a freshman in the school of engineering, I wasn't sure which engineering major I wanted to pursue. I knew I had an interest in creating things that would have real-world applications and impact for people in need. I tried participating in a few different engineering organizations during the fall semester, but I didn't find any that gave me a strong sense of community or let me develop my technical skills with hands-on projects. In the spring semester, I joined the Rutgers Institute of Electrical and Electronics Engineers (RIEEE), and immediately found myself surrounded by a diverse group of students who all shared my interests in technology. I joined the VEXU robotics division, and enjoyed the design process and competition environment that the division provided. My experience at RIEEE convinced me to commit to the ECE program and run for Internal Vice President (IVP) of the organization.

During sophomore year, I took on additional responsibilities within RIEEE as IVP. I worked closely with the ECE department to run tours of the RIEEE lab, headed our undergraduate mentorship program, and organized a VEX Robotics Competition for Monroe Township High School. I gained a lot of experience in leadership and event planning as Internal Vice President, all while serving both the Rutgers community as well as the greater New Jersey robotics community. I also became a Learning Assistant (LA) for Analytical Physics I, for both fall and spring semesters. Teaching has always been one of my passions, and I loved getting to see my students learn and improve throughout the semester. While interacting with other students in RIEEE, as well as the professor I worked with as an LA, I realized that research would be a perfect way to combine my interests in robotics with my desire to improve the world around me. I contacted Professor **Kristin Dana**, who runs the ECE computer vision laboratory, because I found her work on socially cognizant robotics incredibly interesting. After seeing my experience within RIEEE robotics, Professor Dana hired me as a summer research intern through the Wireless Information Network Laboratory (WINLAB).

A. D'Souza

At WINLAB, I worked with the AgileX LIMO, a small unmanned ground vehicle. I worked with system hardware and software to set up LIDAR and camera functionality, so the robot could be used in mapping and navigation experiments. I also worked on fixing the Robotic Operating System (ROS) pipeline on the robot so it could run Simultaneous Localization and Mapping (SLAM) algorithms and SLAM-based navigation algorithms. Additionally, the project I was hired for had to do with topological mapping and navigation. This entails creating maps of the world relying only on important points and their visual information, and navigating semi-autonomously using those maps. Over the summer, I developed ROS-integrated Python scripts that used the LIMO's odometry and camera data to dynamically store important points, and images associated with those points, in a graph network that could be saved and read later.

Although I am passionate about electrical engineering and robotics, they aren't my only interests. Alongside math and science, art has always been one of my hobbies. When I'm not studying, managing RIEEE, or working, I invest my time in digital art. I am a member of the Rutgers University Animation and Illustration Club (RU Animation), where we produce an animated short film each year. I have contributed character designs, storyboards, revisions, and animation for RU Animation since freshman year, and it provides a great creative outlet beyond engineering.

This year, I am excited to be the current Co-President of RIEEE along with my other Co-President Shreya Pandey. We hope to keep the same technical and professional environment our organization provides, while creating a tighter-knit community for our members. Alongside my position in RIEEE, I am continuing as a research assistant for Professor Dana. I will be continuing my work on the topological mapping project with a new robot the lab has acquired. I'm very glad to be a student in the Rutgers ECE department and I cannot wait to see what the future holds for this year.

Mahtab Kokabi

I'm currently on a fascinating journey as a third-year Ph.D. student in Electrical and Computer Engineering (ECE) at Rutgers University. My focus is on bioMEMS, microfluidics, and biosensors. These areas combine technology and biology, which really interests me and shows how different fields can come together to make something new.

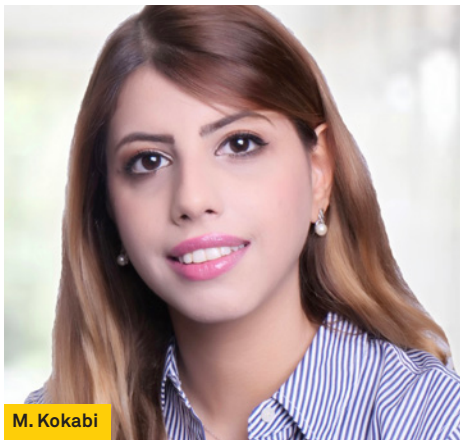
Before Rutgers, I earned my master's degree from the University of Massachusetts Amherst in electrical and computer engineering. It was there I started to understand how electronics and computers can work with tiny tech, called nanotech-nology. What I learned during that time has helped me a lot in my current studies. The study of nanotechnology allowed me to explore how we can manipulate and control materials at the nanoscale, which is at the level of individual atoms and molecules. This knowledge became a solid foundation upon which I could build my understanding of

CONTINUED ▸

Meet an ECE Student (continued)

bioMEMS, microfluidics, and biosensors—areas where precision and control at the nanoscale are crucial. It equipped me with the fundamental principles necessary to comprehend the intricate interplay between electronics, computing, and the cutting-edge field of nanotechnology.

My educational path began during my undergraduate years at AmirKabir University, where I initially ventured into computer engineering. I was drawn to the combination of computer hardware (the physical components of computers) and software (the programs that make them run). This unique blend piqued my curiosity and set me on a path of exploration. I wanted to understand how these components could be harnessed to create practical solutions, particularly in the context of biosensors.



M. Kokabi

In 2021, I decided to take a big step and aim for a Ph.D. in ECE at Rutgers. It's been a dream of mine to be a top researcher in this field. I was happy to get in and even more excited to work with Professor **Mehdi Javanmard**. Together, we're working on projects that can quickly test for diseases. One project we're really proud of is a tool that can detect various cancer cells. Doing hands-on research has been a great experience for me. Running tests, figuring things out, and looking at data helps me learn and think better.

My desire to study at Rutgers became a reality in 2023 when I was awarded the prestigious Puri Memorial Scholarship. This recognition was a significant moment in my academic career. The scholarship not only served as validation of my hard work and dedication but also fueled my motivation to excel further in my studies and research. It was a moment of great pride, and it deepened my commitment to making the most of my educational experience at Rutgers. The Puri Memorial Scholarship is not just a financial honor; it symbolizes a belief in my potential and a vote of confidence in my ability to contribute meaningfully to my field of study. With this recognition, I felt a heightened sense of responsibility to live up to the expectations associated with the scholarship. It became a source of inspiration, driving me to strive for excellence in my research and academic pursuits.

As I progressed further into my Ph.D. research journey, I had the privilege of achieving notable milestones and recognition for my work. One of the most significant achievements came in 2021 when I was honored with the National Science Foundation Graduate Research Fellowship (NSF). This prestigious award marked a pivotal moment in my academic and research endeavors, and it signified not only a personal accomplishment but also a recognition of the potential impact of my research on the broader scientific community.

As I continue my academic journey at Rutgers, I am not only grateful for the opportunity to study at this esteemed institution but also eager to make the most of this experience. The Puri Memorial Scholarship serves as a reminder of the importance of dedication and hard work in achieving one's goals, and it reinforces my determination to reach new heights in my academic and research endeavors. With the support of Rutgers and the motivation instilled by this scholarship, I am confident that I will continue to thrive and contribute significantly to my chosen field.

Zhuolun Meng

I am a fourth-year Ph.D. candidate in the Rutgers University ECE department, specializing in Solid State Electronics. Before joining Rutgers ECE, I obtained my Master's degree from the University of Florida also in ECE. I am part of the NanoBioElectronics Lab, which is under the direction of Dr. **Mehdi Javanmard**.

Z. Meng

My research area is biomedical devices and my research interests span biosensing, microfluidics, and bioMEMS.

Biomedical devices is not a traditional direction under electrical and computer engineering, it is a really interdisciplinary field that attracted me to dedicate myself to this area because I would like to get trained from a comprehensive range of knowledge and use my capability to help humans and creatures. Back in my study at the University of Florida, I was researching implantable neural electrodes for the peripheral nervous system. After joining Rutgers, I transitioned my research to non-invasive biomedical devices. My primary focus includes two projects: rapid diagnostics using our innovative biomedical devices called "Nanowell", and the development of disposable biosensing devices. In the Nanowell project, our lab has invented and microfabricated Nanowell, a device capable of absorbing biological samples, such as antibodies and proteins, on the surface of Nanowell leading to changes in its impedance. When Nanowell absorbs targeted antibodies, any bonding with the targeted protein causes a change in impedance. The absence of a change indicates the absence of targeted proteins in the samples. With Nanowell, we have created a platform for rapid, accurate, quantitative, and label-free diagnosis of potential diseases. Currently, I am using Nanowell for coral samples to assess the healthy status of coral samples, and for COVID samples to develop a rapid breathalyzer platform for COVID diagnosis.

For the disposable biosensing devices project, I have pioneered a computer

vision-enhanced platform featuring a novel sensor technology. This innovative platform leverages consumer electronics to measure the colorimetric changes of analysis strips. It achieves this through precise illumination control and illumination monitoring within a 3D-printed opaque smartphone chassis and embedded illumination system. The embedded illumination system, constructed using an Arduino Uno, incorporates two LEDs for illumination and a photoresistor for illumination monitoring inside the opaque chassis. This design ensures a consistent illumination environment inside the opaque chassis, a crucial factor influencing the accuracy of colorimetric measurements. The sensor itself is designed with cost-effectiveness and user-friendly in mind, utilizing materials such as medical-grade tapes, and microscope glass slides resulting in a cost as low as $0.24 per test. This versatile platform has undergone successful validation for glucose and hemoglobin diagnostics, showcasing its flexibility and transferability for various assays and reagents.

I was selected as the recipient of the Paul Panayotatos Scholarship in 2023 Summer because of my hard work and dedication to academic excellence in sustainable energy, namely the project for diagnostics of coral health situation.

I am so grateful that I had the opportunity to pursue my Ph.D. at Rutgers ECE. Rutgers has helped me develop personally and professionally. Really appreciate the support and help from my advisor, Mehdi Javanmard, and all the ECE staff on my journey.

Shreya Pandey

Hi, I'm Shreya, and I am a rising junior double majoring in Electrical & Computer Engineering and Computer Science. My journey with Rutgers IEEE has been nothing short of transformative. I discovered this organization during my freshman year, and what drew me in was the promise of hands-on experiences beyond the confines of the classroom. As a freshman, I joined the organization as a part of the Intelligent Ground Vehicle Competition (IGVC), where I had the opportunity to compete in an autonomous vehicle competition, where I worked closely with a dedicated team to program our vehicle to navigate a restricted area. Consequently, I was also the freshman representative for IEEE this year, through which I immersed myself in the PR Committee. The PR committee truly shaped my journey at Rutgers, helping me develop strong networking and leadership skills. Through the skills that I gained as a freshman representative and PR Committee, I was elected the External vice President in my sophomore year. In this role, I had the privilege of connecting with accomplished alumni from both IEEE and the Electrical and Computer Engineering (ECE) field. Through close collaboration with the ECE Department and partnerships with organizations like the Society of Women Engineers (SWE), I contributed to a wide range of events from Student Tours, Admitted Women's Day, Rutgers Day, Capstone, and many more.

S. Pandey

The leadership and communication skills I cultivated through these experiences have proven instrumental in setting a solid foundation for my professional journey. Beyond my academics, I've been heavily involved in research at Rutgers for the past two semesters. From exploring the immersive world of virtual reality in the Rutgers Robotics and Automation Lab to delving into the intricacies of Adaptive Learning research this summer under the guidance of Prof. Jallali, I've had the privilege of delving deep into cutting-edge research that combines my passion for technology with real-world applications. Looking ahead to my professional career, I aspire to apply the knowledge and perseverance I've gained as an engineering student to further develop my technical skills and tackle complex challenges as a Software Engineer

Batoul Taki

I am a PhD candidate in the Electrical and Computer Engineering (ECE) department here at Rutgers. I am a member of INSPIRE lab, under the direction of Prof. **Waheed Bajwa**. Before joining Rutgers in 2018, I received my B.S. in Computer and Communications Engineering from the American University of Science and Technology, Beirut. My current research interests include exploring tensor models in theoretical and applied machine learning problems. Briefly, tensor data (or multi-dimensional data) is ubiquitous today in forms like MRI images, video, and social networks. But traditional machine learning methods can destroy the natural structure of this multidimensional data and lead to poor model performance. A core focus of my research is to propose and explore suitable tensor decompositions that preserve tensor structure and provide a more flexible model, which ultimately leads to a model's enhanced ability to predict outcomes in high-dimensional settings. Such work also includes developing algorithms that prove the efficacy of our proposed methods over standard approaches and state-of-the-art techniques and evaluating our methods on real medical imaging data. Another key element of my research includes developing theoretical insights into the proposed methods.

B. Taki

CONTINUED

Meet an ECE Student (continued)

Throughout my time at Rutgers, I have had the opportunity to collaborate with other university departments - such as the Biomedical Engineering department - and relevant researchers in the industry - such as AT&T Labs. I am also a Pre-Doctoral Leadership and Development Academy (PLDA) Fellow at the Center for Organizational Leadership at Rutgers. PLDA is a program designed to provide doctoral students with the supplemental knowledge and skills needed for academic and administrative leadership roles. I have found that cross-organizational collaboration has greatly enriched my research experiences and has led to meaningful research outcomes, which have subsequently been published in high-quality research journals and conferences such as Transactions on Machine Learning Research and IEEE Conference on Signals, Systems, and Computers.

In addition to this, I have been awarded the ECE Teaching Assistant Award and ECE Student Development Award. I was also a Summer Teaching Fellow for Probability and Random Processes. Taking on teaching and mentoring roles at Rutgers has allowed me to appreciate the diverse backgrounds of students and their unique life experiences. For me, teaching and mentoring are some of the more fulfilling aspects of academic service, and I always look forward to meeting former students and hearing about their success stories. I hope to have been an aid in their journey towards their achievements and empowered them towards their successes. I am very grateful to the faculty that have adorned my academic journey thus far, to the staff whose acts of kindness have gone a long way, and to the students who have been an unending source of inspiration and entertainment.

Veronica Vergara

Hello! I'm a student in the BS/MS Program, having completed my Bachelor's in May with a minor in Military Science. Now pursuing my Master's, I'm focusing on Machine Learning and earning a certificate in Cybersecurity. As an Air Force ROTC Cadet, I'm preparing to become an Officer in the US Space Force next year.

My journey began at Rutgers in the Honors College, where the Forum course inspired me to use my knowledge for a greater purpose. My team proposed a business solution to address malnutrition in South America, a crisis that has directly impacted my extended family.

Amidst the challenges posed by COVID-19, I transitioned to remote learning and helped support the transition to online education for non-profit youth organizations in my community. I also continued my involvement as a Technical Mentor with the CyberPatriot program National Youth Cyber Defense Competition.

Building on this experience, I participated in the Air Force Institute of Technologies' "Immersive Cyber Education" program, deepening my interest in Cybersecurity. I also spent time at the Air Force Academy's "Field Engineering Readiness Laboratory", where I contributed to the construction of houses for the Navajo Nation, appling my electrical engineering knowledge from the ECE department.

V. Vergara

Continuing to integrate my passions into my academic path, my Senior Design Capstone team and I worked on a project for Novo Nordisk under the supervision of Professor **Sasan Haghani**—a Digital Companion App for Diabetics, leveraging machine learning and an AI chat-bot to personalize the user experience. This project showcased our teamwork and innovation, earning us 4th place in the ECE Expo Event.

In May, I graduated with High Honors from the ECE department as an Honors College Scholar. I deeply appreciate the dedicated professors who prioritize their students' educational journey, fostering the growth of future engineers contributing to society.

Two professors, in particular, played a significant role in preparing me for the Advanced Course in Engineering (ACE) Cyber Leadership Development internship with the Griffiss Institute and Air Force Research Lab. Professor **Wade Trappe**'s "Intro to Information and Network Security" class introduced me to essential cryptography concepts, providing a strong foundation that boosted my confidence in tackling my initial ACE assignments.

Additionally, Professor **Sheng Wei**'s "Hardware and System Security" class equipped me with a meaningful understanding of topics like Physically Unclonable Functions, Hardware Trojans, and Memory Attacks. These insights were invaluable not only for my ACE papers and presentations but also for helping my peers, some of whom had computer science backgrounds, grasp these complex subjects.

ACE was a transformative experience, immersing me fully in the realms of cyber warfighting, leadership studies, application, and research. It was enlightening to work with select military and civilian staff and students from universities in the US, such as MIT, Harvard, GeorgiaTech, and many others, as well as abroad from the United Kingdom and Switzerland, representing the global joint effort being made in the cyber domain.

Each week presented unique challenges, requiring us to balance responsibilities such as paper writing, presentations, research and development, simulated military operations, and physical fitness. These demands tested not only my mental agility but also pushed me physically to become a more well-rounded professional, leader, and warrior. I was honored to receive recognition as a Distinguished Graduate and "Leader of Consequence" award recipient.

Balancing academics with Air Force ROTC has been a fulfilling challenge. At Rutgers Detachment 485, I've served as the Cadet Wing Vice Commander, overseeing training for over 70 cadets. I've also been an active member of our Arnold Air Society Squadron, engaging in community service and professional development activities related to national defense. With my eyes set on the sky, I am developing training plans for our

i5 Space squadron to teach students about the Space Domain. One of my proudest achievements is receiving the Air & Space Forces Association Outstanding Cadet of the Year Award for exceptional leadership and academic standing.

Next summer, I will embark on my career in the US Space Force as a Second Lieutenant, serving the mission of securing our nation's interests in space. As a Developmental Engineer, I will ensure our nation relies on innovative and superior technology. It's a dream come true to see my childhood fascination with space becoming a reality. "Space, the final frontier" - Star Trek.

Minning Zhu

Ever since high school, I have been deeply passionate about understanding and exploring the truths of our world. Now, I work as a postdoctoral researcher in the Rutgers Electrical and Computer Engineering department, exploring, and collaborating with intelligent colleagues to pioneer cutting-edge technologies in analog computing and sensing. My journey began at the Harbin Institute of Technology with a B.S. in Optical Information Science and Technology. Eager to delve deeper, I pursued an M.S. in Optics from Shanghai University. My academic path then led me to Rutgers University, where I obtained my Ph.D. in Electrical and Computer Engineering.

My endeavors in electrical engineering are driven by passion, curiosity, and a simple willing to build magical technology with my hand. During my Ph.D. studies, I established a solid foundation in both theory and experimentation. My grounding in electrical engineering spans brainstorming, modeling, simulation, fabrication, and testing of novel RF circuits, using tools such as the vector network analyzer, spectrum analyzer, probe station, microwave anechoic chamber, wire bonder machine, and software like MATLAB, HFSS, and ADS. Under the guidance of my advisor, Prof. **Michael Wu**, we successfully designed and fabricated a series of novel reconfigurable distributed amplifier (DA)-based negative group delay (NGD) circuits. This significantly enhances the tuning capabilities for amplitude, overall phase, and NGD responses, enabling flexible S-parameter synthesis with an expanded reconfigurable range. Such a reconfigurable circuit is invaluable for designing compact antenna feedlines and impedance matching for electrically small antenna (ESA) because of its synthesis capability for tunable negative capacitance and inductance. In one project, we combined the NGD circuit with a composite right-left-handed (CRLH) leaky-wave antenna, realizing a wideband squint-free leaky-wave antenna that demonstrates dispersionless fast-wave characteristics within the NGD frequency band. These innovations, among others, have been recognized in prestigious publications and conferences.

M. Zhu

In my postdoctoral role, I am advancing technologies to make the NGD circuit smaller and more potent. With ample funding and opportunities, we have been exploring various platforms, notably GaAs, GaN, and CMOS, to create increasingly efficient devices. Part of the postdoc training allows researchers to explore fields beyond their Ph.D. studies and identify future research trajectories. Lately, I've been working on an RF processor with reconfigurable analog computing capability. This can execute arbitrary matrix-vector multiplication, proving promising for energy-efficient and ultra-low delay in-sensor/near-sensor computing, especially in the RF domain. Additionally, I am keen on investigating energy-efficient neuromorphic circuits based on in-memory learning, which could potentially shape a future permeated by AI services. ECE deparment's diverse faculty and their stellar academic backgrounds have been pivotal in my growth. For instance, I learned a lot about how memristor—artificial neuron synapse work when collaborate with Prof. **Shriram Ramanathan** and Prof. **Aaron Milstein** (Rutgers, Neuroscience and Cell Biology Department) in a project making one-shot learning based on memristor possible. I enriched my modern machine learning knowledge in collaboration with Prof. **Bo Yuan** and his team in exploring possibilities of utilizing tensor-train technology to make large-scale analog computing processor. Rutgers also highly supports research collaborations between different departments and different research institutes for interdisciplinary studies, for example, we and Prof. **Jedediah Pixley**'s group (Rutgers, Physics and Astronomy Department) are trying to verify topologic insulator phase shifting on a circuit design, and Prof. **Austin Chen** (University of California, ECE Department). I look forward to what lies ahead and am always eager to collaborate, learn, and innovate.

I've greatly valued my conversations with our world-class faculty members on a wide range of topics spanning science and life. These discussions have not only enriched my knowledge but also broadened my perspective on the world. I would strongly encourage current Ph.D. students to engage more with them and absorb their insights. Beyond academia, I've taken leadership roles in organizing various activities. Serving as a teaching assistant taught me invaluable lessons in communicating with and teaching international students. Through this role, I enhanced both the students' experience and my own, breaking down language barriers and fostering cultural understanding. My involvement in assembling and testing our microwave anechoic chamber tested both my technical acumen and leadership skills. At Rutgers, I've had the privilege of hosting lab tours and introducing the public to our work during open houses. The support from our exceptional staff team always ensures things to work smoothly and magically, I learned a lot from you.

I am eager to see what the future holds for my research and the potential subjects that will define my career trajectory. As Dr. Seuss aptly said, "Sometimes you will never know the value of a moment until it becomes a memory."

Rutgers executes exclusive license with AI startup developed at school

By Matthew Fazelpoor

Rutgers School of Engineering professor Kristin Dana and double graduate Eric Wengrowski

On March 30th, the Rutgers University Office for Research announced it is executing an exclusive license with Steg.AI, a startup based on artificial intelligence that was developed at Rutgers and founded by double graduate **Eric Wengrowski** and School of Engineering professor **Kristin Dana**.

Steg.AI hopes to use its innovative security software to help businesses and organizations protect their media assets and intellectual property. Its mission is to establish a level of provenance for all digital media, using patented steganography technology to place attribution into content so that users can be sure that what they are engaging with is real and trustworthy.

The technology is the brainchild of Wengrowski, who received his bachelor's degree and doctorate in electrical and computer engineering from Rutgers. He worked with Dana as a senior on his capstone project and she invited him to join her lab as a Ph.D. student in the Electrical and Computer Engineering Department.

"The technology we developed is information security software that businesses can utilize to protect their media assets and intellectual property (IP)," said Wengrowski in a press release. "We leverage a research technology developed along with some of my co-founders called light field messaging, which is an advanced forensic water marketing technique that adds information to files like images, video, pdfs, gifs, etc. that is invisible to us but visible to our algorithms or even a camera. This information is essentially embedded into these files as forensic tracers for our customers, so they can figure out who is doing what their assets."

The research was conducted by Wengrowski, Dana, and a team that focused on the ability to transmit information with light in a way that is only visible to a machine or a camera. They were then able to tailor that work after meeting with some companies.

"We participated in the National Science Foundation's (NSF) national I-Corps program and received feedback regarding the real-use cases of the technology, and we realized that we had a very compelling value proposition for information security," said Wengrowski. "We learned that by talking to companies like Meta, Getty, and Adobe, and then putting two and two together about how we could solve those problems."

"We were able to leverage recent deep learning advances to build a robust solution to the pattern embedding problem," said Dana. "By taking part in the Bay Area I-Corps in the Winter Cohort 2019, we were able to dedicate significant time and effort to in-person customer discovery to explore commercial needs for our technology."

The development of Steg.AI comes at a critical time with the rapid rise of AI technology—which also increases the use of deepfakes or other misleading content using artificial intelligence.

Steg.AI was able to parlay its technology into funding from a variety of sources. It recently closed a seed fundraising deal with leading cybersecurity venture investors.

The Rutgers Office for Research's Innovation Ventures filed patent applications for the technology in the United States, European Union, China, Japan, and India, and helped handle the execution of the exclusive license to Steg.AI.

"Steg.AI is another example of Rutgers excellence and how the university is leading the way into the future," said Deborah Perez Fernandez, acting executive director for Innovation Ventures. "The rise of deepfakes, mis- and disinformation highlights the importance of the potential impact that the technology developed by Dr. Wengrowski and Dr. Dana can have around the world."

2023 ECE Capstone Expo Award Winners

Rutgers ECE had a very successful Capstone EXPO in Spring 2023 with a record number 277 students in 71 teams. Students completed a wide variety of projects in the areas of ML/AI, drones, virtual reality, computer vision, robotics, app development for healthcare applications, hardware design and finance. 49 teams' projects were a combination of hardware and software design, while 22 teams completed software-based projects. The figure below shows a map of keywords from student projects.

Many advisers from the ECE Department undertook students' guidance this year. We are grateful to the ECE faculty who supported the program and advisers inside and outside of Rutgers who contributed their time and effort to help our students, including co-advisors from the Departments of Mechanical and Aerospace Engineering, Music, Food Sciences, the School of Environmental and Biological Sciences, Novo Nordisk and Siemens.

We would like to acknowledge the support of the following industry sponsors: 7x24 Exchange Metro New York Chapter, Novo Nordisk, Lockheed Martin and the Galbiati Family for their generous contributions to the ECE Capstone Program!

A panel of 60 judges from industry and academia joined the Capstone EXPO to select the top 10 projects. In addition, three special awards (best in research, best in impact, and best in commercialization) and three Galbiati Entrepreneurial awards were selected by the judges. The judges were very impressed with the quality of the capstone projects and the enthusiasm with which the students presented their work. The Rutgers ECE Department wishes to sincerely thank the panel of judges for their effort and the time taken from their busy schedules to support and celebrate our students' achievements.

Special thanks to the ECE Staff: Pam, Arletta, John, Kevin and Chris for helping to make this year's EXPO such a success! This would not have been possible without their hard work and dedication, and months of planning. Special thanks also to **Demetrios Lambropoulos** who worked tirelessly from Fall 2022 to help and support the Capstone program. Many thanks also to all the students who volunteered in this event!

The ECE Department congratulates this year's senior students who participated in the ECE capstone program and their advisers from inside and outside Rutgers ECE who helped guide their projects.

Here is the list of award recipients and their advisors:

CONTINUED ▸

2023 ECE Capstone Expo Award Winners (continued)

First Place Team

Top Ten Projects

FIRST PLACE
Project S23-39: Real-Time Overcrowding Detection and Prediction with Aerial Robots
Team members: Erik Jagnandan, Tahmeed Chowdhury, Sreeram Mandava, Preston Stecklein
Adviser: Dr. Dario Pompili

SECOND PLACE
Project S22-51: Virtual Reality Augmented Cycling Kit (VRACK)
Team members: Jing Jia, Parth Darji, Julianne D'Avirro Humphrey, Binsheng Zhang
Advisor: Dr. Yao Liu

THIRD PLACE
Project S23-19: Autonomous Medicine Delivery Drone
Team members: Ayleen Durasno, Andrew King, Bobby Putra, Kieran Burns, Sunit Pradhan
Advisor: Dr. Bo Yuan

FOURTH PLACE
Project S23-04: Diabetic Digital Companion
Team members: Matthew D'Alonzo, Anthony Poppalardo, Daniel Russo, Veronica Vergara
Advisors: Dr. Sasan Haghani, Mr. John Canevari (Novonordisk)

FIFTH PLACE
Project S23-70: Adaptive Guitar Tone Using ML Impulse Response
Team members: Sunny Chen, Jimmy Li, Pranay Musalimadugu, Sterling Shieh
Advisors: Dr. Anand Sarwate, Dr. Gregory Rossetti (Department of Music)

SIXTH PLACE
Project S23-10: LanternPredator
Team members: David Banyamin, Wei Gou, Mark Rezk, Wictor Fedorowiat
Advisor: Dr. Daniel Burbano Lombana

SEVENTH PLACE
Project S23-09: Implementation of Thermoelectric Generators Within Mission-Critical Facilities
Team members: Jonathan Golba, Ashwin Gokhale, Ashwin Anand
Advisors: Dr. Wade Trappe, Mr. Don Bachman (Russelectric)

EIGHTH PLACE (TIE)
Project S23-02: Multipurpose Wireless Toxic Gas Leakage Sensing Bracelet
Team members: David Arevalo, David Falana, Jose Guanipatin, Kamsiyochukwu Osigwe-Daniel
Advisor: Dr. Umer Hassan

EIGHTH PLACE (TIE)
Project S23-21: Affordable Virtual Reality Robot Avatars (A-VRRA)
Team members: Steven Smith, Hamza Ali, Noah Merrits
Advisor: Dr. John McGarvey

TENTH PLACE
Project S23-54: Pool Water Monitoring System
Team members: Andrew Kurtiak, Christine Voynarovskiy, Robert Finke
Advisor: Dr. Yingying Chen

Special Award Winners

BEST IN RESEARCH AWARD
Project S23-39: Real-Time Overcrowding Detection and Prediction with Aerial Robots
Team members: Erik Jagnandan, Tahmeed Chowdhury, Sreeram Mandava, Preston Stecklein
Advisor: Dr. Dario Pompili

BEST IN IMPACT AWARD
Project S23-02: Multipurpose Wireless Toxic Gas Leakage Sensing Bracelet
Team members: David Arevalo, David Falana, Jose Guanipatin, Kamsiyochukwu Osigwe-Daniel
Advisor: Dr. Umer Hassan

BEST IN COMMERCIALIZATION
Project S23-19: Autonomous Medicine Delivery Drone
Team members: Ayleen Durasno, Andrew King, Bobby Putra, Kieran Burns, Sunit Pradhan
Advisor: Dr. Bo Yuan

Galbiati Entrepreneurial Award Winners

FIRST PLACE
Project S23-19: Autonomous Medicine Delivery Drone
Team members: Ayleen Durasno, Andrew King, Bobby Putra, Kieran Burns, Sunit Pradhan
Advisor: Dr. Bo Yuan

SECOND PLACE (TIE)
Project S23-02: Multipurpose Wireless Toxic Gas Leakage Sensing Bracelet
Team members: David Arevalo, David Falana, Jose Guanipatin, Kamsiyochukwu Osigwe-Daniel
Advisor: Dr. Umer Hassan

SECOND PLACE (TIE)
Project S23-09: Implementation of Thermoelectric Generators Within Mission-Critical Facilities
Team members: Jonathan Golba, Ashwin Gokhale, Ashwin Anand
Advisors: Dr. Wade Trappe, Mr. Don Bachman (Russelectric)

Retired Faculty Sophocles Orfanidis


S. Orfandis

Sophocles Orfanidis has had a great influence on me as a teacher. I admire his ethos of assigning textbooks that are freely available online, removing financial barriers for students. His attention to detail in creating the signal processing labs for our undergraduate course has provided countless students with practical, hands-on learning. Sophocles was a great help to me personally as I transitioned into a faculty role. He stepped up big time to assist with the lab component when I had to teach 100+ students in my second semester. His wisdom and generosity made navigating those early challenging semesters much smoother. Sophocles will be dearly missed in our department, but I wish him all the best in his retirement. He has been an invaluable mentor and colleague to me. I am truly grateful for everything he has contributed to my growth as an educator. Sophocles has made a tremendous impact through his commitment to student learning and success. It has been an honor to work with him. – **Waheed Bajwa**

Prof. Orfanidis was a pioneer in signal processing. He has written multiple books to share his knowledge in this area. He was always so patient to mentor students at all levels. – **Yingying Chen**

Sophocles Orfanidis devoted himself to excellence in teaching and has had a tremendous impact on generations of students. His signal processing course is well executed with the level of detail and mathematical rigor required to prepare students for their research and engineering careers. He has shared his textbook as a free downloadable pdf, ensuring a continuation of his impact in engineering education. – **Kristin Dana**

Sophocles wrote two excellent books on digital signal processing (translated in foreign languages), including his book on Optimum Signal Processing that made our department well known all over the world. He was an extraordinarily good lecturer, admired first by our graduate students. Sophocles also wrote an excellent open access book (textbook) on Electromagnetic Waves and Antennas. – **Zoran Gajic**

Sophocles was the best teacher I have seen in my time in the ECE department at Rutgers. His dedication and commitment to teaching and student learning were exemplary. In my experience while department chair, he was the only faculty member I can say that was willing to take on a new course assignment, even in an area somewhat removed from his repertoire of courses in signal processing and linear systems, and executing it better than anyone had done it in the past. Upon my request, I was amazed at how well he taught Digital Logic Design during the last few years of his teaching in the department. I have never seen students enrolled in large classes happier than when Sophocles was teaching them. **-Narayan Mandayam**

I have known Sophocles for many years since I started in ECE. He has always been kind and gentlemanly. I will miss his mild manners and calm advice. – **Ivan Marsic**

Sophocles has made significant contributions to signal processing and communication systems. His books on signal processing, and electromagnetic waves and antennas are widely regarded as masterpieces, having educated numerous students worldwide. During his tenure at Rutgers, he served as a model teacher and an inspiration for new faculty members, setting a high standard for excellence in educational delivery. **- Athina Petropulu**

Sophocles has been a great instructor over the past several decades. I remember when he gave me priceless educational advice when I was assigned as a junior professor to teach Digital Signal Processing years ago. His seminal application-oriented textbook, "Introduction to Signal Processing", was instrumental in my course for crafting MATLAB-oriented signal processing problems and exercises specifically targeting electrical engineering undergraduates. He will be missed in the department! **-Dario Pompili**

When I first started teaching ECE 345 I reached out to Sophocles, and he was very generous in sharing his meticulously curated collection of problems and notes. I learned a lot from co-teaching with him and was really thankful to have such a supportive colleague, especially since I was way out of my depth at the time. – **Anand Sarwate**

He was an outstanding guide for junior faculty and held expertise in diverse research domains, from signal processing to applied physics. **-Michael Wu**

ECE Welcomes New Faculty Members


D. Kruger


D. Lambropoulos


H. Liu


Z. Zhang

Dr. Dov Kruger joined the Rutgers ECE Department as an Associate Teaching Professor after teaching for several years at Stevens Institute of Technology. One of his research interests is in re-engineering the HTTP protocol and the Internet to improve security and increase throughput by by transmitting data in binary, explicit control of local data storage, and innovative data compression. Besides high performance, high security networking, his secondary interests include computer architecture for faster code excecution, 3D manufacturing technologies, and optimizing engineering education.

Dr. Demetrios Lambropoulos joined the Electrical and Computer Engineering department as a NTT Instructor. His research looked into topics from machine learning in wireless communication networks and mobile password security in bring-your-own-device (BYOD) scenarios. Throughout his graduate studies, Demetrios also devoted his time to teaching and leadership roles at Rutgers University. Notably, Demetrios has been assisting with the organization of the Capstone Senior Design program since 2018.

Dr. Hang Liu joined the department of Electrical and Computer Engineering at Rutgers, the state university of New Jersey, as an assistant professor in the Spring of 2023. Before that, he was an assistant professor at the Stevens Institute of Technology (2019 - 2022) and the University of Massachusetts Lowell (2017 - 2019). His research exploits powerful hardware resources, e.g., Graphics Processing Unit (GPU), Field-Programmable Gate Array (FPGA), and Solid-State Drive (SSD), to build high-performance systems for graph analytics, machine learning, and numerical methods. He received his Ph.D. degree from George Washington University (2017) and his B.E. degree from Huazhong University of Science and Technology (2011).

Dr. Lui is the recipient of the prestigious IEEE CS TCHPC Early Career Researchers Award for Excellence in High-Performance Computing (2022) and the NSF Early CAREER Award (2021).

Dr. Zhao Zhang joined the Department of Electrical and Computer Engineering at Rutgers University as an assistant professor in Fall 2023. Prior to that, Dr. Zhang was a computer scientist and led the machine learning group at Texas Advanced Computing Center (TACC). From 2014 to 2016, Dr. Zhang was a postdoc researcher at AMPLab, UC Berkeley, and a data science fellow at Berkeley Institute for Data Science. Dr. Zhang received his Ph.D. from the Department of Computer Science at UChicago in 2014. Dr. Zhang has extensive experience in high-performance computing (HPC) and big data systems. His recent research focus is the fusion of HPC and deep learning (DL) with a wide range of topics of optimization algorithms, I/O, architecture, and domain applications.

Four ECE Faculty receive NSF CAREER Awards


S. Jalali


H. Liu


B. Yuan


Z. Zhang

Career Development (CAREER) Award is the National Science Foundation's most prestigious award in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization. Activities pursued by early-career faculty build a firm foundation for a lifetime of leadership in integrating education and research.

The NSF CAREER award is a 5-year grant awarded to early career faculty who exemplify the role of teacher-scholars through outstanding research and education. The highly competitive and respected NSF CAREER award funds research and educational initiatives of faculty at the beginning of their careers.

This year four Rutgers ECE faculty have won this milestone award.

Shirin Jalali

Shirin Jalali was awarded a $554,656 National Science Foundation (NSF) CAREER award to provide a theoretical framework to design, analyze, and optimize snapshot compressive imaging systems (SCI).

The ability to capture high-resolution 3D data cubes, such as video files or hyper-spectral images (HIS), is essential for many medical and robotic applications. Snapshot compressive imaging systems (SCI) can solve the process's time-consuming, costly, and ineffective issues by enabling efficient 3D imaging.

Jalali says the award is especially exciting because "SCI systems can potentially speed up a wide range of imaging applications, such as hyperspectral imaging and optical coherence tomography, which are used to diagnose certain diseases. Improving the speed of these imaging systems can make them accessible to everyone and create new opportunities for applications in everything from medical diagnosis and robotics to agriculture."

Hang Liu

Hang Liu won an NSF CAREER award of $584,000 for his project, "An Algorithm and System Co-Designed Framework for Graph Sampling and Random Walk on Graphics Processing Units (GPUs)."

In the mathematics, a graph simply shows how things are connected. The things being considered are vertices (also called points or nodes) on the graph, and the edges are the lines extending from those points to indicate relationships, or connections, to other points. In our complicated world, anything from the possible relationships between people worldwide to the combinations of air-ports and incoming flights could potentially have trillions of connections, or edges. Liu's research focuses on high-performance data analytics, which involves using computers to find patterns and insights in massive chunks of information. The goal is to quickly, efficiently, and effectively analyze trillion-edge graphs representing anything from social networks to genomics to product reviews to GPS directions.

Liu is aiming to build a system that can quickly analyze and extract insights from trillion-edge graphs of data. It's the topic of the research he's undertaking in his recent National Science Foundation (NSF) CAREER project.

Liu will be pioneering the effort to create a user-friendly framework that can take advantage of future exascale-level supercomputers—that's a computer that can perform a billion-billion operations per second. Liu will be pioneering the effort to create a user-friendly framework that can take advantage of future exascale-level supercomputers—that's a computer that can perform a billion-billion operations per second. "My CAREER project research will introduce novel algorithms, a scalable software system currently in development, and an expressive application programming interface for users to solve some of today's biggest and most complicated questions with fewer lines of code."

Bo Yuan

Bo Yuan is the recipient of an NSF CAREER award for the project titled "Chimp: Algorithm-Hardware-Automation Co-Design Exploration of Real-Time Energy-Efficient Motion Planning."

As the fundamental and critical robotic task for planning and deciding the actions of robots, motion planning is widely desired in many real-world applications, such as autonomous driving, in-warehouse package handling, assisted surgery etc.

To date, there exists an increasing performance gap between the intensive computation of modern motion planning workloads and the insufficient support from general-purpose hardware, calling for efficient hardware acceleration to realize real-time energy-efficient high-quality planning. This project proposes Chimp, a cross-layer co-design framework for highly efficient motion planning processor. Chimp aims to develop a new design paradigm that can efficiently integrate domain expertise into learning-based motion planning, improving the planning reliability and performance. This project will significantly promote the intelligence and durability of modern autonomous systems, enhancing the economic opportunities in many fields such as autonomous driving, smart manufacturing, and intelligent healthcare.

Dr. Bo Yuan is the PI on this five-year $500,000.00 project.

Zhao Zhang

Zhao Zhang received his NSF CAREER award for his project "Efficient and Scalable Large Foundational Model Training on Supercomputers for Science".

Training foundational models at extreme scale is time consuming, prone to low utilization and limited scalability, and human effort demanding. This NSF CAREER project addresses the convergence, performance, and scalability gaps of large foundational model pre-training on supercomputers with innovative algorithm, system, and interface design. In addition to the algorithm and computer system innovation, this project contributes to translational computer science by lowering the barrier of large foundational model training and the time consumption of scientific deep learning, thus enabling significantly more scientific research to embrace large foundational models. The research results will be publicly available in the form of open source software to the wider community with comprehensive documentation on the design and usage to help users from all domains.

The total value is $599,707 for a five-year period will start in Summer 2024.

Anand Sarwate receives the Outstanding Engineering Faculty Award

A. Cuitiño, A. Sarwate, Y. Chen

Associate Professor **Anand Sarwate** received the Outstanding Engineering Faculty Award at the SOE Faculty Awards Reception. The award was presented by Dean **Alberto Cuitiño** and Department Chair **Yingying Chen**.

Since joining the Department of Electrical and Computer Engineering faculty in 2014, Anand Sarwate has established a reputation as a leading researcher in areas such as statistics, machine learning, information theory, distributed optimization and signal processing, and privacy-preserving data analysis. A recipient of the prestigious NSF CAREER award, he has received more than $6 million in funding from federal agencies including the NSF, NIH, PNNL, and DARPA for projects on which he is PI, as well as those on which he is a co-investigator. He has received a five-year renewal on an NIH subaward on a collaborative project for enabling decentralized analysis of neuroimaging data, as well as a research contract from the Pacific Northwest National Laboratories (PNNL) to develop deep neural networks for machine learning and artificial intelligence applications. His growing publishing portfolio addresses issues in various ECE subfields, while he serves as an associate editor and consulting editor for IEEE publications.

Collaborative Research on Speech Eavesdropping from Vibrations on Room Objects via Phased-MIMO Radar


A. Petropulu


M. Wu


Y. Chen

The unencrypted nature of voice makes speech eavesdropping always a lucrative attack as well as a core topic in computer security. Rutgers ECE Professors **Athina Petropulu, Chung-Tse Michael Wu** and **Yingying Chen** with ECE PhD students **Tianfang Zhang, Zhaoyi Xu, Shuping Li, Donglin Gao,** and **Changming Li** discovered a new form of speech eavesdropping attack. Such an attack can remotely extract speech from minute surface vibrations upon common room objects, such as paper bags, cardboard boxes, and plastic storage bins, through high-resolution mmWave sensing techniques. A user's private information or an enterprise's financial/intellectual properties can be compromised if an adversary can listen onto the voice communication channel. Lessons learned from numerous cyber attacks triggered by voice leakage have prompted people to maintain distance or use soundproof settings when speaking sensitive speech content. Nonetheless, research studies reveal that voice communication can still be compromised by leveraging vibrations produced by speech. For example, motion sensors of a victim's smartphone can be compromised and exploited to sense speech played by loudspeakers of the same smartphone. When speech is produced, conductive vibrations can propagate through a solid medium (e.g., a desk or the body of the smartphone) and reach the motion sensor. These prior studies show promising results, but rely on unrealistic assumptions, where the sensor is in direct contact between the sensor and the sound source (or vibration source).

The Rutgers ECE team considered a more practical form of eavesdropping attacks that targets minute speech-induced vibrations from common room objects. When airborne speech interacts with surrounding objects, it is reflected, refracted, and absorbed, inducing minute vibrations upon the objects' surfaces. Based on this phenomenon, the team discovered a new and stealthy speech eavesdropping attack that remotely captures such minute vibrations leveraging commercial mmWave devices as shown in **Figure 1.** The millimeter-level wavelength enables mmWave signals to capture vibrations with orders of higher sensitivity compared to traditional radio frequency techniques (e.g., WiFi, RFID). In addition, the integration of mmWave hardware onto mobile and IoT devices (e.g., 5G routers, smart home sensors) makes mmWave increasingly accessible and desirable for adversaries. Compared to traditional attacks via microphones, which directly sense sounds, the proposed attack uses mmWave sensing to remotely turn room objects into acoustic sensors. It enables the attack to bypass sound insulation, which is designed to lock sounds (mechanical waves) instead of mmWave signals (electromagnetic waves). Example speech vibrations of three digits ("zero", "one", "two") captured with a mmWave sensor (TI AWR2243) is shown in **Figure 2.**

The team designed an attack system as illustrated in **Figure 3** to realize the proposed attack. A critical challenge for the proposed attack is the short wavelength of mmWave signals, which incurs high signal propagation losses and short sensing distances. To tackle this inherent challenge, we develop a software-defined

Figure 1: Workflow of the proposed attack.

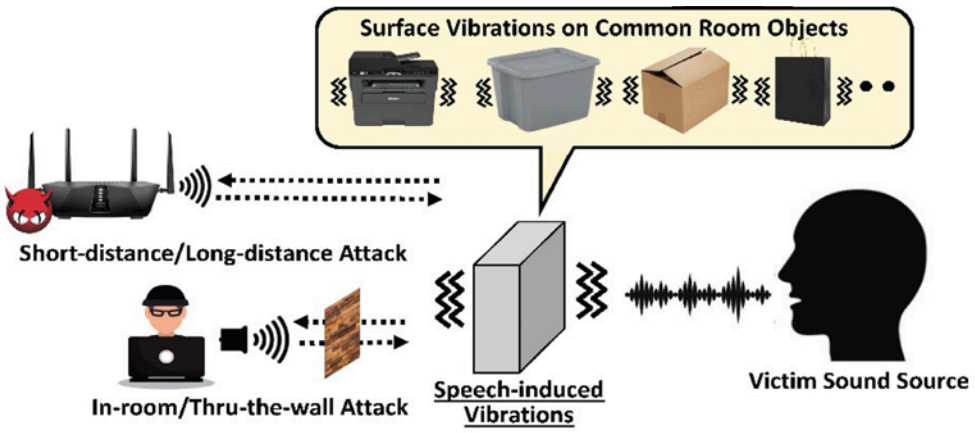
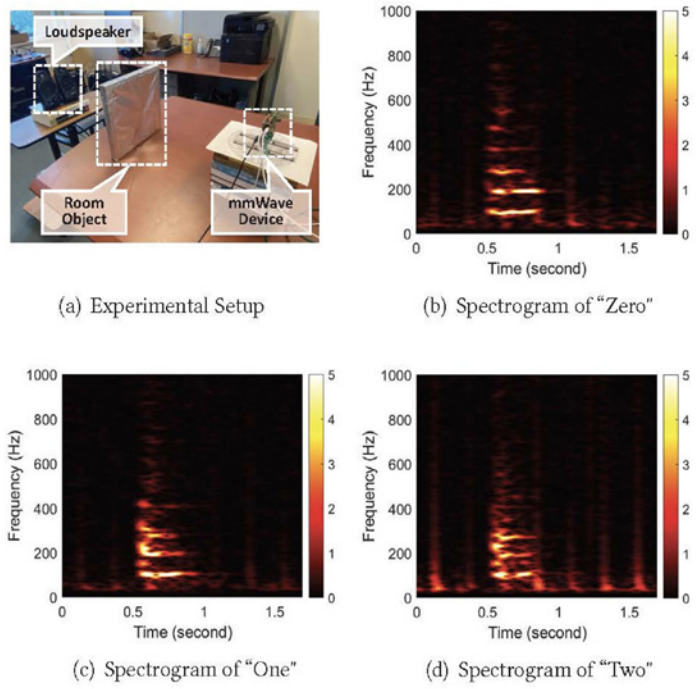


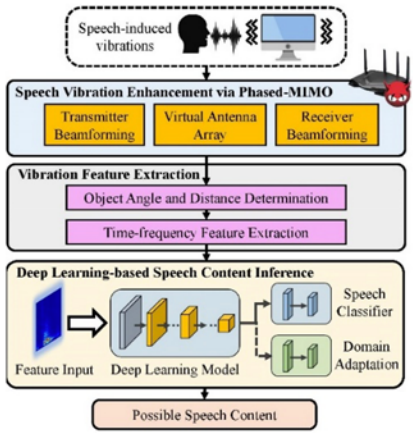
Figure 2: Illustration of capturing speech-induced vibrations on a tinfoil through mmWave sensing.



high-resolution radar sensing scheme, phased-MIMO radar, a technique that automatically adjusts signals applied to the transmitter and receiver antenna pairs to steer multiple mmWave beams towards the vibrating object, aiming to retain effective speech sensing even under long distances (e.g., >5m) and even occlusion. With the phased-MIMO radar, the attack system then applies a series of signal processing techniques to denoise phase values and extracts time-frequency features carrying speech information. Another challenge is that in practical settings, the victim's speech labels to train machine learning models may not be available to the adversary. Therefore, the team designed a deep learning framework with domain adaptation techniques to infer speech content. The design framework utilizes only the mmWave data of the victim to adapt a pre-trained model built on other people's data through domain adaptation (unsupervised training). The adapted model better fits the victim's feature space, and it can be used to infer the victim's speech content.

This project is supported by NSF grant titled "MIMO Radar with Sparse Linear Arrays – Theory, Implementation and Applications." Under collaboration with Professor **Cong Shi** from the New Jersey Institute of Technology, who graduated from the Rutgers ECE department, the outcomes of this project have been published at the 30th ACM Conference on Computer and Communications Security (ACM CCS 2023) with paper titled as "Privacy Leakage via Speech-induced Vibrations on Room Objects through Remote Sensing based on Phased-MIMO." ACM CCS is a top-tier conference in computer security with less than 20% acceptance rate. The research work will alert the public to high privacy concerns of mmWave, which has been included in the 5G communication and networking era.

Figure 3: Architecture of the attack system.



Research Day 2022

After two years, ECE Research Day was finally back on Friday, December 16 and it was a great success. This event was an excellent opportunity for ECE students and ECE PostDoc Associates to present their research projects, share their creative ideas, and network with their peers. The 52 posters were presented by graduate and undergraduate students (including summer research, internships, and co-ops), covering a diverse range of research topics. Also, five Fall 2022 Capstone teams had a chance to showcase their senior design project:

- Concussion Detecting Football Helmet advised by Prof. **Sasan Haghani**
- Navigation Control of a Robot for Smart Warehouse Applications advised by Prof. **Daniel Burbano Lombana**
- Workout Repetition Counter advised by **Mehdi Javanmard**
- Smart Visual Aid Cane advised by **Jorge Ortiz**
- Dynamic Line Rating Systems advised by Prof. **Michael Caggiano**

The event was well-received by faculty, students, and industry representatives. Special thanks to Prof. **Laleh Najafizadeh** and Prof. **Yao Liu** for coordinating this important event that showcases the exciting research in our department!

ECE Professor Shriram Ramanathan wins AFOSR grant

ECE Professor **Shriram Ramanathan** and collaborators (Dr. C. Grienberger, Brandeis) have been awarded a new AFOSR grant on "Plasticity in the mammalian brain and emulation in oxide devices". The total obligated amount is $900K/ 3 yrs (Rutgers share: $390K).

This project is related to understanding the fundamental mechanisms of plasticity in animal brains and their emulation in electronic devices. Longer term goal will be to advance physical models based on bio-plausible plasticity that could be useful to AI algorithms.

Timing-Harmonic Adaptive Waveform Estimation using Deep learning

P. Spasojevic

M. Kasher

There are few devices capable of sampling a signal tens of billions of times per second, and even fewer which use cryogenically-cooled superconducting circuits to do it. Professor **Predrag Spasojevic** and his Ph.D. student **Morriel Kasher** are pursuing an ongoing research project that studies exactly such a device, seeking to use a combination of artificial intelligence and advanced signal processing techniques to improve its performance. The work is a collaboration with industry partner Expedition Technology and is funded by the Office of Naval Research. It is titled Timing-Harmonic Adaptive Waveform Estimation using Deep Learning (THAWED).

Radio frequency (RF) signals today cover a wide range of frequency bands in almost every part of the world, servicing critical applications including Wi-Fi, GPS, Cellular, and Radar. Their prevalence makes it difficult to simultaneously view the entire RF spectrum at once, as a receiver must have an extremely wide bandwidth to effectively sample so many signals coherently. This motivates superconducting receiver designs, which utilize cutting-edge electromagnetic technology to achieve extremely high sampling rates but require cryogenic cooling to temperatures below −450 °F. While innovative, such receivers exhibit many unique challenges including low amplitude resolution, non-linearity, and reliability. The THAWED project, which began in 2020, seeks to remedy these issues in order to make wideband superconducting designs practical. Through deep learning, an artificial intelligence is trained to characterize the sampling superconducting circuits and compensate for imperfections in real-time. Likewise, a variety of conventional signal processing methods are being developed and honed to digitally improve spectral purity while working around the difficult constraints imposed by high sampling rate and low resolution architectures.

The impact of the team's work is profound, enabling several new modes of usage for such devices. Rather than being limited to use as high-speed measurement devices, superconducting receivers which are enhanced by the project's proposed augmentations can become effective in enabling new applications such as spectral sensing and wireless communication. In the former case such receivers allow users to simultaneously view spectral activity across an enormous range of frequencies, which can be crucial for privacy, security, and signal intelligence. In the latter case, superconducting communication devices facilitate data transmission at unprecedented speeds. The project is expected to continue for at least two more years and produce several theoretical publications alongside practical experimentation in the field.

AI on the Bog

K. Dana, P. Oudemans, P. Akiva

K. Dana

Since 2018, Professor **Kristin Dana** has forged a collaborative partnership with Professor Peter Oudemans from the Plant Biology Department at Rutgers and the PE Marucci Cranberry and Blueberry Research Center at Rutgers Extension in Chatsworth, NJ. The focal point of their research resides in the application of AI, deep learning, and computer vision to gauge crop health through automated analysis of drone-captured imagery. Every summer, aerial images of the cranberry bogs in Chatsworth, NJ are obtained via drones over the span of several weeks in the growing season. This concerted effort culminates in the creation of an extensive Cranberry Research Aerial Imagery Dataset (CRAID). Spanning four years, the CRAID dataset stands as the most expansive agricultural data repository for cranberries within the computer vision research community.

Engaged in this endeavor are several students, including ECE graduate students **Peri Akiva, Faith Johnson,** ECE undergraduate **Jack Lowry,** as well as students from ACCC (Atlantic County Community College). On the industrial front, collaborators encompass **Benjamin Planche** and **Aditi Roy** from Siemens Research. An integral component of the project involves annual meetings with stakeholders ranging from local cranberry growers to the Wisconsin State Cranberry Growers Association, the Massachusetts-based Cranberry Institute, and industry representatives from Ocean Spray.

Key project publications include:

1. "Vision on the Bog: Cranberry Crop Risk Evaluation with Deep Learning" P. Akiva, B. Planche, A. Roy, P. Oudemans, K. Dana - Computers and Electronics in Agriculture, 2022
2. "Vision on the Bog: Cranberry Crop Risk Evaluation with Deep Learning." , Akiva, Peri, et al. , Computers and Electronics in Agriculture 203 (2022): 107444.
3. "AI on the Bog: Monitoring and Evaluating Cranberry Crop Risk." Akiva, Peri, et al. Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision, 2021.
4. "Vision-based Cranberry Ripening Assessment", in submission, Faith Johnson, Jack Lowry, Peter Oudemans and Kristin Dana

The collaboration between Prof. **Kristin Dana** and Prof. **Peter Oudemans**, in conjunction with their diverse team of students and industrial partners, underscores the advancement of AI and computer vision techniques in revolutionizing the assessment of cranberry crop health. Their comprehensive datasets, AI algorithms, and groundbreaking research contribute significantly to the domain of agricultural technology.

Celebrating 20 Years of WINLAB's Summer Internship Program: Nurturing Technology Innovators

This year, WINLAB proudly commemorates the 20th anniversary of its Summer Internship Program. An enduring cornerstone for fostering innovation, this program has molded thousands of young engineering minds, facilitated collaborative research, and given students an opportunity to participate in research at the forefront of wireless and IoT technology.

The WINLAB Summer Internship Program serves as a vibrant hub of diverse talent, drawing students from a wide range of educational levels: high school, undergraduate, and graduate. Rooted in the vision of providing real-world, team-based research experiences, the program has consistently delivered on its commitment.

20 Years Of Excellence

Since its inception in 2003, the program has evolved in tandem with the dynamic landscape of wireless technologies. This year, it welcomed a cohort of 74 students, a testament to its enduring appeal and the profound impact it has on the young researchers who participate.

This year, the program's success was made possible through the invaluable financial support of nVERSES CAPITAL and the Kim family, the National Science Foundation (NSF) Research Experiences for Undergraduates (REU) program, and AT&T, which provided funding for student stipends. Special thanks go to **Tracy Van Brakle** from AT&T for generously providing a weekly pizza lunch. The program culminated in an engaging Open House on August 10th which was split into two sessions due to the enthusiastic participation of interns and their families and friends, highlighting the sense of community that had flourished throughout the summer. Spanning a duration of 10 weeks, from June 5th to August 11th, the program offers students a unique opportunity to immerse themselves in cutting-edge research. Under the dedicated mentorship of our ECE and CS faculty members, each intern seamlessly integrated into an active research group centered on specific projects. This interdisciplinary approach cultivates a spirit of collaboration, empowering students to explore a wide spectrum of technologies.

The program's wide reach was reflected in its diverse student body, which encompassed individuals from a wide range of universities, including Rutgers, Cornell, Stonehill College, Columbia University, Indiana University Bloomington, Carnegie Mellon, University of Michigan - Ann Arbor, and NYU. This international melting pot of talent also included students from the University of Angers in France. Furthermore, the program reached out to the next generation of aspiring minds by opening its doors to high school students from numerous institutions such as High Technology High School, East Brunswick High School, The Pennington School, Academy for Information Technology, John P. Stevens High School,Edison High School, Highland Park High School, The Pingry School, Union County Vocational, Metuchen High School, Jose Marti STEM Academy, Middlesex County Edison Academy, Rae Kushner Yeshiva High School, and Biotechnology High School, making it a truly inclusive and enriching experience for all involved.

Diverse Projects, Boundless Potential

The 2023 WINLAB Summer Internship Program offered an exciting variety of projects, each providing a unique glimpse into the realm of cutting-edge technology research. One such endeavor centered on deploying a robust Ceph file system, subjected to meticulous stress tests to ensure its resilience as a distributed data store—a pivotal pursuit in the domain of data management.

Another project delved into the heart of artificial intelligence, with a particular focus on enhancing user authentication security. This innovative approach relies on a biometric signature based on daily activities, promising a secure future for AI applications.

The internship program also continued some of its perennial research interests, including a project revolving around Smart Intersection Situational Awareness. In this undertaking, students use multiple cameras within the Orbit miniature smart city environment to form a fused model for the purposes of detecting both cars and pedestrians.

Meanwhile, another project focused on the creation of a lifelike intersection simulation environment. Leveraging state-of-the-art technology, the students designed, implemented and meticulously analyzed traffic data, aiming for pinpoint accuracy—a glimpse into the future of smart traffic systems.

The Augmented Reality Mural project was focused on the development of a collaborative augmented reality application that enabled remote users to collaboratively create a virtual mural. It was an exploration into the convergence of art and technology,

where participants could digitally express their creativity in a shared virtual space. Students working on this project gained experience in using modern game development tools as well as knowledge of practical distributed programming.

Another project focused on minimizing latency in unicast camera-to-computer connections over a network. Students on this project got an in-depth look at many of the components and protocols involved in a modern computer network, as well as hands-on experience in performing practical measurements in a computer engineering context.

Continuing another of the program's multi-year focuses, one project delved into the intriguing realm of beehive monitoring, aiming to assess the impact of human-generated electromagnetic radio frequency (RF) waves on bee behavior and hive health. Simultaneously, another group of students employed neural networks to analyze features, placing a specific emphasis on motion datasets linked to bee behavior. Together, these dual projects provided valuable insights into the intricate interactions between wireless technologies and the natural world, with a particular focus on how RF waves may influence the behavior of bees.

The theme of machine learning was prevalent throughout the program, with another project employing the computing resources of ORBIT to design experiments that analyzed the training and prediction of various machine learning models across multiple edge devices, with a keen eye on timely inferences.

In the Robotic IoT SmartSpace Testbed project, students worked on setting up Internet of Things (IoT) sensors to create a testbed which would allow the collection of real-world data for IoT machine learning models. This work was an essential foundation upon which future students will be able to build their results.

At the forefront of wireless communication, another project made contributions to a new open-source implementation of a 5G system. Students on this project had an incredible opportunity to participate in the development of cutting edge next-generation technology, as well as gain rare insight into the engineering underpinnings of the cellular systems that have become an integral part of modern life.

Lastly, there was a project dedicated to developing a real-time information system for first responders, enhancing their situational awareness and response capabilities during emergencies.

These diverse projects not only provide students with theoretical knowledge but also offer hands-on experiences that transform them into active contributors in the evolution of future technologies.

A Bright Future

As the WINLAB Summer Internship Program marks its 20th year, it leaves an indelible mark on the young minds that have graced its halls. With a commitment to diverse projects, unwavering mentorship, and a dedication to pushing the boundaries of wireless technology, this program remains a beacon of innovation. In the words of the undergraduate student **Tommy Chu**: "The summer internship at WINLAB was an invaluable experience that significantly expanded my technical and presentation skills as an engineer. Conducting research at WINLAB gave me the opportunity to work with incredible team members and learn from mentors who are highly knowledgeable in their fields." As we look ahead, WINLAB is primed to inspire countless more students, propelling them toward excellence in the ever-evolving world of wireless technologies. The legacy of the program's first 20 years stands as a solid foundation upon which the next two decades will undoubtedly be built. This year, we also celebrated a remarkable milestone as our program welcomed its first student who participated as a high schooler, an undergraduate, and a graduate student, exemplifying the diverse and transformative opportunities it offers. For the bright future of the program, we find inspiration in the words of one of this year's interns, **Ana Obradovic,** who shared, "As a high schooler, this internship has truly opened my eyes to all the different kinds of research that can be done in the field. The friendliness of all the researchers has made me look forward to future pursuits in ECE", highlighting the enduring impact and promise of the WINLAB Summer Internship Program.

As WINLAB forges ahead, it's evident that the next 20 years promise even more internship achievements and an unwavering commitment to nurturing the wireless technology leaders of tomorrow.

Narayan Mandayam Appointed Acting Director of WINLAB

N. Mandayam

Distinguished Professor **Narayan Mandayam** has assumed the position of Acting Director of WINLAB, the Rutgers University Wireless Information Network Laboratory. The one-year appointment became effective on August 1, 2023. Dr. Mandayam, who has served as WINLAB's associate director and as ECE department chair, steps into the acting directorship while long-term director and ECE Distinguished Professor **Dipankar Raychaudhuri** is on sabbatical.

With its focus on wireless technology research and industry partnerships, WINLAB has been a leading industry-university research center and collaborative forum on innovative wireless technologies and their applications since it was established in 1989. Under the leadership of Dr. Raychaudhuri, WINLAB has enriched its research portfolio, which includes everything from information theory and radio technology to wireless systems and mobile networks and computing. WINLAB's current comprehensive and synergistic research program aims to advance research in the areas of smart cities and vehicles, eHealth, security and privacy, wireless and mobile networks, machine learning, the Internet of Things (IoT), and more.

Dr. **Mandayam**, whose research interests encompass smart city resilience, privacy and security in IoT, and energy efficient IoT, will provide outstanding leadership in developing a focused research and operational plan for WINLAB over the next year.

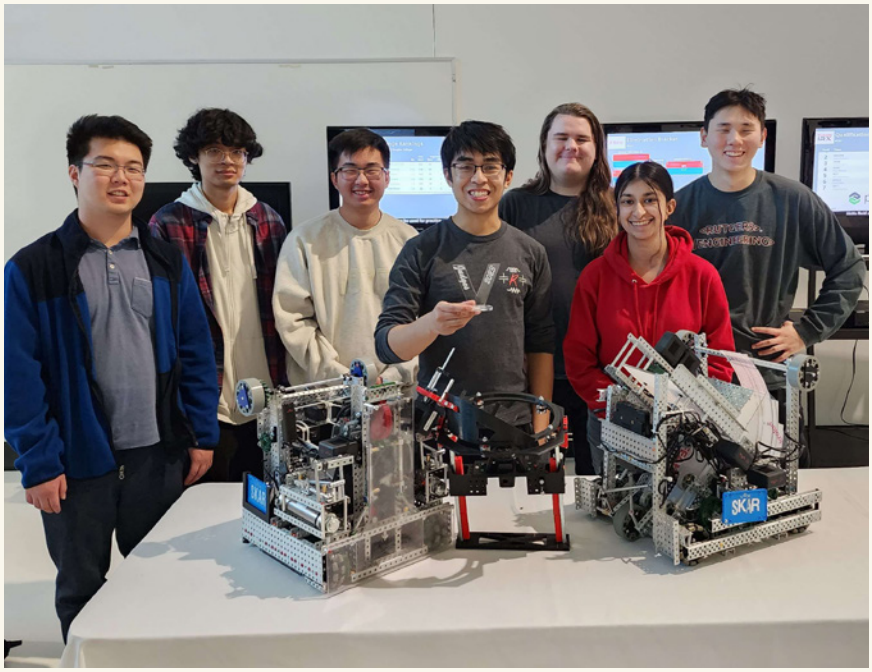
ECE faculty Anand D. Sarwate received PNNL grant to develop deep neural networks for ML/AI applications

A. Sarwate

Rutgers ECE Associate Professor **Anand D. Sarwate** has been awarded a $70,000 research contract from the Pacific Northwest National Laboratories (PNNL) as part of a larger project on interpretability and the Mathematics of Artificial Reasoning Systems (MARS).

Prof. Sarwate will work with collaborators at PNNL to develop a structured framework for understanding the variability of the deep neural networks (DNNs) that drive contemporary ML/AI applications. Because DNNs are trained using stochastic optimization methods, there is inherent variability in the resulting predictive models: on one run they may be good and on another not so good. This is a form of process variation which only now being studied systematically in the machine learning literature. Prof. Sarwate will work with Rutgers ECE graduate student **Sinjini Banerjee** to develop statistical analyses of this performance variability in a longer-term effort to develop appropriate robustness/reliability measures for ML models. If successful, this pilot project will develop the foundations for a number of future investigations into assessing and characterizing the impact of different parameters and choices in neural network training on the stability of the training process itself.

Journey to world tournament



The Rutgers IEEE VEXU team has qualified for worlds this year! This year's game, Spin Up, focuses on playing a modified version of frisbee golf. The team, led by Electrical and Computer Engineering major, **Jack Lowry**, and Computer Science major, **Joshua Chung**, has 15 members and meets twice a week in the IEEE lab in the ECE building. The team attended three different events this year, culminating in a second place finish at the NJIT VEXU tournament and a Judges Award from the Vaughn College VEXU tournament. They are currently ranked 48th in the world, which helped secure them a spot at the VEXU Worlds Tournament running from April 27th to 29th. This event will host 100 of the best teams from all around the world to compete for the title of world champion.

facultynews

ECE faculty Athina Petropulu received the Stephen O. Rice Prize of the IEEE Communications Society


A. Petropulu

ECE Distinguished Professor **Athina Petropulu** is part of a team that has been selected to receive the Stephen O. Rice Prize of the IEEE Communications Society for the paper, "Joint Radar and Communication Design: Applications, State-of-the-Art, and the Road Ahead," *IEEE Transactions on Communications,* vol. 68, no. 6, pp. 3834-3862, June 2020. The award was presented at the Awards ceremony on May 29 at ICC 2023 in Rome, Italy.

ECE faculty Emina Soljanin received the Aaron D. Wyner Distinguished Service Award


E. Soljanin

ECE Faculty **Emina Soljanin** has been selected as the 2023 recipient of the Aaron D. Wyner Distinguished Service Award. This award is given by the IEEE Information Theory Society to honor an individual who has shown outstanding leadership in, and provided long-standing, exceptional service to, the Information Theory community. The selection committee was particularly impressed with the diversity of Emina's service activities, especially her mentorship of young researchers

ECE faculty Michael Caggiano received EGC Student's Professor of the Year Award 2023


M. Caggiano

Professor **Michael Caggiano** has been voted by the Rutgers SOE Undergraduate Student Body to receive the 2022-23 Engineering Governing Council (EGC) Professor of the Year Award from within the Department of ECE. This award is annually given to one faculty member from each department in Rutgers SOE who best exemplifies the SOE mission of "Education, Research, and Service." Michael has been an outstanding teacher in ECE covering courses in the important area of sustainable energy.

PROMOTIONS

Emina Soljanin
Promoted to
Distinguished Professor

Mehdi Javanmard
Promoted to
Full Professor

Predrag Spasojevic
Promoted to
Full Professor

Sheng Wei
Promoted to
Associate Professor
with Tenure

Mehdi Javanmard Named National Academy of Inventors Senior Member

M. Javanmard and Rutgers University President Holloway

The National Academy of Inventors (NAI) has named **Mehdi Javanmard**, an associate professor in the School of Engineering Department of Electrical and Computer Engineering, a senior member. He is one of 95 of the foremost emerging academic inventors identified by NAI's member institutions to be welcomed to the 2023 class of senior members.

"I'm extremely delighted for this recognition by the NAI for my lab's efforts in developing electronic and biomedical technologies," says Javanmard. "It's truly an honor to achieve this career milestone in becoming a senior member of the NAI.

"I must thank my students, postdocs, and collaborators for their efforts. I could not have achieved this without their help. I also give special thanks to the fantastic staff at the Rutgers tech transfer office for being so supportive of my team's efforts."

NAI senior members are active faulty, scientists, and administrators from NAI member institutions whose remarkable innovations have produced technologies that have made, or aspire to make, real impact on the welfare of society. The senior members have also achieved growing success in securing patents, licensing, or commercialization while educating the next generation of inventors.

"This is a well-deserved recognition of Mehdi's accomplishments, which brings national prestige and visibility to Rutgers, the School of Engineering, and the Department of Electrical and Computer Engineering," says Interim Dean **Alberto Cuitiño**."

Cutting-Edge Inventions

Javanmard holds 6 patents for his inventions, with another eight patents pending. Among his health-centric devices are:

- Lab on a Chip, hand-held or wearable devices equipped with biosensors that monitor exposure to bacteria, viruses, and toxic pollutants
- A graphene-based sensor for managing asthma and other respiratory diseases
- A tool that analyzes microbes in aquatic environments to help assess the effects of climate change on sensitive ecosystems
- The use of nanowell impedance sensing for a wide variety of medical applications, such as the detection of stress hormones like cortisol in blood; smart bandages for monitoring biomolecular activity during wound healing, in collaboration with biomedical engineering professor **François Berthaume**; and a COVID breathalyzer in collaboration with mechanical and aerospace engineering professors **Edward DeMauro, German Drazer,** and **Hao Lin**.

Javanmard's innovative wearable impedance cytometry and integration of machine learning and impedance cytometry analyzer has been licensed to RizLab Health. "This is a startup company spinoff out of my lab at Rutgers that's working to develop a handheld blood cell analyzer for oncology, infectious disease, and mental health patients," he explains.

Javanmard will attended the Washington, D.C. celebration of the 2023 class of senior members at the NAI's annual meeting, *Diversifying Innovation for a Strong Economy and a Sustainable Future* in June.

Emina Soljanin won 2023-24 Urmila Agrawal Distinguished Visiting Chair Professorship at IISc

E. Soljanin

Professor **Emina Soljanin** has won the 2023/24 Urmila Agrawal Distinguished Visiting Chair Professorship at the Indian Institute of Science (IISc). This professorship is an institute-level award with a single recipient across all fields per school year. More information is available at https://odaa.iisc.ac.in/urmila_agrawal/.

IISc scientists are one of the leading groups in India in Emina's field of research. She will visit IISc Quantum Technology Initiative (IQTI) and the Centre for Networked Intelligence (CNI) for four to ten weeks in the Summer of 2024.

ECE Chair Receives N2Women Stars Award in Networking and Communication

Y. Chen

Electrical and computer engineering chair **Yingying (Jennifer) Chen** is the recent recipient of a prestigious N2Women Stars Award in Networking and Communication that honors her cutting-edge research outcomes in edge computing and mobile sensing.

Chen is a professor in the Department of Electrical and Computer s and Peter Cherasia Endowed Faculty Scholar at Rutgers. She is also a fellow of the National Academy of Inventors (NAI), a fellow of the Institute of Electrical and Electronics Engineers (IEEE), and a fellow of the Asia-Pacific Artificial Intelligence Association (AAIA).

"This award means a lot to me," says Chen. "It indicated that female researchers are doing impactful research in the networking and communications area and being recognized. It is a great encouragement to me and my work. I feel even more energized to explore more in the advancement of information technology."

Encouraging Women Engineers

"Yingying is a strong role model for our women undergraduate and graduate students, who are increasingly achieving success in formerly male-dominated industries," says School of Engineering Interim Dean **Alberto Cuitiño**. "This award is not only a major recognition of her outstanding research results in a challenging field, but also reflects her growing national reputation and stature as a leading engineer."

Networking and communications are critical for the advancement of information technology and are the fundamental research areas to enable our mobile world," notes Chen. "N2Women plays an important role by informing the outside world about the contributions of women researchers in these areas."

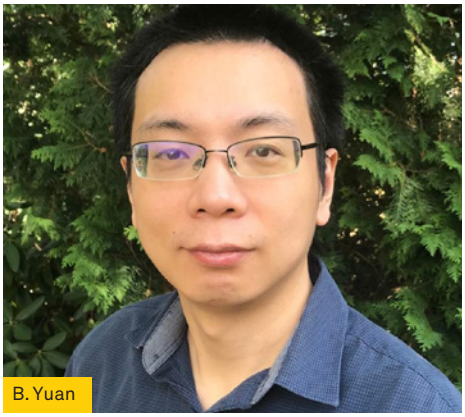
According to Chen, the group provides members with opportunities such as workshops and lunches and dinners at almost every Association for Computing Machinery, or ACM, conference where they can share their experiences, exchange ideas, and gain support from each other at almost every Association for Computing Machinery, or ACM, conference.

Herself a workshop co-organizer and panelist at N2Women meetings at major international conferences, Chen says, "My vision is to encourage more female students and researchers to pursue their careers in science and engineering by sharing my working and family experiences."

Looking ahead, Chen predicts that with the new advancements in 5G and 6G technology, and the support of N2Women, female researchers will contribute even more to the field of networking and communications.

Bo Yuan receives NSF CAREER Award and IEEE Technical Committee on Secure and Dependable Measurement (TCSDM) Early-Career Award

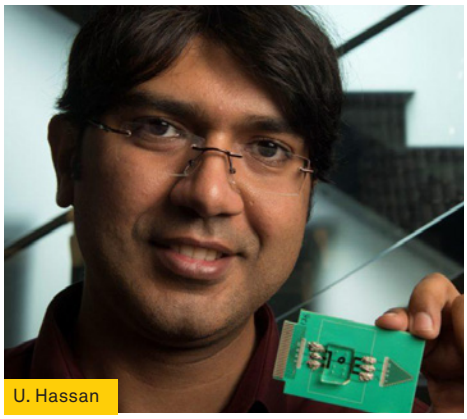
ECE Assistant Professor **Bo Yuan** is the recipient of a new NSF CAREER Award for the project titled "Algorithm-Hardware-Automation Co-Design Exploration of Real-Time Energy-Efficient Motion Planning". Dr. Bo Yuan is the PI on this 5-year $500,000 project.



B. Yuan

Dr. Bo Yuan is also the recipient of the IEEE Technical Committee on Secure and Dependable Measurement (TCSDM) Early-Career Award in 2022, "for his contribution to develop fault-tolerant and efficient signal processing and machine learning techniques for reliable, secure, and low-cost sensing and computing systems." The IEEE Technical Committee on Secure and Dependable Measurement aims to promote interdisciplinary research and education in the field of secure and dependable measurement (SDM), which addresses security, dependability, reliability, fault tolerance, flexibility, and extensibility of advanced measurement and sensing systems. IEEE TCSDM Early-Career Award recognizes a junior researcher from either academia or industry who has demonstrated outstanding contributions to the field of secure and dependable measurement and systems in the early stage of his/her career development. The award information can be found at: http://www.ieee-sdm.org/

ECE Assistant Professor Umer Hassan receives ABioM 2023 Junior Investigator Research Award


U. Hassan

ECE Assistant Professor **Umer Hassan** has received an Advanced Biomanufacturing (ABioM) 2023 Junior Investigator Research Award. The Research award recognizes the junior investigators who have made significant research contributions to the field and have built a successful career in advanced biomanufacturing. The Research award was presented to Dr. Hassan at Biomedical Engineering Society (BMES) Advanced Biomanufacturing (ABioM) special interest group's (SIG) 2023 meeting in Hyattsville, MD.

The specific theme of the 2023 meeting was "Accelerating Advanced Biomanufacturing Through Discovery to Implementation." Dr. Hassan was invited to present his group's research in the area of "3D Printed, Portable Fluorescence Microscopy System for Single-Cell Imaging Enabling Automated Quality Assessment for Advanced Biomanufacturing". The 2023 ABioM SIG meeting brought together policy makers, scientists, engineers, and entrepreneurs, as well as educators to map the field and identify the grant challenges and opportunities within the field.

Grants received by ECE faculty

Bo Yuan received NSF CAREER Award for the project titled "CAREER: SHF: Chimp: Algorithm-Hardware-Automation Co-Design Exploration of Real-Time Energy-Efficient Motion Planning."

Shirin Jalali received NSF CAREER Award for the project titled "CAREER: Theoretical Framework for Design and Analysis of Snapshot Compressive Imaging Systems."

Athina Petropulu received an ARO Grant for the project titled "Dual Function Radar Communication Systems for Efficient and Secure Spectrum Utilization."

Predrag Spasojevic received an ONR/DURIP Grant for the project titled "Deployable Battlefield of Highly Reconfigurable Wideband RF Transmitters."

Waheed Bajwa received the Rutgers Office for the Vice Provost for Research (OVPR) ML/AI Pilot Seed Grant for the project titled "Enabling Precision Medicine in Psychiatry Through Advances in Machine Learning for Multimodal Neuroimaging Data."

Yingying Chen received a Rutgers Brain Health Institute (BHI) Pilot Grant in Neuroscience for Center and Program Project Grant for the project titled "An Integrated Approach to Build Precision Medicine for Substance Use Disorders."

Hang Liu received an NSF/CICI Grant for the project titled "TCR: Prompt, Reliable, and Safe Security Update for Cyberinfrastructure."

Umer Hassan received an NSF Grant for the project titled "A Medical Device Enabled by Portable Fluorescence Microscopy and Microfluidics for Monitoring Surgical Inflammation Biomarkers."

Ivan Marsic received a NIH/NBIB Grant for the project titled "Development of a Video-based Personal Protective Equipment Monitoring System."

Emina Soljanin received an NSF/CIF Grant for the project titled "Maximizing Coding Gain in Coded Computing."

Laleh Najafizadeh received an NSF/NCS-FO Grant for the project titled "Uncovering Dynamics of Neural Activity of Subjective Estimation of Time."

Umer Hassan received an NSF/PFI-TT Grant for the project titled "Immuno-Dx: A Biomedical Platform Technology for Personalized Diagnostics."

Hang Liu received an NSF Grant for the project titled "ExpandQISE: Track 1: Analog quantum simulation of non-Markovian dynamics of multi-qubit systems."

Narayan Mandayam, Yingying Chen, and **Ivan Seskar** received an NSF Grant for the project titled "FMRG: Cyber: Manufacturing USA: NextG-Enabled Manufacturing of the Future (NextGEM)."

Narayan Mandayam, Ivan Seskar and **Chung-Tse Michael Wu** received an NSF/SWIFT-SAT Grant for the project titled "Software Defined Radio based Emulation of SAT-Terrestrial Network Coexistence in "FR3" Bands."

Yingying Chen received an NSF/IIS Grant for the project titled "Efficient and Robust Multi-model Data Analytics for Edge Computing."

alumninews

T. Sanam

Tahsina Farah Sanam, Ph.D., is serving as an Associate Professor in the Institute of Appropriate Technology at Bangladesh University of Engineering and Technology. She completed her Ph.D. from the Department of Electrical and Computer Engineering at Rutgers University, New Jersey in 2020. She earned both her M.Sc. degree in Electrical and Electronics Engineering in 2012, and B.Sc. degree in Electrical and Electronics Engineering in 2009 from Bangladesh University of Engineering and Technology. During her time at Rutgers, Ms. Sanam received the Rutgers Chancellor's Leadership Award in 2019. She also received the ECE Graduate Program Academic Achievement Award for her Ph.D. dissertation in May 2020, the ECE Research Excellence Award in Fall 2018, and the Best Poster Award in 'ECE Research Day', Rutgers University 2017. After returning back from USA, Ms. Sanam received the Faculty Scholarship, from Grace Hopper Conference (GHC 22), Florida, USA in June 2022 and Forum 86 Research Excellence Award by BUET Forum 86 in June 2023. Currently, besides her faculty position, Ms. Sanam is serving as the Newsletter Editor of IEEE Bangladesh Section Executive Committee. Her research works lie at the intersection of Signal Processing, Machine Learning, Wireless Communications, and the Internet of Things (IoT). Her goal is to establish an independent research career in Bangladesh with multidisciplinary collaborations in the field of Smart City and Connectivity leveraging advanced signal processing and artificial technologies. With that focus, Dr. Sanam has established her research lab 'Cyber Physical Intelligence Laboratory' and currently, her research group consists of 12 M.Sc. students.

H. Imtiaz

Hafiz Imtiaz, Ph.D. is serving as an Associate Professor in the Department of Electrical and Electronic Engineering at Bangladesh University of Engineering and Technology. Hafiz earned his Ph.D. degree from the Department of Electrical and Computer Engineering at Rutgers University, New Jersey in 2020. He earned his first M.Sc. degree and his B.Sc. degrees from Bangladesh University of Engineering and Technology in 2011 and 2009, respectively. He earned his second M.Sc. degree from Rutgers University in 2017. During his time at Rutgers, Hafiz received ECE Graduate Program Academic Achievement Award in 2020 for his Ph.D. dissertation, the ECE PhD Research Excellence Award in 2019 and 2016, the Pre-Doctoral Leadership Development Academy Fellowship Award in 2019, School of Graduate Studies Conference Travel Award in 2018, TA/GA Professional Development Fund Award in 2018, 2017, and 2016, and the National Science Foundation (NSF) Conference Travel Award in 2016. After completion of his Ph.D. degree, Hafiz returned to Bangladesh University of Engineering and Technology to rejoin his role as a faculty in the Department of Electrical and Electronic Engineering. His primary area of research includes developing privacy-preserving machine learning algorithms for decentralized data settings. More specifically, he focuses on matrix and tensor factorization problems, which are core components of many modern machine learning algorithms. His research group currently consists of 10 M.Sc. students and 1 Ph.D. student. He is also serving in several national committees as consultant and technical expert.

Dr. Sanam and Dr. Imtiaz have been collaborating in several ongoing research projects. They co-supervised two undergraduate thesis projects: "Human Activity Recognition from Wi-Fi CSI Using Principal Component-Based Wavelet CNN" and "Designing Efficient and Implementation-friendly Convolutional Neural Network for Sign Language Recognition using Wi-Fi CSI Data". Currently, they are supervising an M.Sc. research project on privacy preserving cross environment human activity recognition. Dr. Sanam and Dr. Imtiaz have received a research grant from the Committee for Advanced Studies and Research (CASR), BUET on "Development of an End-to-end Privacy-preserving Human Activity Recognition System using Wi-Fi Channel State Information Data for Application in Smart Healthcare" worth BDT 5,00,000. One M.Sc. student is currently working with them on this project. They have supervised a team of 10 students in IEEE Signal Processing Cup 2022 organized during the 2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) and secured the Second Runner-Up position with Prize money 1500 USD in May 2022.

industry advisory board

The **Advisory Board** provides input on academics, research, administration, outreach, advocacy, and development. The Board reviews the graduate and undergraduate curriculum and degree programs, program educational objectives, and program outcomes, and offers suggestions for change to keep them current. The Board evaluates the quality and scope of our research, its relationship to our programs, its relevancy and helps guide future directions. The Board recommends ways to build new relationships with industry and to strengthen those we have.

Don Bachman
Head of Strategy
Russelectric, a Siemens Business

Dorin Comaniciu
Senior Vice President
Artificial Intelligence and Digital Innovation
Siemens Healthineers

Ed Cordero
Director
Protiviti

Anindo Dutta
Partner
Ernst & Young, Asia Pacific

David Famolari
Managing Director
Hearst Ventures

Hubertus Franke
Distinguished Research Staff Member
IBM Research

Kfir L. Godrich
Managing Director
BlackRock

Rajiv Jain
CTO for Financial Services Industry
CDW

Ed Knapp
Chief Technical Officer
American Tower Corporation

Chris Marty
Managing Director
Two Sigma Investments LP

Rita Marty
Vice President
AT&T - Chief Security Office

Gihan B. Oraby
Deputy Director for the Weapons
and Software Engineering Center (WSEC)
Picatinny Arsenal, U. S. Army

Bharat Parikh
President
AASKI Technology Business Unit
MAG Aerospace

Pete Pupalaikis
Founding Partner and Director
of Signal Integrity
Nubis Communications

Joe Rambala
President
Electronic Warfare, Space & Airborne Systems
L3Harris

Thomas Richardson
Vice President, Engineering
Qualcomm Inc.

Ashwin Sampath
Senior Director of Technology
Qualcomm Inc.

Sanyogita Shamsunder
Director of Strategy-Technology
Network CTO Office
Verizon Wireless

Stephen Wilkus
Chief Technology Officer
Spectrum Financial Partners

RUTGERS
School of Engineering

thank you

The ECE Department Wishes to Thank All the Donors Who Supported Us During the Past Year.

Your Contributions Helped Us

- Attract brilliant new faculty, by supplementing startup packages
- Attract excellent students, by providing fellowships
- Support student travel to conferences
- Maintain state-of-art laboratories for educating our students on cutting edge technology
- Create materials to advertise our program to the external world.

Your support has been essential in our ability to sustain excellence.

To support ECE please visit **www.ece.rutgers.edu/donate**
or scan this code

RUTGERS
Department of Electrical and Computer Engineering
Rutgers, The State University of New Jersey
94 Brett Road
Piscataway, NJ 08854

Non Profit org
US POSTAGE PAID
New Brunswick, NJ 08901
Permit 157

RUTGERS
School of Engineering