RUTGERS School of Engineering

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Rutgers University School of Engineering | Department of Electrical and Computer Engineering | 2018

Project Skywatch team

COSMOS City Scale Testbed

Health Monitoring

S. El Rouayheb

J. Lindqvist

P. Karimi

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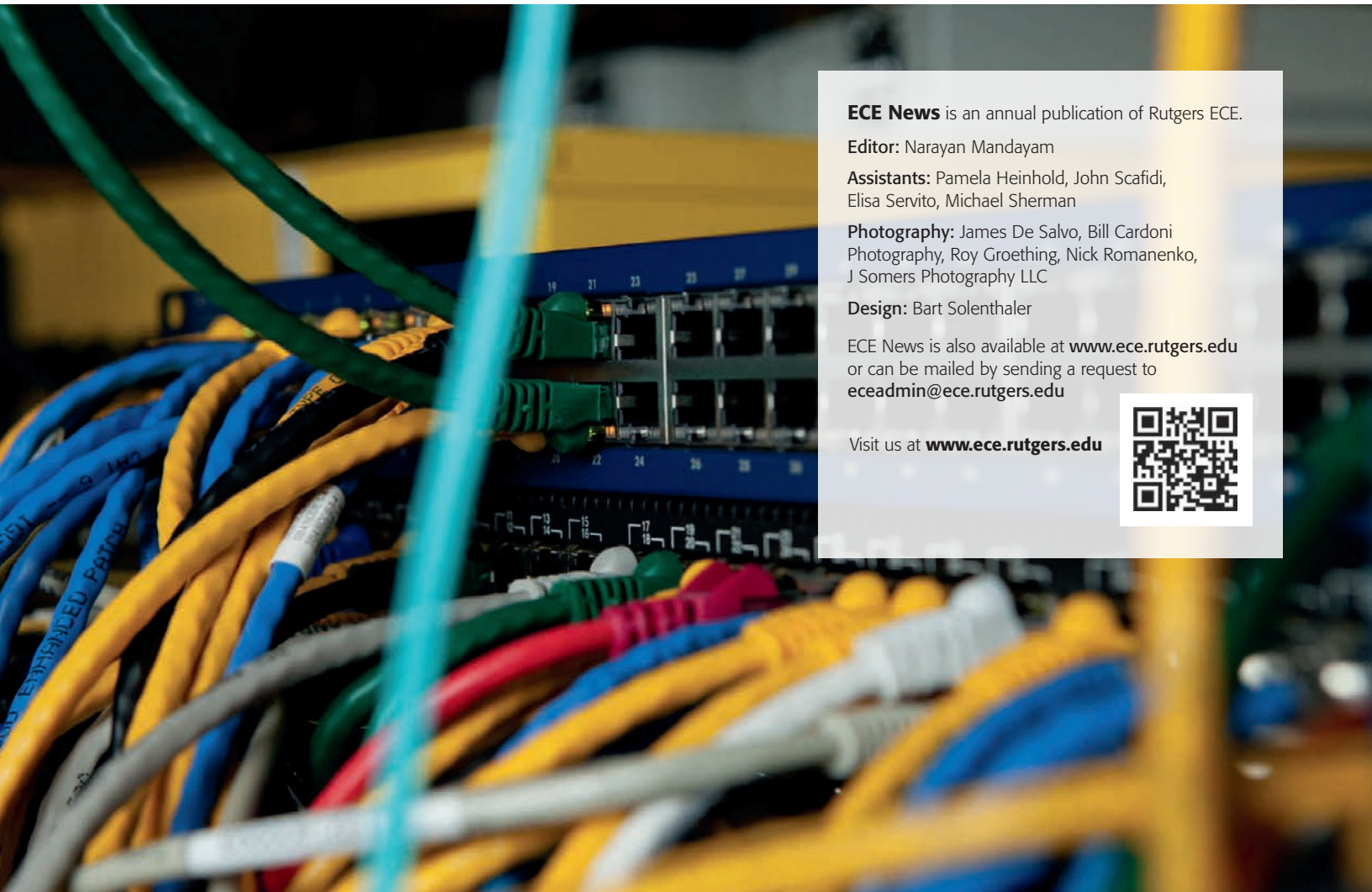

ECE News is an annual publication of Rutgers ECE.

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message from the Chair


N. Mandayam

ECE Numbers

38 Faculty

6 Part-Time Lecturers

844 Undergraduate Students

288 Graduate Students, 130 PhD

Space: **40,000 sq. ft.**

As I commence the last year of my current term as Chair, it is my pleasure to share with you some exciting news about my department during this past academic year. Our department continues to see an influx of highly talented faculty members contributing expertise in important emerging areas. This Fall we welcomed 4 new Assistant Professors: Dr. **Umer Hassan** (an expert in point of care devices for global health), Dr. **Jorge Ortiz** (an expert in smart sensing and machine learning), Dr. **Sheng Wei** (an expert in hardware security) and Dr. **Bo Yuan** (an expert in computer architecture for energy efficient machine learning). This makes it 7 new tenured and tenure-track faculty members we have welcomed to the department in the last 2 years, strengthening our footprint in areas such as signal and information processing, security, privacy, cyberphysical systems, bioelectrical engineering, machine learning and high performance computing.

Our faculty and students have made ECE at Rutgers into one the most vibrant departments, creating a community that fosters excellence in education and research. This excellence is reflected in the remarkable successes and outstanding achievements of our students and faculty members alike. Highlights include Professor **Peter Meer** (a world renowned computer vision expert promoted to Distinguished Professor), Professor **Marco Gruterser** (named the Peter D. Cherasia Endowed Faculty Scholar), Professor **Anand Sarwate** (named the A Walter Tyson Endowed Assistant Professor), Professor **Janne Lindqvist** (2018 NSF CAREER Award), Professor **Salim El Rouayheb** (2018 Google Faculty Award), Professor **Shantenu Jha** (2018 IEEE Scale Award), and Professor **Narayan Mandayam** (2018 Distinguished Alumnus Award from Indian Institute of Technology (IIT), Kharagpur). Professor **Dipankar Raychaudhuri** led a team from WINLAB, Columbia and NYU that was the winner of a $ 22M award from the NSF to build a city scale advanced wireless testbed in Manhattan. Professor **Mehdi Javanmard**'s research on biosensing was featured multiple times in mainstream national and international media, Professor **Yingying Chen** was featured for her work on object detection using WiFi, and Professor **Emina Soljanin** was featured on the PBS American Masters Podcast celebrating the life of Hedy Lamar. Like the year before, this year too was marked with a large number of external grants.

ECE graduate student **Parishad Karimi** received the Student Research Award at the highly prestigious 2017 ACM Grace Hopper Celebration. In addition, ECE students amassed a large number of recognitions, including best paper awards at the IEEE International Conference on Communications and Network Security (**Chen Wang, Jian Liu**) and IEEE International Conference on Multimedia and Expo Grand Challenge (**He Zhang**), 2nd place at the Siemens Corporate Technology's FutureMakers Challenge on Autonomous Agricultural Production using Robotics and AI (**Matthew Purri, Jia Xue, Peri Akiva, Eric Wengrowski**), the School of Engineering Outstanding Graduate Student Award (**Tuyen Tran**) and a best dissertation award from the IEEE Aerospace and Electronics Systems Society (**Bo Li**). ECE undergraduate student teams continued their string of winning prizes for their research projects at national competitions by following up on last year's first place at Harvard PacBot competition with first place at this year's Harris Corporation competition for the SKY-WATCH drone project.

Consistent with this excellence, our student enrollment has grown dramatically with our undergraduate enrollment across sophomore, junior and senior years at around 845, and the incoming graduate student class size at around 80 students. Our international program with a top tier university in China continues to flourish bringing in excellent students as we seek to expand such partnerships with other universities. ECE also remains one of the most sought after majors for employers from a broad spectrum of industry, with the fundamentals that ECE students are exposed to here making them versatile and productive employees from day one.

This was a great year for our alumni, whose amazing success is a source of inspiration to our students and faculty. Our department has produced outstanding scholars, industry leaders, entrepreneurs. You can meet some of them on page 29-30.

In our pursuit of excellence the support of our alumni and friends is essential. I would like to thank everybody who supported us this past year. Through this support we were able to supplement startup packages of new faculty, provide student fellowships, support student travel to conferences and maintain state-of-art laboratories.

I am very proud of the accomplishments highlighted in this newsletter. Please visit us next time your travels bring you to our area, to experience up close the vibrancy of this department.

Sincerely,

Narayan Mandayam
Distinguished Professor and Chair

ecefaculty

Waheed U. Bajwa
Associate Professor
NSF Career Award, ARO YIP Award
Research Interests: High-dimensional inference and inverse problems, compressed sensing, statistical signal processing, wireless communications, and applications in biological sciences, complex networked systems, and radar & image processing.

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

Yingying (Jennifer) Chen
Professor
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, large-scale sensing data analysis.

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

Salim El Rouayheb
Assistant 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 and Graduate Director
Research Interests: Power control of wireless networks.

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

Marco Gruteser
Professor
Peter D. Cherasia Faculty Scholar,
NSF Career Award,
ACM Distinguished Scientist
Research Interests: Location-aware systems, pervasive computing systems, privacy and security, mobile networking, sensor networks and performance evaluation.

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

Mehdi Javanmard
Assistant Professor
Research Interests: Nanobiotechnology, BioMEMS, Point of care diagnostics, Biomarker detection, Microfluidics, Electrokinetics, Applications of nanotechnology to medicine and biology.

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

Janne Lindqvist
Assistant Professor
NSF Career Award
Research Interests: Security Engineering, Science of Security, Human-Computer Interaction.

Yicheng Lu
Distinguished Professor
IEEE Fellow
Research Interests: Microelectronics material and devices.

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

Narayan Mandayam
Distinguished Professor & Department Chair
Peter D. Cherasia Faculty Scholar and Associate Director of WINLAB, 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.

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

John McGarvey
Assistant 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.

Sophocles Orfanidis
Associate Professor
Research Interests: Statistical and adaptive signal processing, audio signal processing, electromagnetic waves and antennas.

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

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
Associate Professor
NSF Career Award, ONR Young Investigator Award, DARPA Young Faculty Award
Research Interests: Wireless ad hoc and sensor networks, underwater acoustic communications, underwater vehicle coordination, team formation/steering, task allocation, thermal management of datacenters, green computing, cognitive radio networks, dynamic spectrum allocation, traffic engineering, network optimization and control.

Lawrence Rabiner
Professor Emeritus
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.

Dipankar Raychaudhuri
Distinguished Professor & Director of WINLAB
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.

Peddapullaiah Sannuti
Professor Emeritus
IEEE Fellow
Research Interests: Simultaneous internal and external stabilization of linear time-invariant systems in the presence of constraints is pursued. Internal stabilization is in the sense of Lyapunov while external stabilization is in the sense of L_p l_p stability with different variations, e.g. with or without finite gain, with fixed or arbitrary initial conditions with or without bias.

Anand D. Sarwate
Assistant Professor
NSF Career Award, A Walter Tyson Award
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
Professor
IEEE Fellow and Distinguished Lecturer
Research Interests: Efficient, reliable, and secure storage and transmission networks, coding, informatin, and queueing theory.

Predrag Spasojevic
Associate Professor
Research Interests: Communication and information theory, signal processing and representation, cellular and wireless Lan systems, adhoc 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.

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

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

Sheng Wei
Assistant Professor
NSF Career Award
Research Interests: Hardware security and trust, hardware-enabled system security, heterogeneous system architecture and security, mobile and multimedia systems.

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

Roy Yates
Distinguished Professor & Associate Director of WINLAB
IEEE Fellow
Research Interests: Resource management in wireless systems, dynamic spectrum access and spectrum regulation, information theory for wireless networks and future internet architectures.

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

Yanyong Zhang
Professor
NSF Career Award, IEEE Fellow
Research Interests: Computer architecture, operating systems, parallel computing cluster computer, performance evaluation and sensor networks.

Jian Zhao
Professor
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.

Saman Zonouz
Associate Professor
NSF Career Award
Research Interests: Networks security and privacy, trustworthy cyber-physical critical infrastructures, embedded systems, operating system security, intrusion detection and forensics analysis, and software reverse engineering.

Abraham Borno
Part-time Lecturer
AT&T Labs Research
Expertise: Optimal control, large-scale systems, Markov chains, parallel algorithms.

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

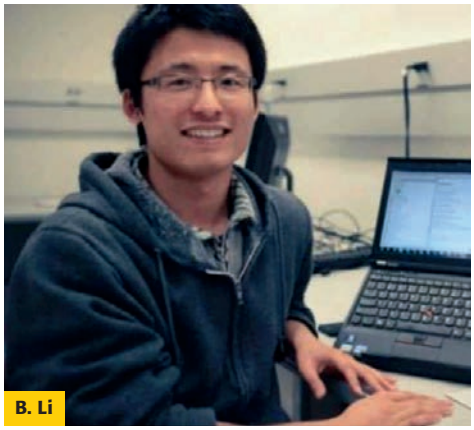
Richard Frenkiel
Part-time Lecturer
National Medal of Technology, Alexander Graham Bell Medal, National Academy of Engineering, National Academy of Inventors, Draper Prize
Expertise: Cellular Systems, Wireless Networks

Phil Southard
Part-time Lecturer
Harris Corporation
Expertise: Field programmable gate arrays (FPGA's), computer hardware, digital design, programmable logic, application specific integrated circuits.

Shiyu Zhou
Part-time Lecturer
Expertise: design and analysis of data structures and algorithm, computational complexity, information theory.

studentnews

ECE PhD Graduate Bo Li wins 2017 Robert T. Hill Memorial Best Dissertation Award from IEEE Aerospace and Electronics Systems Society


B. Li

Bo Li, a recent PhD graduate (2017) of the Rutgers Electrical and Computer Engineering (ECE) department, has won the 2017 Robert T. Hill Memorial Best Dissertation Award, given by the Institute of Electrical and Electronics Engineers (IEEE) Aerospace and Electronics Systems Society (AESS).

The Best Dissertation Award, in honor of Robert T. Hill, is an annual AESS award to recognize candidates that have recently received a Ph.D. degree and have written an outstanding Ph.D. dissertation that has made particularly noteworthy contributions in a field of interest of the Aerospace and Electronic Systems Society. Its purpose is to grant international recognition for the most outstanding Ph.D. dissertation by an AESS member in the year she/he is nominated. The award consists of an honorarium of $1,000 and a plaque, and was presented to Bo Li at the 2018 IEEE Radar Conference that was held in Oklahoma City in April 2018.

In his thesis titled "Topics in MIMO Radars: Sparse Sensing and Spectrum Sharing," Bo studied sparse sensing in the context of MIMO radars, and provided efficient algorithms and rigorous theoretical analysis of performance. Bo also did groundbreaking work on spectrum sharing between commercial wireless communication systems and radars, a topic that has been attracting increasing attention after plans of regulatory agencies to release spectrum, previously earmarked for radar, for shared use by communication systems and radars. Bo's work enables radar-communication coexistence via a novel use of sparse sensing at the radar, and also use of optimal precoding at both systems. He proposed a novel system framework, which allowed him to systematically address the challenges of coexistence, and propose a novel, efficient physical layer methods for spectrum sharing.

Bo was a member of the Communications and Signal Processing Laboratory (CSPL) at ECE Rutgers, and did his PhD under the supervision of Distinguished Professor **Athina Petropulu.** His work was funded by the National Science Foundation and Raytheon. He joined Rutgers in 2012, after receiving a MS degree from Peking University and undergraduate degree from Lanzhou University. He is currently with Qualcomm Inc, Corporate Research & Development in San Diego CA.

It is the second year in a row that a Rutgers ECE graduate has received the Robert T Hill Dissertation Award. Shunqiao Sun (2016 PhD), also a CSPL member, was the recipient of the 2016 Robert T Hill Dissertation Award.

Tahsina Farah Sanam Awarded Microsoft Conference Scholarship


T. Farah Sanam

Tahsina Farah Sanam, an ECE PhD student working with Prof. Hana Godrich, was awarded a Microsoft Scholarship to attend 2018 ACM Richard Tapia Conference in Orlando, Florida.

The Tapia conference is the premier venue to acknowledge, promote and celebrate diversity in computing. The goal of the Tapia Conferences is to bring together undergraduate and graduate students, faculty, researchers, and professionals in computing from all backgrounds and ethnicities. Tapia 2018 hosted an ACM Student Research Competition (SRC), sponsored by Microsoft Research.

Tahsina's current research on "Indoor Localization: A Device Free Perspective" was accepted for participation in ACM SRC competition in 2018 Tapia Conference.

Capstone Project SKY-WATCH Wins First Prize at Harris Corporation competition

A team of Electrical and Computer Engineering (ECE) seniors from Rutgers University, **Michael Collins, Gregory Mueller, Kevin Quizhpi, Shannon Sabino,** and **Omar Shaban,** advised by Dr. **Dario Pompili,** Associate Professor with the Rutgers Department of ECE, was awarded 1st prize in the Harris Corporation senior project competition on April 27, 2018 for their project titled SKY-WATCH. Two days earlier, the team had also secured the third prize in the Rutgers ECE Capstone Design Competition, which this year saw 68 projects competing. SKY-WATCH is a drone-based architectural scanner system that is geared toward architectural surveying for early detection of faults and deformations, verifying insurance claims, and historical preservation. By integrating drones, 3D reconstruction, and multi-agent reinforcement learning, the team has developed a system that can autonomously scan buildings and structures and construct a 3D visual model.

ECE Graduate Student wins Student Research Award at 2017 ACM Grace Hopper Celebration

Parishad Karimi captured first place in the graduate category of ACM's Student Research Competition at the Grace Hopper Celebration held October 2017 in Orlando. The Grace Hopper Celebration is the world's largest gathering of women technologists. It's produced by the ACM and AnitaB.org, which connects, inspires, and guides women in computing. Parishad's research was sparked by the exponential growth of wireless networks and the incompatibility of different access technologies within the same frequency band. To solve this problem, she proposed SMART, a distributed resource management architecture that enables coordinated resource usage.

P. Karimi

ECE Researchers win First Prize at the 2018 IEEE International Conference on Multimedia and Expo Grand Challenge

Assistant Professor **Vishal Patel** and ECE PhD student **He Zhang** have won the 1st prize at the 2018 IEEE International Conference on Multimedia and Expo (ICME) Grand Challenge for their work on heterogeneous face recognition. Their algorithm for polarimetric thermal-to-visible face recognition achieved the best performance on the Heterogeneous Face Recognition Grand Challenge organized by the Army Research Laboratory (ARL) as part of the 2018 IEEE ICME. Professor Patel and Zhang's approach is based on a Generative Adversarial Network (GAN) which uses a multi-stream feature-level fusion technique to synthesize high-quality visible images from polarimetric thermal images.

ECE Senior Greg Mueller Graduates After Initially Pursuing Music Career

Manya Goldstein

G. Mueller

The interplay of the left brain and right brain is epitomized by **Gregory Mueller,** whose greatest passions are music and math. He says the two disciplines kept him grounded throughout childhood and gave context to his adolescent life.

But when the time came to choose a focus for college, he faced a strong internal debate: Music or engineering? Engineering or music? Ultimately, Mueller just couldn't see himself sitting behind a desk all day. And so music prevailed – at least for the time being.

Mueller graduated with a bachelor's degree in electrical and computer engineering from Rutgers-New Brunswick's School of Engineering. He joined the digital design team at Harris Corporation in Clifton, New Jersey, working as an electrical engineer.

Mueller might seem like any other engineering graduate on the cusp of his career, but his graduation serves as a major shift in a life devoted to music. The California native made the initial decision to pursue music in his junior year of high school. From that point onward, he spent all of his time pursuing an array of musical endeavors – orchestra, drum line, jazz band, marching band, percussion ensemble and musicals.

Mueller began his formal music education at Indiana University, determined to capture a position in a national orchestra. After graduating, he traveled to the Northeast to continue his orchestral studies at the Mason Gross School of the Arts at Rutgers and to learn from the New York and Philadelphia musicians on faculty. When he graduated from the Mason Gross School with a master's degree in music in 2010 without an orchestra position lined up, Mueller took a job working the front desk in the school's music department to supplement his income as a freelance musician.
"I played for musicals, local orchestras, Afro-Cuban jazz groups, shekere ensembles, brass bands, churches, avant-garde operas, new music experiences and more," he said.

At the same time, Mueller also started working heavily in the field of audio and video production. As his tech skills improved, he found himself fascinated by the way the equipment worked.

"In particular, I spent most of my time trying to understand how the signal processing algorithms I used at work actually functioned," Mueller said. "After some research, I discovered that electrical engineers were almost entirely responsible for the majority of the design and implementation of the tools I used day to day."

In 2015, he decided to take the leap and formally pursue engineering.

"I asked to change my day job at Rutgers to include running the newly minted recording studio at Mortensen Hall on Douglass campus in addition to attending school full time at Rutgers. Fortunately, my supervisors were extremely supportive and gave the go-ahead to start my engineering odyssey," he said.

Despite his switch in professions, Mueller has no intention to neglect his musical side.

He believes his musical expertise helps him succeed in the right-brain dominated world of engineering.

"The verbal and nonverbal communication skills used in the music world help me with the soft skills needed to convey engineering ideas to tech and nontech-minded individuals," he said. "I look forward to pursuing music for my own personal fulfillment for a change."

ECE Graduate Student Team wins 2nd Place in Siemens FutureMakers Challenge Hackathon

An ECE graduate student team has won 2nd place at the Siemens Corporate Technology's FutureMakers Challenge for the theme "Autonomous Agricultural Production using Robotics and AI." The team comprising of students **Matthew Purri, Jia Xue, Peri Akiva** and **Eric Wengrowski,** who work in Professor **Kristin Dana**'s lab won this recognition for their project "Computer Vision in Agriculture." Professor Peter Oudemans from Rutgers School of Environmental and Biological Sciences co-advised the students on this project.

Meet an ECE Student

Deepti Upmaka

I am a rising senior double majoring in Electrical & Computer Engineering and Computer Science. I found Rutgers IEEE in my freshman year and was intrigued by the hands-on experience outside the classroom the club offered. Over the years, I held multiple positions where I brought in professionals for career development events, organized outreach events, and participated in the quadcopter division. Last year I co-organized Rutgers IEEE's largest event. We hosted the first student-run VEX Robotics Competition and brought over 100 high school students to the Rutgers campus. We received positive feedback from both the participants and the School of Engineering. As President next year, I plan to expand our mission by increasing the club's visibility within Rutgers and lead efforts to engineer a solution to a problem that exists in our local community.

Being a part of Rutgers IEEE and HKN, gave me the opportunity to bring the joy of engineering to a wider audience by participating in numerous events. During Young Engineers Day we taught middle school students how to make an app and during Rutgers Day we demonstrated basic circuitry by creating a moving "jitterbug" with a motor and battery to children of all ages.

Rutgers helped me develop personally and professionally. Through the Engineering Honors Academy I have had the chance to get to know Dean **Jean Patrick Antoine.** He advised me during my undergraduate career and encouraged me to seek out opportunities like the Deloitte National Leadership Conference. ECE Undergraduate Director, **Hana Godrich,** has lent her support to Rutgers IEEE by attending our showcases and gave us the opportunity to volunteer and raise the profile of Rutgers IEEE and HKN.

Outside of my academics, my summers have been filled with great experiences. During the summer of 2016 I learned about Neural Networks in the Aresty Summer Science Program. I spent last summer at LGS Innovations and am currently interning at Capital One. These internships have allowed me to gain insight into the real-world applications of software engineering in defense and finance.

I would also like to explore my career opportunities in STEAM (STEM x Arts). I am interested in applying engineering to design and creating solutions for systemic challenges in our society. As I sprint to my final year at Rutgers I am considering graduate school and industry. I'm excited to see what the future holds for me!

Srikrishnaraja Mahadas

I am an undergraduate student majoring in Computer Engineering at Rutgers University. Simultaneously I am also pursuing a double minor in Computer Science and Psychology. I have enjoyed every moment at Rutgers University and I have learned many new concepts and gained valuable experience.

I am currently involved in a research project called Sports Biomechanics under the guidance of Professor **George Shoane.** The project is about creating the ideal golf swing and analyzing the dynamics of the golf stroke. A program called OpenSim was used to create and simulate a model of the body undergoing the motions of the golf swing, while Matlab was used to measure the various dynamics of the swing. The research project has really been an enriching experience for me, as it involved applying learned concepts to real life scenarios. Another activity that has really changed my time here at Rutgers is membership in IEEE. I am mainly involved in IEEE through VEX, which is a division of IEEE focused on robotics. As a member of VEX, I was mainly involved in the construction a robot that participated in a prestigious competition. Vex was a wonderful experience that allowed me to express the creative and innovative aspects of the engineering discipline.

Another major milestone for me at Rutgers is that I am the first person to receive the **Pedda** and **Suseela Sannuti** Scholarship for the year 2017-2018. I am grateful to receive the benefits of this scholarship as it allowed me to explore various other opportunities at Rutgers. All these experiences helped me grow as a person and made me who I am today.

Gazing into the future, I have near term and long term goals and I believe that my current experiences at Rutgers will help me to achieve them. When it comes to the near future, I will be a Learning Assistant in the Fall of 2018. I will be sharing my outlook and knowledge with my fellow students and inspire them to accomplish their goals. Further down the line I plan to pursue a Master's degree in Computer Engineering.

I really appreciate the staff of the ECE department in supporting and guiding me throughout my educational journey. I believe that the knowledge gained and the wonderful learning opportunities at Rutgers will be extremely valuable in all my future endeavors.

Sakshi Sardar

I am a joint Ph.D. candidate in Electrical and Computer Engineering, and Quantitative Biomedicine working under the guidance of Dr. **Javanmard** and Dr. **Fabris**.

I began my joint PhD program in Fall, 2016. From the beginning, it became clear that I was excited to work on biosensor design. This led to projects involving quantification of analytes using SERS and my submissions to be accepted at MicroTAS 2017 and MRS Fall 2017 meeting. I have traveled with the research group that I am part of and my advisor, Dr. Javanmard, to Georgia for presenting our research work.

I am a recipient of the ECE Research Excellence Award, Fall 2017 cycle, which provided financial assistance for my travel to MRS Fall 2017 meeting where I presented my poster in solution processed inorganics for electronics and photonic device applications focus area.

My passion for social entrepreneurship led me to join a Rutgers team called LivingWaters. Currently, I am learning intricacies of launching startups from numerous social entrepreneurs at Hultprize accelerator program. I am also actively involved with running a pilot in India while working closely with people in rural areas suffering from acute water shortages. This experience has brought to light numerous issues facing people residing in rural settings of certain regions. I found that they not only suffer from lack of adequate water supply, even during monsoons, but are also forced to migrate to other regions in search of employment during the other parts of the ear, and this is just the tip of the iceberg.

I hope that working in rural areas can help in identifying key aspects that will have impact to change trajectories of lives of people, enabling them to break the cycle of poverty. One such key aspect is to help them have access to basic necessities of life.


D. Upmaka


M. Srikrishnaraja


S. Sardar


S. Nagesh


T. Dai

I have been working with a great team of ECE graduate student organization during the past one year. They have successfully organized events to bring together graduate students from the department. We also hope to provide additional academic and social interactive experiences among graduate students in upcoming years.

I expect to complete my doctoral studies in 2019. Post-graduation, I hope to continue my research that could enable social change through innovative solutions, especially in areas with low-resource setting.

Samyuktha Nagesh

I am a graduate student majoring in computer engineering with great interest in data science. For someone with diverse interests as mine, one of the great things about the ECE department curriculum is its flexibility. While I learned about Computer Architecture, parallel computing, and software engineering from core ECE courses, I also learned business data management, financial forecasting and data analysis from courses offered by supporting departments.

Curriculum is only part of the college experience, not all of it. "Emotional Ambivalence" is what I felt on the day I left India, home, to come to Rutgers to get my Masters. I was incredibly excited for all the learning. At the same time, I was anxious of finding my place in this big university. This was only until I got my first ever job! Student worker for the ECE department. Dr **Hana Godrich** (whom I work for) and all the staff at the department made me feel welcome from day one, showed patience and support, appreciated me when I did well and instilled confidence in me.

Primarily I work with the capstone design project, course for the ECE senior class where students design and develop projects in teams. As students innovate and built new projects, the staff, who support the course and events associated with it also innovate and come up with new ideas to make the process more efficient. I absolutely enjoy being part of such a fun team.

With the superior technical training, I also take valuable people skills I perfected at work with me as I graduate this December. Looking forward to my professional career, I will always cherish my time spent at Rutgers and forever be thankful for a great college experience.

Thorson Dai

I graduated *summa cum laude* with Bachelor of Science in Electrical & Computer Engineering in 2018. Most important of all, I turned twenty-one on the day of graduation.

Though it was brief, my time spent studying in the ECE department spurred my growth as both an engineer and a systems designer. I took an unusual path getting here, transferring after a one-year stint at Rutgers-Camden to taking eight (8) credits in the department my very first summer. Strangely enough, I found passion in sharing what I had learned, and over the course of my two years here I tutored under the Office of Student Services, EOF Summer Institute, and even ECE Fishbowl Tutoring. Beyond coursework, I also mentored fellow transfer students under the Transfer Integration Program during my last year here.

Moreover, in my studies, I decided upon the Electrical Engineering option as a focus. Power Electronics, Microelectronic Fabrication, and RF Integrated Circuit Design are all fascinating topics of study, and each provides a different cross-sectional view into a modern electrical world. Bearing that in mind, my advice to current and prospective students would be also to self-study and learn outside of lecture contents. With a wider skillset and breadth of knowledge, you can cast your proverbial net out wider for opportunities. Who knows — it might even land you a job offer, like I did independently learning to use Unix.

Today I work as an Assistant Facilities Manager, helping to manage electrical and mechanical equipment serving a datacenter facility, alongside a fantastic crew of engineers and a great manager mentoring me. It's a fascinating line of work for a management job that I never envisioned having. Despite my relative inexperience and complete lack of internships, my passion for learning and a grasp of core engineering concepts have helped me in quickly understanding interchanges between many systems (e.g., HVAC, Power Distribution, Networking, etc). For me, every day is a new challenge — something ventured and insight gained.

ECE PhD Student Tuyen (Harry) Tran receives the 2018 School of Engineering Outstanding Graduate Student Award

T. Tran

ECE PhD student **Tuyen (Harry) Tran** received the 2018 School of Engineering Outstanding Graduate Student Award.

Harry joined the Department of Electrical and Computer Engineering (ECE) as a PhD student in September 2014 and completed his PhD degree in April 2018 under the supervision of ECE Professor **Dario Pompili,** director of the Cyber-Physical Systems Laboratory (CPS Lab). He received the B.Eng. (Honors Program) degree in electronics and telecommunications from the Hanoi University of Science and Technology, Vietnam, in 2011 and the M.Sc. degree in ECE from the University of Akron, Ohio, in 2013. In the summers of 2015-2017, he held research internships in the Huawei Technologies R&D Center, Bridgewater, NJ. After graduation, he started his professional career as a Research Scientist with the Next Generation and Standards Group, Intel Corporation, in Hillsboro, OR in June 2018.

Harry's research interests lie in the areas of wireless communications, mobile cloud computing, and network optimization. During the course of his PhD program, he has made significant research contributions to the emerging Cloud Radio Access Network (C-RAN) and Mobile-Edge Computing (MEC) paradigms. He designed disruptive innovations for 5G wireless access networks to satisfy service requests from mobile users under resource constraints; and proposed novel collaborative frameworks to make optimized control decisions by taking communications, caching, and computing aspects into account. His series of innovative solutions have resulted in a solid track record of 14 referred scholar publications, including 6 articles in high-impact journals and 8 papers in highly-competitive conferences. Additionally, he currently has 6 submissions under review, including 4 journal articles and 2 conference papers. His publications have received more than 234 citations, with an h-index of 9 and an i10-index of 7 (Google Scholar, April'18).

Harry is also the leading author of a conference paper that won the Best Paper Award at the IEEE/IFIP Wireless On-demand Network Systems and Services Conference (WONS) in February 2017. For two consecutive years, in 2015 and 2016, he received the NSF Travel Grant Awards to present his papers at the IEEE Conference on Mobile Ad hoc and Sensor Systems (MASS) in Dallas, TX and Brasilia, Brazil, respectively. Harry has also been a regular recipient of the Graduate Assistant Professional Development Fund Award from Rutgers University in 2015-2018. In addition, his outstanding performance in teaching and research was recognized by a number of awards from the Rutgers ECE Department, including the Teaching Assistant of the Year Award in 2015, the Best Poster Award in ECE Research Day in Fall'16, and the PhD Research Excellence Award in Fall'16.

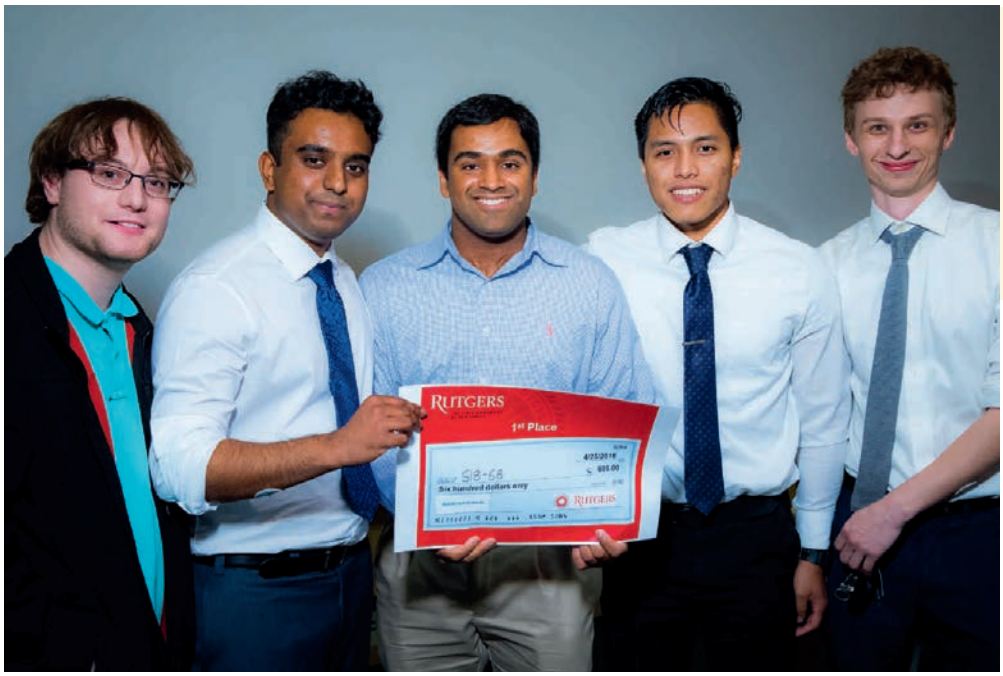
ECE PhD Student Kazem Cheshmi wins 2018 Adobe Research Fellowship

ECE PhD student **Kazem Cheshmi** has received the 2018 Adobe Research Fellowship. The Adobe Research Fellowship is highly competitive and recognizes outstanding graduate students anywhere in the world carrying out exceptional research in areas of computing of interest to Adobe. The Adobe Research Fellowship consists of a $10,000 award, Creative Cloud subscription membership for one year, an Adobe Research mentor, and an internship at Adobe for the summer of 2018.

Kazem Cheshmi is a second-year PhD student and a member of the Paramathics Lab, working under the supervision of Professor **Maryam Mehri Dehnavi.** His research is on developing compiler techniques for optimizing numerical methods. He won first place in the prestigious Grand Finals of the 2017 ACM's Student Research Competitions and has participated in several research internships. His ultimate research goal is to develop a new programming language and compiler framework that can automatically generate high-performance code for many large-scale applications.


K. Cheshmi

ECE Capstone Expo Day and Top Ten Award Winners



Capstone design program, or engineering design projects, marks an important milestone in the ECE undergraduate students' education. Students, in teams of three to four, get an opportunity to develop an engineering project from idea inception to a fully operational product. Faculty and industry advisers work with the students on design and implementation of cutting-edge technology and research. This year, over 250 students participated in the program with 68 projects.

The capstone program initiation is marked by a kickoff event. It serves as a great opportunity for professionals from diverse industries to meet with our senior students and learn about their design projects and offer expert advice. This year the event was held on October 26, 2017, with representatives from companies such as AT&T, Qualcomm, BlackRock, JP Morgan Chase, Two Sigma, IBM, Juniper, Harris, ASCO, Siemens, 7x24 Exchange Metro NY chapter, Credit Suisse, Verizon Wireless, Highland Associates, Interactions, and Lutron participating. Class of 2017 capstone program winners addressed the class of 2018, including Kien Nguyen, Danica Sapit, and Nishtha Sharma. Faculty address has been delivered by Prof. Roy Yates, IAB address was delivered by Hubertus Franke and industry address by Donald Bachman, emphasizing the importance of engineering innovations and its potential impact on society.

The climax of the program is Capstone Expo day that was held on Wednesday April 25 in the Busch Students' Center. In this event students' hard work, creativity, skills and knowledge are evaluated by a panel of industry and academia judges. This year's panel of 30 judges chose the top 10 ranking projects and additional three awards: Best in Innovation, Best in Research, and Best in Impact. The following judges participated this year: Kishore Ramachandran (Zipreel), Chris Marty (Two Sigma), Don Bachman (ASCO Power Technology), Nikhil Shenoy (Siemens), Sam Goldfarb, Justine McLean (JP Morgan), Kooksang Moon (JP Morgan), Stanley Rosario (Verizon Wireless); Phillip Southard (Harris), Mike Dolan (Harris), Alan Chan (Harris), Manoj Viswambharan (Harris), Jon Pucila (Blackrock), Daniel Arkins (Blackrock), Seong Park (MangidB), Mike Lynn (MangidB), John Chen (Interactions LLC), Ludwig Randazzo (Juniper), Richard Huber (AT&T), Elissa Backas (AT&T), Roque (Rocky) Rios (AT&T), Kumar Ramaswam (Igolgi), Kamal Abburi (Microsoft), George Christiana (Highland Associate), Gradeigh Clark (Rutgers), Gabriel Salles-Loustau (Rutgers), Foroogh Shamsi (Rutgers), Nagi Naganathan (Broadcom), Jane Luo (Qualcomm), Nazmul Islam (Qualcomm) and Harry Heinold (Qualcomm). Their expertise, care, and insights where priceless in making the hard decisions as for the top projects. Our judges were very impressed with the quality of the projects and commended our students' capabilities and enthusiasm.

FIRST PLACE
(awarded $600, sponsored by Siemens)

Project S18-68: Dextera Dei: EMG Controlled Prosthetic Hand with Bio-Feedback

Team members: **Sean Byju, Jesse Gatling, Jonathan Olcheski, Alejandro Sanchez**

Advisors: **Laleh Najafizadeh** and **Li Zhu**

Many advisers undertook students' guidance this year. Their efforts and support are key to the success of our capstone program and the students' learning experience. We would like to recognize the following advisors outside the ECE department who worked with our students: Don Bachman (ASCO Power Technology & 7x24 Exchange Metro New York Chapter), George Christiana (Highland Associates), Hubertus Franke (IBM), Phillip Southard (Harris), Jeremy Gorospe (Harris), David Ydoate (Harris), Vikram Padma (Harris), Manoj Viswambharan (Harris), Howard Cohan (Harris), Mubbasir Kapadia, Javier Diez-Garias, Kostas Berkins, Yong Feng Zhang, Ilker Hacihaliloglu, Michael Kornitas, and Samuel Ramrajkar.

The Capstone Expo event and students' awards were sponsored by Siemens, Harris, 7x24 Exchange Metro New York Chapter, JP Morgan Chase, ASCO Power Technology.

We would like to thank our faculty, advisers, judges, staff, and sponsors for their commitment to this program and for making the capstone experience for our class of 2018 professionally effective and memorable.

This year's other top ten and special award winners are on the following three pages. A full list of projects is available on the ECE website at **http://www.ece.rutgers.edu/capstone-design-2018**.

Congratulations to class of 2018 for an exceptional capstone year!

Capstone Top Ten Award Winners

SECOND PLACE
(awarded $400, sponsored by JP Morgan Chase)

Project S18-65: SLAMid - Autonomous Simultaneous Localization and Mapping with Object Identification

Team members: **Daniel Chen, Akhilesh Bondlela, Nicholas Grieco** and **Bhargav Tarpara**

Advisor: **Kristin Dana**

THIRD PLACE
(awarded $300, sponsored by Harris)

Project S18-63: Sky-Watch: A drone-based implementation of MARL to facilitate 3D reconstruction

Team members: **Michael Collins, Gregory Mueller, Kevin Quizhpi, Omar Shaban, Shannon L. Sabino**

Advisors: **Dario Pompili, Manoj Viswambharan** and **Howard Cohan**

FOURTH PLACE ($100)

Project S18-27: PassMon

Team members: **Shivani Patel, Akanksha Pathak, Srujana Sure, Lauren Williams**

Advisors: **Hana Godrich** and **Janne Lindqvist**

FIFTH PLACE ($100)

Project S18-35: EyeTouch: Portable Braille Converter

Team members: **Pragathi Sudheer, Aisvarya Chandrasekar, Kara Greenwood, Khalid Akash**

Advisor: **Dario Pompili**

SIXTH PLACE ($100)
Project S18-61: Home Defender
Team members: Tyler George, Vincent Vigliotti, Christopher Stiles, Anthony Lau, Chris Czechowicz
Advisor: Hana Godrich

SEVENTH PLACE (Tie) ($100)
Project S18-11: Configurable In-line
Team members: Brian Ellsworth, Alexandr Nazartsev, Arhum Siddiqi, James Taylor
Advisor: Predrag Spasojevic

SEVENTH PLACE (Tie) ($100)
Project S18-13: Android Drone
Team members: Tim Gilligan, Ishan Patel, Jimmy Jorge, Ivan Konatar, Dhruv Mana
Advisor: Javier Diez

NINTH PLACE ($100)
Project S18-14: Augmented Reality Exposure Therapy
Team members: Ashwin Kadaru, Frank Velazquez
Advisor: Deborah Silver

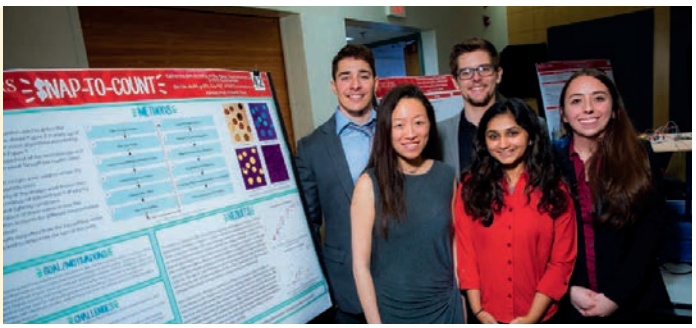
TENTH PLACE ($100)
Project S18-12: Good Samaritan: A Mobile Aid to Help Concerned Parents Monitor Their Young Children
Team members: Sumathi Arumugam, Neharika Bhandari, Ama Freeman, Raphaelle Marcial
Advisors: Marco Gruteser and Hana Godrich

Capstone Special Award Winners

BEST IN RESEARCH AWARD
(awarded $200, sponsored by Siemens)
Project S18-50: Sound Recovery from Perturbations of Common Objects
Team members: Sarah Pearson, Seyoung Kim, Bingqing Xiang, Hsinyo Yin
Advisor: Athina Petropulu

BEST IN SOCIAL IMPACT
(awarded $200, sponsored by Harris)
Project S18-35: EyeTouch: Portable Braille Converter
Team members: Pragathi Sudheer, Aisvarya Chandrasekar, Kara Greenwood, Khalid Akash
Advisor: Dario Pompili

STUDENTS FAVORITE AWARD
(awarded $200, sponsored by Siemens)
Project S18-42: Snap to Count
Team members: Katheryne Zak-Strzalka, Svikriti Kasichainula, Guy Rubinstein, Kristen Wong, Arthur Rafal
Advisor: Vishal M. Patel



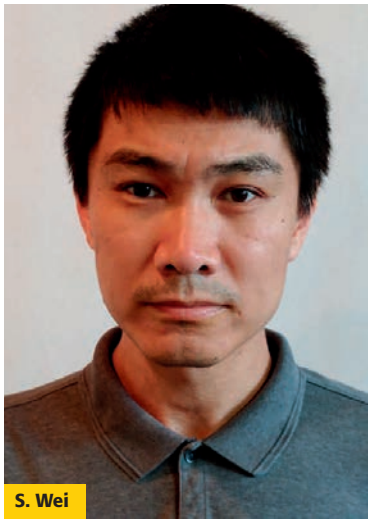
STUDENTS FAVORITE AWARD
(awarded $200, sponsored by Siemens)
Project S18-26: SolarSmarts
Team members: Mit Patel, Nill Patel, Prabhjot Singh, Raj Patel
Advisor: Hana Godrich

BEST IN INNOVATION AWARD
(awarded $200, sponsored by 7x24 Exchange)
Project S18-14: Augmented Reality Exposure Therapy
Team members: Ashwin Kadaru, Frank Velazquez
Advisor: Deborah Silver

ECE Welcomes New Faculty


U. Hassan


J. Ortiz


S. Wei


B. Yuan

Umer Hassan will be joining Department of Electrical and Computer Engineering as an Assistant Professor at Rutgers University starting Fall 2018. Previously, he worked as a Research Scientist in the Department of Bioengineering at University of Illinois Urbana-Champaign (UIUC) with a Research Affiliate appointment at Carle Foundation Hospital, Urbana. Dr. Hassan completed his B.Sc in Electrical Engineering from UET, Lahore and M.S. and Ph.D. studies in Electrical and Computer Engineering from UIUC in 2015. His research has been focused on developing point-of-care (PoC) translational biosensors for infectious disease diagnostic applications. He has received Brandt Early Career Investigator Award in Precision Medicine (2017), BMES Career Development Award (2017), Baxter Young Investigator Award (2016, & 2017), Emerging Engineer Award (2015), Cozad New Venture Competition Award (2014), NSF I-Corps Fellowship (2014) and Our Common Future Fellowship (2010). In 2014, Dr. Hassan cofounded a startup, Prenosis, Inc. that is working on commercializing his developed biosensors.

Jorge Ortiz recently spent 5 years at IBM Research working on machine learning for cyber-physical systems and the Internet-of-Things. His work applies machine learning techniques to problems in intelligent infrastructure systems and smart health applications. He has examined how learning techniques can be used to identify human activities using mobile phones, how to create models that can run on resource-constrained devices with small data, and has created tools that use machine learning to assist in the interaction between humans and cyber-physical systems. His work has also examines how to build smarter systems in the built environment, allowing buildings to integrate more easily with existing software and identify anomalous energy use patterns. The goal of his work is to make sensor-based systems smarter, trustworthy, and easier to use.

He attained his M.S. and Ph.D. in Computer Science from UC Berkeley (2010, 2013), and B.S. in Computer Science from the Massachusetts Institute of Technology (2003).

Sheng Wei joined Rutgers ECE as an Assistant Professor in September 2018. Before that, he had been an Assistant Professor in the Department of Computer Science and Engineering at University of Nebraska-Lincoln (UNL) for three years and a Research Scientist at Adobe Research for two years. He obtained his PhD in Computer Science from University of California, Los Angeles (UCLA) in 2013. His research has been mainly focused on Hardware Security, which aims to protect the security and integrity of low-level hardware systems (namely "security of hardware"), as well as employ hardware-based techniques to enhance system and software security (namely "hardware for security"). He is a recipient of the NSF CAREER Award in 2018 under the Secure and Trustworthy Cyberspace (SaTC) program. Also, his recent research work has been recognized by the community with a Best Paper Award at IEEE ICCD 2016 and Best Paper Nominations at IEEE HOST 2018, ACM MM 2016, and ACM/EDAC/IEEE DAC 2014.

Bo Yuan received his bachelor and master degrees from Nanjing University, China in 2007 and 2010, respectively. He received his PhD degree from Department of Electrical and Computer Engineering at University of Minnesota, Twin Cities in 2015. His research interests include algorithm and hardware co-design and implementation for machine learning and signal processing systems, error-resilient low-cost computing techniques for embedded and IoT systems and machine learning for domain-specific applications. He is the recipient of Global Research Competition Finalist Award in Broadcom Corporation and Doctoral Dissertation Fellowship in University of Minnesota. Dr. Yuan serves as technical committee track chair and technical committee member for several IEEE/ACM conferences, including ICCAD, GLSVLSI, ISVLSI, ISCAS, ICASSP, WCNC, SiPS, DSP. He is the technical member for VSA and CASCOM technical committees in IEEE Circuits and Systems society and DISPS technical committee in IEEE Signal Processing society. He is the associated editor of Springer Journal of Signal Processing System.

Data Privacy: Making You the Non-Product Again

ECE Assistant Professor **Salim El Rouayheb** is establishing a world class program in Data Privacy. He joined Rutgers ECE in September 2017. His research interests lie in the areas of information theory, coding theory and their application to data security and privacy. In particular, he has been recently working on problems related to private information retrieval and search in coded data, on secure distributed computing algorithms, and on novel algorithms for data synchonization and deduplication in distributed systems. Dr. El Rouayheb, who received his Ph.D. degree in electrical engineering from Texas A&M University, has held faculty positions at Illinois Institute of Technology (IIT), Princeton University and the University of California, Berkeley. He received the NSF CAREER award in 2016.

"If you are not paying for the product, you are the product." This has become the macabre Orwellian a-la-The-Sixth-Sense mantra that many experts refer to when describing how the Internet has essentially evolved to work. We share our opinions, photos and videos on social networks, search online billions of websites, collaborate online on writing documents and software, publish scientific data, take pictures on our smart phone and expect "the cloud" to make it seamlessly appear on all our other devices — and the cloud does deliver. Unfortunately, all these amazing and impressive services seem to have come at the expense of our privacy. Users' online activity can be used to profile them based on their gender, sexuality, race, illness, to name a few. This can result in dear consequences in "real life" if this information is misused or sold to third parties. One can get denied health insurance because of some learning algorithm has classified him/her to have a high risk factor of a certain disease. When living under an oppressive regime, this jeopardize the well-being of parts of the opulation and make it an easy target for discrimination and possible persecution.

There is good news however. Prof. El Rouayheb and his students, at the Coding and Securing Information (CSI) lab at the ECE department, develop algorithms and the necessary mathematical tools needed to offer these sought-after online data services with privacy guarantees. How can you google information without revealing to Google what you are looking for? How can your Fitbit cooperate with your smart phone and Internet-of-Things (IoT) sensor, and may be wearable devices of other users, to analyze your data and monitor your health and the health of the population without breaching your privacy? How can we run computationally intensive learning algorithms on biomedical and genomic data in a decentralized way on thousands of machines, without the help of the "big brother" cloud and while keeping the patients data confidential? How does misinformation spread in social networks and how to stop it? These are samples of the questions that PI El Rouayheb and his students try to answer at the CSI lab using mathematical tools from information theory and coding theory. Recent research outcomes at the CSI lab are new algorithms for speeding up secure machine learning based on the new so-called Staircase Secret Sharing schemes, and novel private information retrieval schemes from coded data achieving optimal download rates.

ECE Researchers win $750K Prize in DARPA Spectrum Collaboration Challenge

An ECE team led by WINLAB Associate Director **Ivan Seskar** along with graduate students **Ratnesh Kumbhkar** and **Dragoslav Stojadinovic** has won the $750K 5th place prize at the DARPA Spectrum Collaboration Challenge (SC2). The SC2 is the first-of-its-kind collaborative machine-learning competition to overcome scarcity in the radio frequency (RF) spectrum. The team from Rutgers in partnership with IMEC of Belgium (an R&D and innovation hub in digital technologies) developed a collaboration scheme called SCATTER that promotes collaboration to overcome spectrum scarcity. Ratnesh Kumbhkar graduated with a PhD under the supervision of Distinguished Professor Narayan Mandayam and Ivan Seskar. Dragoslav Stojadinovic is a PhD student working under the supervision of Professor Wade Trappe and Ivan Seskar.

I. Seskar

R. Kumbhkar

D. Stojadinovic

Professors A. Petropulu and W. Bajwa co-organized IEEE SPAWC 2018

Prof. A. Petropulu (third from the right) and Prof. W. Bajwa (fifth from the right) with other members of the SPAWC 2018 organizing committee

The 19th IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC) was held in Kalamata, Greece, June 25-28, 2018. SPAWC, the flagship workshop of the Signal Processing for Wireless Communications and Networking Technical Committee (SPCOM-TC) of the IEEE Signal Processing Society, is an annual workshop that brings together researchers in signal processing, wireless communications, information theory, optimization and networking from both academia and industry.

Two Rutgers ECE faculty were involved in the organization of SPAWC 2018, Distinguished Professor **Athina Petropulu,** a native of Kalamata, Greece, was the general program co-chair, and Associate Professor **Waheed Bajwa** was the technical program co-chair.

SPAWC 2018 was devoted to the emerging research areas of (i) machine learning and data analytics, (ii) physical-layer security and privacy, (iii) biological communications and signal processing, and (iv) 5G and beyond. Via an innovative structure, the attendees were immersed in these topics at varying degrees of detail. For each theme, there was a plenary talk as well as one invited poster session. Further, on each themes there three invited speakers who provided additional depth to these emerging topics. The program also included complimentary tutorials on quantum signal processing and communications and on caching in wireless networks. Another innovative component of SPAWC 2018 was its industrial program, which explored synergies between industry and the workshop themes, most prominently, the role of wireless technologies for the shipping industries.

The workshop had a record 250 registered attendees. It received record-breaking sponsorships of $35K from various sponsors, including the US National Science Foundation, Huawei, Nokia, Intralot, Navarino, the Kalamata Mayor's office and the IEEE Signal Processing Society. Several local businesses contributed local products as gifts for the attendees, of commercial value over $5K.

Kalamata, and the wider Messinia area with their rich history and abundant natural beauty became the backdrop of a memorable SPAWC experience. The workshop received widespread coverage by the local media, including a press conference with the general chairs, several newspaper articles and TV and radio interviews of the general chairs. This provided an opportunity for outreach, as issues pertaining to 5G communications were discussed.

In an effort to attract the attention of the public, the workshop included a talk by a legendary Greek engineering professor and philosopher, T. Tassios, on the topic of wireless communications in ancient Greece. To further engage the international audience to the local culture and Greek history, during the banquet, a special performance was delivered by prominent attendees: Drs. Anna Scaglione, H. Vince Poor, Andrea Goldsmith, Petar Djuric and Georgios B. Giannakis joined on stage a professional actor and recited parts of Pericles' Epitaph, a work of ancient Greek Historian Thoucidides. Pericles was an eminent Athenian politician led Athens to the heights of its political and cultural glory during the 5th century BC. Pericles' Epitaph is a recording of the speech that Pericles gave in 430 BC in Athens, in honor of the fallen of the Peloponnesian War. It is a classical masterpiece, and an impassioned and eloquent ode to Athenian Democracy. Messinians had sided with Athens in that war, and fought against a coalition led by Sparta, which is only a few kilometers away from Kalamata.

More information about the technical program and also photos from the workshop can be found at spawc2018.org

ECE Team wins Best Paper Runner Up Award at ACM MobiSys'18

The paper "AVR: Augmented Vehicular Reality" by **Hang Qiu, Fahwad Ahmed, Fan Bai, Marco Gruteser,** and **Ramesh Govindan** won the Best Paper Runner-Up Award at the ACM International Conference on Mobile Systems, Applications, and Services (MobiSys'18). This is a collaboration between a USC team, General Motors, and Rutgers.

The paper explores rich sensor sharing between vehicles to augment perception. Vehicles in the future will have rich sensors to map and identify objects in the environment. For example, many autonomous vehicle prototypes today come with line-of-sight depth perception sensors like 3D cameras. These cameras are used for improving vehicular safety in autonomous driving, but have fundamentally limited visibility due to occlusions, sensing range, and extreme weather and lighting conditions. To improve visibility and performance, not just for autonomous vehicles but for other Advanced Driving Assistance Systems (ADAS), we explore a capability called Augmented Vehicular Reality (AVR). AVR broadens the vehicle's visual horizon by enabling it to share rich visual information with other nearby vehicles.

Monitoring Vital Signs and Postures During Sleep Using Commodity WiFi

Y. Chen

Vital signs, such as breathing rate and heart rate, indicate the state of a person's essential body functions. They are the essential components to assess the general physical health of a person and identify various disease problems. Correlating the vital signs with our sleep quality can further enable sleep apnea diagnosis and treatment, treatment for asthma and sleep stage detection. However, the traditional way to monitor vital signs during sleep requires a patient to perform hospital visits and wear dedicated sensors, which are intrusive and costly. The obtained results may be biased because of the unfamiliar sleeping environments in the hospital. Moreover, it is difficult, if not possible, to run long-term sleep monitoring in clinical settings. Thus, a solution that can provide non-invasive, low-cost and long-term vital signs monitoring without requiring hospital visits is highly desirable.

Professor **Yingying (Jennifer) Chen**'s group at WINLAB and Data Analysis and Information Security (DAISY) Lab proposes to perform continuous long-term vital signs monitoring at low cost and without the requirement of wearing any sensor. This is collaborative research with Robert Wood Johnson Medical School and Florida State University. The research team shows that it is possible to track the breathing rate and heart rate during sleep by using off-the-shelf WiFi. This will largely increase the opportunity for wide deployment and in-home use. The proposed system re-uses the existing WiFi network for tracking vital signs without dedicated/wearable sensors or additional wireless infrastructure. Furthermore, by exploiting fine-grained channel information, Channel State Information (CSI), provided by off-the-shelf WiFi device, the new system captures not only the breathing rate but also heart rate. Specifically, our system utilizes the readily available channel information to detect the minute movements caused by breathing and heartbeats (i.e., inhaling, exhaling, diastole and systole).

To build such a system under realistic settings as a typical in-home scenario, Professor Chen's team needs to address a number of challenges.

Robustness to Real Environments: the placement of WiFi devices in real environments could change over time, and different persons present different sleeping postures. The proposed system should be able to provide accurate vital sign monitoring under such challenging conditions including various distances between the AP and WiFi devices, the presence of walls between WiFi devices (creating none-line-of-sight (NLOS) scenarios), and different sleeping postures. In addition, the new system should be able to identify regular sleep-related events (such as turnover or getting out of bed) to facilitate vital signs monitoring.

Tracking Breathing & Heartbeat Simultaneously: both breathing and heartbeat only involve small body movements, presenting significant challenges when monitoring such vital signs simultaneously in realistic settings. Even if the repeatable CSI changing pattern caused by breathing could be detected, it is difficult to capture heartbeat movements using WiFi links at the same time. Because the noisy environments will also affect CSI measurements, making it much harder to distinguish the minute movements caused by breathing (i.e., inhaling and exhaling) and heartbeats (i.e., diastole and systole).

Sensing with Single Pair of AP and WiFi Device: the new system should work with existing WiFi infrastructure, which may have only a single wireless ink (between the AP and the device) across the human body in a home environment. This presents additional challenges when two people are in bed together. The s ystem should be able to distinguish and measure breathing rates coming from two people. Furthermore, the system should use WiFi traffic as little as possible, such as only utilizing existing beaconing traffics.

Toward this end, Professor Chen's team demonstrates using only a single pair of WiFi device and wireless AP for detecting the breathing rate, heart rate and sleeping patterns (e.g., sleeping events and postures) during sleep. The team develops the breathing rate detection algorithm that first obtains time series of CSI from off-the-shelf WiFi device (e.g., desktop, laptop, tablet, and smartphone) and then analyzes the information in the time domain and frequency domain. The algorithm achieves high accuracy for both single and two-person in bed scenarios. We distinguish different sleep events (e.g., going to bed, turnovers during sleep) based on the CSI's variance energy and further identify people's sleep posture using a machine learning based approach. Extensive experiments are conducted in lab environments and two apartments of different sizes. The results show that the new system provides accurate breathing rate and heart rate estimation not only under typical settings but also covering challenging scenarios including the long distance between the WiFi device and AP, none-line-of-sight (NLOS) situation (e.g., the WiFi device and AP are in two different rooms) and different sleep postures. This indicates that Prof. Chen's work can provide device-free, continuous fine-grained vital signs monitoring without any additional cost. It has the capability to support large-scale deployment and long-term vital signs monitoring in non-clinical settings.

This research has been reported by many media outlets including MIT Technology Review, "Engineering Innovation" on WTOP Radio (Washington's Top News), Yahoo News, Fierce Mobile Healthcare, and Healthcare Information and Management Systems Society (HIMSS) News.

ECE Researchers win Best Paper Award at the 2018 IEEE International Conference on Communications and Network Security

Professor **Yingying Chen** and ECE Ph.D. students **Chen Wang** and **Jian Liu** have won the Best Paper Award at the 2018 IEEE Conference on Communications and Network Security (IEEE CNS) for their work on non-intrusive in-baggage suspicious object detection using commodity WiFi. In recent years, the portable dangerous objects such as lethal weapons, homemade

bombs and explosive chemicals have posed an increasing threat to public security. To detect the existence of such objects, Professor Chen's team proposes to utilize the fine-grained channel state information (CSI) from off-the-shelf WiFi to detect objects that are suspected to be dangerous (e.g., any metal or liquid objects) without compromising privacy through physically opening the baggage. The proposed suspicious object detection system significantly reduces the deployment cost and is easy to set up in public venues such as museums, theme parks, stadiums and schools. Particularly, the ECE team detects the existence of suspicious objects and identifies the dangerous material type based on the reconstructed CSI complex values. It further determines the risk level of the object by examining the object's dimension (e.g., liquid volume and metal object's shape), which is estimated based on the WiFi signals reflected by the object. IEEE CNS provides a premier forum for security researchers, practitioners, policy makers, and users to exchange ideas, techniques and tools, raise awareness, and share experience related to all practical and theoretical aspects of cybersecurity. More information about the conference can be found at http://cns2018.ieee-cns.org/.

Quantum Information Science being Offered Fall 2018

A new course introducing Quantum Information Science is being offered by the ECE Department in Fall 2018, taught by Professor **Emina Soljanin.** Quantum phenomena provide computing and information handling paradigms that are distinctly different and arguably much more powerful than their classical counterparts. In the past quarter of the century, much progress has been made on the theoretical side, and experiments have been carried out in which quantum computational operations were executed on a very small number of quantum bits. The NSF has declared this general area to be one of the 10 big ideas for future investments. In June 2018, the science committee of the House of Representatives unanimously approved the National Quantum Initiative Act (H.R. 6227), which would create a 10-year federal effort aimed at boosting quantum science. The students taking the class will learn the fundamentals of quantum information science and some more advanced topics of their individual interests. The course material will be accessible to undergraduate and graduate students with a variety of backgrounds, e.g., electrical engineers, physicists, mathematicians, and computer scientists.

Science of security: working towards ensuring security means secure

J. Lindqvist

Security impacts our everyday lives. The news often reports on security breaches on credit cards, tax, and people's health data. On travel, you must have used to hear "for security reasons, we ask you.." But, what makes something secure or insecure?

This is what Dr. **Janne Lindqvist,** the director of the Rutgers Human-Computer Interaction and Security Engineering laboratory researches with his group. This work is funded by a new NSF CAREER award titled, "CAREER: Science of Security for Mobile User Authentication." This is a 5-year $507,568.00 award. This is the NSF'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 lead advances in the mission of their department or organization.

"I have been working on security throughout my career both in the private sector and academia," says Dr. Lindqvist. He continues, "As long as I can remember, I have been fascinated with how systems are vulnerable, how they could be protected, and how to protect people's privacy." Indeed, Dr. Lindqvist was a co-founder of Electronic Frontier Finland (EFFI) – modeled after the US Electronic Frontier Foundation (EFF) - a non-profit association founded as an advocate for citizens' digital rights. After starting in 2001, the association rapidly gained over 1000 paying members, and has influenced Finland and EU legislation on copyright, spam and privacy.

Dr. Lindqvist's group has been working on secure gestures – a robust alternative for user authentication – over the past few years. "The more my group and I have been working on user authentication, the more I started to wonder about how we really should be measuring security," says Dr. Lindqvist. The more he thought about the science of security, the more he got excited about the topic and decided to focus on it for the CAREER proposal. This has given now Dr. Lindqvist to focus on developing the fundamentals of his field.

Given that Dr. Lindqvist has been working on smartphone and mobile device authentication for some time, it was natural to ground the work in that domain. This was further justified by the following observations: 1) people are switching from desktops to smartphones as their main computing and Internet platform, 2) mobile platforms provide opportunities for ingenious authentication methods, and 3) although the scientific and engineering community is producing many solutions to mobile authentication, the underlying trade-offs and science behind mobile authentication are not well understood.

This project blends a multifaceted research agenda, which integrates statistical theory with empirical studies to advance the science of security. This is an interdisciplinary project that requires computational knowledge from signal processing and machine learning, information about threats from security engineering, and the understanding of usability from human factors and human-computer interaction. Towards that end, Dr. Lindqvist's group is naturally interdisciplinary, he works with students with backgrounds in electrical and computer engineering, computer science, mathematics and statistics, while he also has a post-doc from social psychology, and collaborates with cognitive scientists, among others. Most professors in the Electrical and Computer Engineering department are members of the IEEE or ACM (Association for Computing Machinery), as is Dr. Lindqvist. Dr. Lindqvist's interdisciplinary take on science has motivated him to also join the American Association for Advancement of Science (AAAS) and Association for Psychological Science (APS).

These interdisciplinary efforts lead to illuminating results. For example, Dr. Lindqvist will be presenting this August (2018) in the tier-1 conference, USENIX Security Symposium, results answering a crucial question on systems security: why do people forget passwords? It turns out that this question can be answered from psychology, by an ecological theory of human long-term memory. The team was able to derive quantitative predictions for forgetting passwords from psychological theory.

"It's going to be fun over the next five years and beyond discovering the limits and boundaries of science of security," Dr. Lindqvist ends.

Software Framework Designed to Accelerate Drug Discovery Wins IEEE International Scalable Computing Challenge

Ariana Tantillo

S. Jha

The framework could revolutionize drug design by supporting accurate and rapid calculations of how strongly compounds bind to target molecules

Solutions to many real-world scientific and engineering problems—from improving weather models and designing new energy materials to understanding how the universe formed—require applications that can scale to a very large size and high performance. Each year, through its International Scalable Computing Challenge (SCALE), the Institute of Electrical and Electronics Engineers (IEEE) recognizes a project that advances application development and supporting infrastructure to enable the large-scale, high-performance computing needed to solve such problems.

This year's winner, "Enabling Trade-off Between Accuracy and Computational Cost: Adaptive Algorithms to Reduce Time to Clinical Insight," is the result of a collaboration between chemists and computational and computer scientists at the U.S. Department of Energy's (DOE) Brookhaven National Laboratory, Rutgers University, and University College London. The team members were honored at the 18th IEEE/Association for Computing Machinery (ACM) International Symposium on Cluster, Cloud and Grid Computing held in Washington, DC, from May 1 to 4. "We developed a numerical computation methodology for accurately and rapidly evaluating the efficacy of different drug candidates," said team member **Shantenu Jha,** Associate Professor at Rutgers ECE and Chair of the Center for Data Driven Discovery, part of Brookhaven Lab's Computational Science Initiative. "Though we have not yet applied this methodology to design a new drug, we demonstrated that it could work at the large scales involved in the drug discovery process."

Drug discovery is kind of like designing a key to fit a lock. In order for a drug to be effective at treating a particular disease, it must tightly bind to a molecule—usually a protein—that is associated with that disease. Only then can the drug activate or inhibit the function of the target molecule. Researchers may screen 10,000 or more molecular compounds before finding any that have the desired biological activity. But these "lead" compounds often lack the potency, selectivity, or stability needed to become a drug. By modifying the chemical structure of these leads, researchers can design compounds with the appropriate drug-like properties. The designed drug candidates then move along the development pipeline to the preclinical testing stage. Of these candidates, only a small fraction enters the clinical trial phase, and only one ends up becoming an approved drug for patient use. Bringing a new drug to the market can take a decade or longer and cost billions of dollars.

Overcoming drug design bottlenecks through computational science

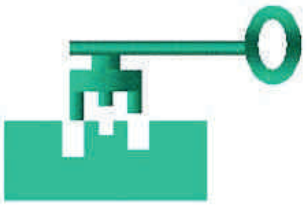
Recent advances in technology and knowledge have resulted in a new era of drug discovery—one that could significantly reduce the time and expense of the drug development process. Improvements in our understanding of the 3D crystal structures of biological molecules and increases in computing power are making it possible to use computational methods to predict drug-target interactions.

In particular, a computer simulation technique called molecular dynamics has shown promise in accurately predicting the strength with which drug molecules bind to their targets (binding affinity). Molecular dynamics simulates how atoms and molecules move as they interact in their environment. In the case of drug discovery, the simulations reveal how drug molecules interact with their target protein and change the protein's conformation, or shape, which determines its function.

However, these prediction capabilities are not yet operating at a large-enough scale or fast-enough speed for pharmaceutical companies to adopt them in their development process.

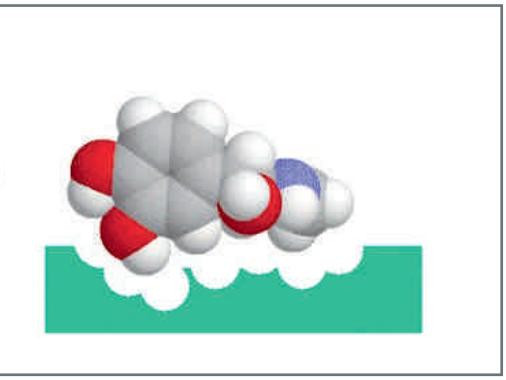
"Translating these advances in predictive accuracy to impact industrial decision making requires that

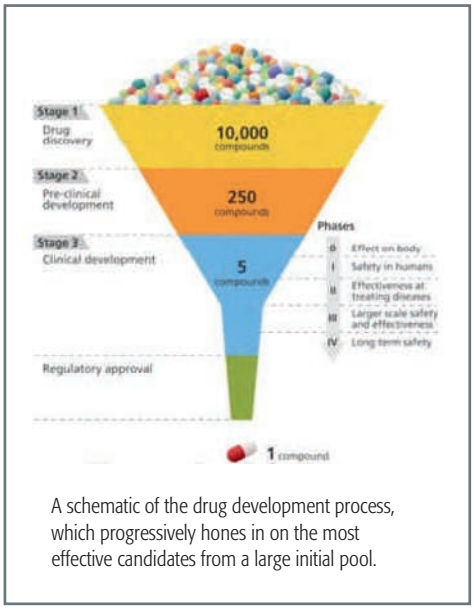
Drug discovery is a lock-and-key problem in which the drug (key) must specifically fit the biological target (lock).



on the order of 10,000 binding affinities are calculated as quickly as possible, without the loss of accuracy," said Jha. "Producing timely insight demands a computational efficiency that is predicated on the development of new algorithms and scalable software systems, and the smart allocation of supercomputing resources."

Jha and his collaborators at Rutgers University, where he is also a professor in the Electrical and Computer Engineering Department, and University College London designed a software framework to support the accurate and rapid calculation of binding affinities while optimizing the use of computational resources. This framework, called the High-Throughput Binding Affinity Calculator (HTBAC), builds upon the RADICAL-Cybertools project that Jha leads as principal investigator of Rutgers' Research in Advanced Distributed Cyberinfrastructure and Applications Laboratory (RADICAL). The goal of RADICAL-Cybertools is to provide a suite of software building blocks to support the workflows of large-scale scientific applications on high-performance-computing platforms, which aggregate computing power to solve large computational problems that would otherwise be unsolvable because of the time required. In computer science, workflows refer to a series of processing steps necessary to complete a task or solve a problem. Especially for scientific workflows, it is important that the workflows are flexible so that they can dynamically adapt during runtime to provide the most accurate results while making efficient use of the available computing time. Such adaptive workflows are ideal for drug discovery because only the drugs with high binding affinities should be further evaluated.





A schematic of the drug development process, which progressively hones in on the most effective candidates from a large initial pool.

Jha's team demonstrated how HTBAC could provide insight from drug candidate data on a short timescale by reproducing results from a collaborative study between University College London and the London-based pharmaceutical company GlaxoSmithKline to discover drug compounds that bind to the BRD4 protein. Known to play a key role in driving cancer and inflammatory diseases, the BRD4 protein is a major target of bromodomain-containing (BRD) inhibitors, a class of pharmaceutical drugs currently being evaluated in clinical trials. The researchers involved in this collaborative study are focusing on identifying promising new drugs to treat breast cancer while developing an understanding of why certain drugs fail in the presence of breast cancer gene mutations.

HTBAC not only has the potential to improve the speed and accuracy of drug discovery in the pharmaceutical industry but also to improve individual patient outcomes in clinical settings. Using target proteins based on a patient's genetic sequence, HTBAC could predict a patient's response to different drug treatments. This personalized assessment could replace the traditional one-size-fits-all approach to medicine. For example, such predictions could help determine which cancer patients would actually benefit from chemotherapy, avoiding unnecessary toxicity.

Emina Soljanin Explores Secret Communications and featured in American Masters PBS Podcast

Congratulations to Professor **Emina Soljanin** on her new NSF award for the project titled "Covert/Secret and Efficient Message Transfer in (Mobile) Multi-Agent Environments." This is a three year $500,000 collaborative effort led by Rutgers University (Emina Soljanin, PI) with NJIT. Rutgers' share of this award is $250,000.

E. Soljanin

As part of this project, Emina and her team will explore secret and efficient (preferably covert) communications by harnessing the resources brought in by smart everyday devices in emerging Internet of Things (IoT) environments. The research plan is organized in two central thrusts: The first thrust investigates a novel covert, secure and efficient communication scheme between mobile nodes, which has the main feature that any data transfer is only performed over short distances, thus reducing exposure to adversarial actions as well as energy and bandwidth requirements. The second thrust builds on the first one and devises secure coding schemes for the case where an eavesdropper discovers that messages are being exchanged and/or gets in possession of some helping IoT devices.

Professor Soljanin also participated in an American Masters podcast hosted by PBS celebrating the life of Hedy Lamar, along with Academy-Award-winning actor Susan Sarandon and filmmaker Alexandra Dean. In The podcast Emina discusses similarities of her NSF project to Hedy Lamar's work.

WINLAB Summer Research Program

"I really enjoyed working with the summer interns. It was very rewarding to watch them solve problems and learn to work effectively in a team. My group had a large and difficult task, and I'm really pleased with how much they accomplished and learned in just a few months. " Jenny

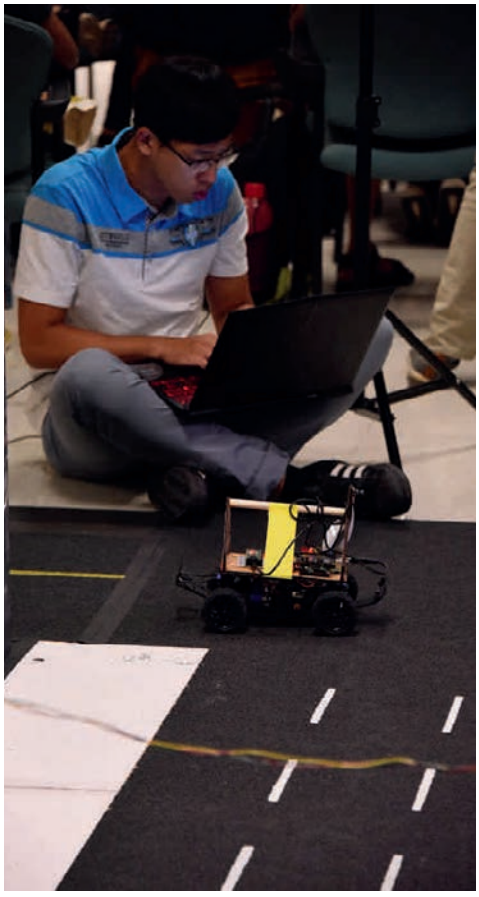
This was the largest group of students that WINLAB has hosted to date, and perhaps the most ambitious. Additional staff was brought on board for the purpose of assisting these students, and the extra attention seems

That's not to say that everything went perfectly. There was one memorable incident where the IoT Blue team managed to remotely turn off the communal refrigerator while following what would

On Thursday, August 16th, 2018, WINLAB held its annual Summer Research Program open house, where interns had the opportunity to present the results of two months of work with posters and live demos. There were 56 students (14 high school, 30 undergraduate, and 12 graduate) gathered together to work on various projects in Sensor Networks, Neural Networks, Augmented Reality, Security and Wireless, a couple of which directly competed against each other.

"It was extremely rewarding," says Kinjal Patel, a student who worked on the VR Escape the Room team, "Our team was able to make a virtual-reality based game in Unity, in which we built an escape room inspired experience. Our project (named Chalet) consisted of a house of 5 rooms, in which players are required to solve clues in order to advance to the next room. As a team, we were required to build the entire game from scratch. This included designing clues, coding interactions, and adding decorative features throughout the house."

Another team went so far as to construct a scale model of a real New York city intersection in order to build and test a driving emulator. The technical side of the project was no less meticulous; students built self-driving RC cars, augmenting them with depth cameras deployed all over the intersection to cover for any gaps in information the cars themselves did not have in order to navigate the model intersection.



normally be standard protocol. Thankfully, no lunches were harmed as a result. This was shortly prior to the weekly meeting, where the IoT Red team considered new ways to compromise these same systems. They eventually managed to block all communication between the IoT sensors and the management service, but jammed all wifi in the Summer research building as a side effect.

This was one of many weekly presentations where their progress was reviewed by peers and professors, both to receive feedback on their progress and ideas, but also to learn from each other's work. The students were also required to maintain a wiki page and website for their projects, ensuring that they can be replicated by and and expanded on by future interns, or to simply inspire them to pursue their own project ideas for the summer. Some students have gone on to make these summer projects the focus of their graduation requirements before ultimately gaining employment pursuing the topic of their choice.

At the open house itself, friends, parents, and Rutgers students and staff attended presentations by each group, followed by demonstrations, and Q&A sessions. The interns themselves finally got a chance to circulate and explore each others' projects, after being so immersed in their own.

COSMOS City Scale Testbed

Prof. Dipankar Raychaudhuri and Ivan Seskar (WINLAB/ECE) are leading the NSF-funded Rutgers/Columbia/NYU "COSMOS" project aimed at real-world deployment of advanced wireless platforms in New York City

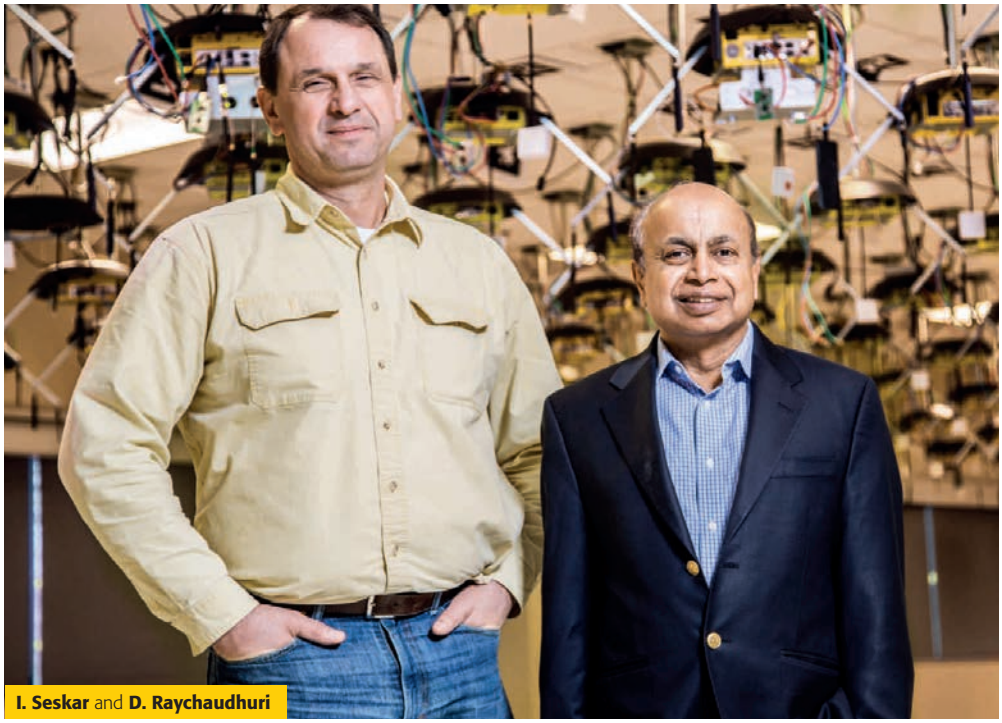
Fourth generation wireless, better known as 4G, turned mobile phones into movie-streaming platforms, but the next wireless revolution promises more than speedy downloads. It could pave the way for surgeons operating remotely on patients, cars that rarely crash, and events that can be vividly experienced from thousands of miles away.

To realize this vision of the future, the National Science Foundation (NSF) and an industry consortium are investing $100 million in the next seven years to build a set of wireless networks for U.S. researchers to test new ways of boosting Internet speeds to support data-intensive applications in robotics, immersive virtual reality and traffic safety. New York and Salt Lake City are the first cities to receive funding under the NSF Platforms for Advanced Wireless Research (PAWR) initiative, with New York set to receive $22.5 million.

Led by researchers at Rutgers, Columbia and NYU, and in partnership with New York City, Silicon Harlem, City College of New York, University of Arizona, and IBM, the platform in New York, called COSMOS, will be a proving ground for a new generation of wireless technologies and applications. The COSMOS testbed will cover one square mile in West Harlem, with City College to the north, Columbia University's Morningside Heights campus to the south, the Hudson River to the west, and Apollo Theater to the east. This vibrant, densely populated neighborhood is seen as an ideal place to push the bandwidth and latency limits of 4G, and even fifth-generation wireless technology, or 5G, which carriers are starting to roll out in some cities now.

By 2020, the number of Internet-connected devices is expected to grow to 20 billion, creating an urgent need in the U.S. and abroad for infrastructure that can rapidly process all that data. To improve networking speeds, the New York City COSMOS network will tap previously unused radio spectrum bands and integrate optical fibers underground with radio antennas and other equipment on city rooftops and light poles.

The high-bandwidth, low-latency network is expected to allow applications to transmit data faster than one gigabit per second and reduce response times to a few milliseconds, improving performance 10-fold over current wireless networks. To achieve this high level of performance, data-processing will be handled by on-site "edge cloud" servers rather than in far-off data centers.



I. Seskar and **D. Raychaudhuri**

The open-access COSMOS platform will allow researchers from anywhere in the country to log in and try out their ideas for improving network performance and creating city-focused applications, from augmented-reality navigation for the blind to "smart" traffic lights.

"COSMOS is an outdoor laboratory that will allow us to test entirely new classes of wireless applications such as smart intersections that can process massive data in real-time," said principal investigator Dipankar Raychaudhuri, an engineering professor at Rutgers University-New Brunswick, and director of its Wireless Information Network Laboratory, or WINLAB.

The technologies underpinning the experiments will include:

• **mm-Wave Radio Bands:** The use of new millimeter-wave bands, from 20 GHz to 200 GHz, will make it possible to extract more capacity from the radio spectrum, but one drawback is that mmWave signals don't travel as far. To overcome this, researchers will use the network to test new radio and antenna designs and techniques for aiming radio waves directly at mobile devices.

• **Software-Defined Radios:** Processing signals with software rather than hardware increases network flexibility and allows researchers to experiment with a wide range of frequency bands. The radios will be used to test new algorithms to support mmWave and flexible use of frequencies across various bands, a feature known as dynamic spectrum access.

• **Edge Cloud:** By shifting data-processing from cloud-based data centers to servers integrated into the wireless access network, researchers can speed up processing time. This is especially critical for applications involving Internet-connected devices that require fast response time.

• **Advanced Optical Networking:** To use edge-cloud infrastructure effectively, a fast front-haul network with high bandwidth and low-delay connectivity is needed to tie together computing clusters and the wireless access network. COSMOS will offer this connectivity with state-of-the-art wavelength division multiplexed optical technology.

New York's tech sector is now the nation's third largest, after Texas and California, with most of those jobs concentrated in New York City, according to a recent New York State Comptroller report. The City has embraced the COSMOS project for its potential to create far-ranging public benefits. These include bringing startups to the neighborhood that can build smart-city applications that make cities safer and more resilient. Applications to come out of COSMOS could reduce the number of crashes that injure and kill drivers and pedestrians, improve accessibility for people with disabilities, and make next-generation 911 systems more secure.

"We are eager for the opportunity to accelerate the development of new products and services based on advanced wireless technology, and shrink their time to market in New York City, benefitting millions of residents and visitors," said Chief Technology Officer Miguel Gamiño, Jr.

The project will also provide hands-on STEM training for students and West Harlem residents who will be among the first to see and touch technologies that are still years away from appearing on the market. Silicon Harlem will involve K-12 students from the community and City College will partner with researchers to involve its engineering students and support the testbed installation.

One key piece of radio equipment to be piloted will be the millimeter-wave wireless antennas and radio front-ends that will be unique to COSMOS. These mmWave radios will operate at 28 GHZ, a frequency recently made available by the U.S. Federal Communications Commission.

The COSMOS research team is led by Raychaudhuri and Ivan Seskar at Rutgers, and Gil Zussman and Sundeep Rangan, electrical engineering professors at Columbia Engineering and New York University's Tandon School of Engineering respectively.

The Rutgers team at WINLAB will build on extensive research experience with wireless testbeds, software-defined radio technology, and mobile Internet architecture. WINLAB's open-access, NSF-funded ORBIT wireless-testbed is currently used by researchers nationally to run controlled experiments at scale. Other COSMOS team members include electrical engineering professors Marco Gruteser and Narayan Mandayam, and computer science professor Thu Nguyen.

The Man Behind COSMOS - Dipankar Raychaudhuri

Distinguished Professor Dipankar Raychaudhuri who directs WINLAB has been the Principal Investigator (PI) for the nationally recognized large-scale research program in the area of "future Internet architecture". He says, "The research we are carrying out on this topic aims to fundamentally change the Internet architecture and protocols with new clean slate approaches designed for service flexibility and efficiency. In particular, we have proposed a novel architecture called "MobilityFirst" which has been well accepted by the research community and has resulted in many papers and working prototypes (see project website http://mobility-first.winlab.rutgers.edu for more details)." Professor Raychaudhuri obtained funding and served as lead PI for a multi-institutional $7.5M

NSF grant (2010-14) under the FIA (future Internet architecture) and follow-on $5M FIA-Next Phase (2014-18) programs. The project has supported a number of PhD and MS thesis students (about 14 so far) and has also provided REU projects for over 40 undergraduate students in the past 7 years.

Professor Raychaudhuri currently leading (as PI) the new $22.5M "COSMOS" Platforms for Advanced Wireless Program funded by the National Science Foundation and the PAWR industry consortium. The goal of the COSMOS program is to deploy an open/programmable future wireless testbed at scale in New York City in order to enable a wide range of experimental research in real-world settings. The COSMOS system has a unique focus on wireless access networks with ultra-high bandwidth and low latency tightly integrated with edge computing, thereby enabling many new classes of real-time applications such as augmented reality, autonomous vehicles and industrial control. The COSMOS project is a team effort involving Columbia University and NYU as partners, and is expected to involve significant industry collaboration and community outreach.

Professor Raychaudhuri has also been PI for the NSF-funded ORBIT testbed at WINLAB, with a $2M CRI project for major equipment upgrades (2010-15), followed by a $2.275M grant (2015-19) for development of new radio cloud and open LTE features. He says, "This funding has enabled us to maintain ORBIT as a leading-edge community testbed at Rutgers, and to exploit synergies with other programs such as GENI and CloudLab, and more recently with COSMOS/PAWR."

In other major research efforts, Professor Raychaudhuri has also conducted research on new techniques to improve radio spectrum use, leading to a novel distributed spectrum management architecture called "SAVANT". He served as PI for a research grant under the NSF EARS (Enhanced Access to Radio Spectrum) program and the results from this project include a best paper award at IEEE DySpan 2015. Professor Raychaudhuri has also conducted research on virtual networks applied to augmented reality or CPS (cyber-physical systems). This research led to a collaborative Japan-US project with NICT (Japan's national research lab in information technology) under the NSF JUNO program. He received the 2014 IEEE Donald J. Fink Award for the best review paper published in IEEE journals, the ECEDHA award in 2013 for program innovation, and the Schwarzkopf award for technology innovation in 2009. He is also a recipient of the School of Engineering's faculty of the year award in 2017.

Narayan Mandayam receives Distinguished Alumnus award from IIT Kharagpur

Dr. **Narayan Mandayam** received the 2018 Distinguished Alumnus Award from his alma mater, the Indian Institute of Technology (IIT), Kharagpur, where he obtained the B. Tech (Honors) degree in Electrical Engineering in 1989. The profiles of awardees over the years includes high achieving contributors to academia, industry, business, politics and society, with notable recent recipients such as Google CEO Sundar Pichai.

After obtaining his M.S. and Ph.D. degrees from Rice University, Dr. Mandayam joined Rutgers in 1994 where he is currently a Distinguished Professor and Chair of the ECE department. He also serves as Associate Director at WINLAB. He pioneered the application of microeconomic principles to the radio resource allocation problem in wireless data networks. The fundamental connections made in his work between the efficiency of resource allocation and interference management using "pricing" (a form of policing), form the basis of radio resource management algorithms for cellular wireless data networks. His contributions to wireless communications systems have been recognized with several awards, notably the 2015 IEEE Communications Society Advances in Communications Award for his seminal work on power control and pricing, the 2014 IEEE Donald G. Fink Award for his IEEE Proceedings paper titled "Frontiers of Wireless and Mobile Communications" and the 2009 Fred W. Ellersick Prize from the IEEE Communications Society for his work on dynamic spectrum access models and spectrum policy. He is also a recipient of a US National Academies Keck Future Initiatives (NAKFI) Award (2013), the Peter D. Cherasia Faculty Scholar Award from Rutgers University (2010), the US National Science Foundation CAREER Award (1998) and the Institute Silver Medal from the IIT (1989).

Dr. Mandayam's recent research interests include privacy in IoT, resilience in smart cities as well as modeling and analysis of trustworthy knowledge creation on the internet. He is a coauthor of the books: Principles of Cognitive Radio (Cambridge University Press, 2012) and Wireless Networks: Multiuser Detection in Cross-Layer Design (Springer, 2004). He has served as an Editor for the journals IEEE Communication Letters, IEEE Transactions on Wireless Communications and IEEE Journal on Selected Areas in Communications. He is a Fellow and Distinguished Lecturer of the IEEE, and now also a Distinguished alumnus of his alma mater. The award was conferred on him at the 2018 Convocation of the IIT Kharagpur that was presided by the President of India, Ram Nath Kovind (shown seated in the middle of the first row in the photo where Dr. Mandayam is 1st from left in the second row).

Marco Gruteser named Peter D. Cherasia Faculty Scholar


M. Gruteser

ECE Professor **Marco Gruteser** was named as the Peter D. Cherasia Faculty Scholar, an endowed faculty position instituted in the School of Engineering by ECE alumnus Peter D. Cherasia. Professor Gruteser is widely recognized for his contributions to the privacy, safety, and robustness of mobile wireless systems, with particular emphasis on applications to automated cars and smart transportation solutions. Specifically, he currently focuses on technologies, models, and data analysis frameworks to quantify and enhance the robustness of automated driving, with applications in the insurance market. While research has resulted in a number of automated driving prototypes and emerging products with impressive performance, it remains widely recognized that ensuring dependability under varied traffic and road conditions remains a key challenge. He advocates and develops techniques for mining traffic events from thousands of lightly equipped vehicles rather than only attempting to collect data with a few highly instrumented vehicles, as is common practice today. This will provide a massive dataset for quantitative analysis of important corner cases that can accelerate the development of truly safe automated driving technologies. Further it will also lead to models of risk and robustness, which can inform regulatory decisions and find applications in insurance risk models to support new products for this market.

In earlier work, he has pioneered techniques for quantifying and enhancing the privacy of location data through depersonalization, while still allowing algorithms to benefit from this data. That a key article from this line of work received more than 2000 citations (Google Scholar) illustrates the influence of this work. His work was also cited in a letter from US Senators Franken and Coons urging the car industry to reconsider their privacy practices and major smartphone operating systems now implement randomized MAC addresses, a version of his concept of disposable WiFi interface identifiers, to reduce wireless tracking by unrelated third parties. His team was also the first to demonstrate on CNN TV how cyberattacks can remotely compromise the privacy and security of unmodified cars. He further invented safety techniques to reduce distraction in traffic such as a technique for mobile phones to sense whether they are used by drivers. Apple's iOS 11 now implements delayed text notifications when driving, which is a solution that his research publications highlighted. Overall, testament to the impact and recognition of his research are six prize papers, ten keynotes, 10,000+ citations, numerous press articles, and more than $10M of research funding in projects that he has led or contributed to.

In terms of teaching, he has focused on developing a mobile software curriculum as well as refocusing introductory computing classes on computational thinking. He developed a networking course that covers Internet of Things topics, and co-developed a mobile systems and software class. He has also taught and started a modernization of the Introduction to Computers for Engineers freshmen course for the School of Engineering, one of the largest courses in engineering with about 550 enrolled students per semester, by emphasizing computational thinking and key software concepts. At the graduate level, Dr. Gruteser has supervised or co-advised 13 PhD students at Rutgers, who have completed their degrees and enjoy successful careers as faculty members or in industry at companies like Google and Two Sigma. Given his tenure at Rutgers so far this represents an exceptional mentoring accomplishment.

He has also been elected chair of the Association for Computing Machinery (ACM) Special Interest Group on Mobile Computing (SIGMOBILE), the preeminent international professional organization for mobile computing whose members have pioneered medium access mechanisms that underpin Wi-Fi and IoT, positioning systems in smart phones, caching techniques that inspired Dropbox, and networking techniques for ubiquitous wireless broadband.


A. Sarwate


J. Lindqvist


H. Godrich


L. Najafizadeh


G. Burdea

Anand Sarwate selected for the 2018 A. Walter Tyson Assistant Professorship Award

ECE Assistant Professor **Anand D. Sarwate** is the recipient of the 2018 A. Walter Tyson Assistant Professorship Award from the Rutgers School of Engineering. The Tyson fund, established by A. Walter Tyson, a 1952 alumnus of the School, is used to recruit promising junior faculty. The funds support exploratory research that is not yet funded by external grants.

Prof. Sarwate joined the ECE Department in January of 2014 from the Toyota Technological Institute at Chicago, where he was a Research Assistant Professor. His interests are in information theory, machine learning, and signal processing, with applications to distributed systems, privacy and security, and biomedical research. His current research projects include designing algorithms for medical researchers to collaborate while protecting patient data, frameworks for privacy risks in the Internet of Things, signal processing for multi-modal sensor systems, and strategies for robust communication in uncertain environments. Since joining Rutgers in January of 2014, Prof. Sarwate's research on privacy has been supported by awards from the National Science Foundation (NSF), the National Institutes of Health (NIH), and the Defense Advanced Research Projects Agency (DARPA). He is a recipient of the NSF CAREER Award for young investigators. In addition to his primary appointment in ECE, he is a graduate faculty member in the Departments of Computer Science and Statistics, reflecting his interdisciplinary interests.

In addition to his research work, Prof. Sarwate has been actively involved in several department and campus activities, including work with the Douglass College Women in STEM program, promoting undergraduate research in the ECE department, and improving conditions for graduate teaching and research assistants.

Janne Lindqvist Receives NSF CAREER Award

Rutgers electrical and computer engineering assistant professor **Janne Lindqvist** was awarded a prestigious CAREER award by the National Science Foundation. The award is given to early career faculty who show excellence in integrating teaching and research.

Lindqvist was awarded $507,568 for his research in science of security. As smartphones have become the main computing and internet platform, a critical need has emerged for secure authentication methods to verify authorized users. Many solutions have been proposed, but there remains insufficient understanding of effective and user-friendly methods of securing information. The research will provide understanding of human cognitive capabilities that can support security. Lindquist also focuses on promoting underrepresented students in STEM, from K-12 and above. A native of Finland, Lindqvist came to Rutgers in 2011.

"CAREER awards are a tremendous honor for Rutgers and recognize our most promising junior faculty who will provide meaningful research opportunities for the students they teach and mentor" said Thomas N. Farris, dean of the engineering school.

Hana Godrich Promoted to Associate Teaching Professor

Dr. **Hana Godrich** was promoted to Associate Teaching Professor effective July 1, 2018. Professor Godrich has been an outstanding member of our faculty while leading the execution of our undergraduate mission on several fronts related to teaching, research and outreach. This well-deserved promotion of Professor Godrich in the non-tenure track path is a first in the history of ECE and shows the University's strong appreciation and long term commitment to her exemplary efforts.

Laleh Najafizadeh Promoted to Associate Professor with Tenure

The Rutgers Board of Governors has approved Dr. **Laleh Najafizadeh**'s promotion to Associate Professor with tenure effective July 1, 2018. She has published more than 90 peer-reviewed papers in premier journals and conference proceedings. Professor Najafizadeh and her students are developing data-driven techniques that can reliably characterize the temporal evolution of the dynamics of brain functional networks, at multiple scales, for different physiological elements. They experimentally examine the ability of theoretical frameworks in quantifying the dynamics of brain networks, via data that is collected through simultaneous monitoring of brain function at multiple physiological levels, and various controlled conditions. The outcome of her research is expected to provide important insights into the neural mechanisms underlying learning, and brain-related diseases.

Grigore Burdea - Virtual Reality Showcase

Virtual reality pioneer and ECE Professor **Greg Burdea** organized a Virtual Reality Showcase at Rutgers University where he delivered a keynote speech. Professor Burdea spoke about applications in integrative medicine. He shared positive results using therapeutic games on stroke, chronic pain and Alzheimer's patients because of its high level of repetition and ability to included audio, visual and sensory stimulation. The event was an exciting exhibition of the latest in virtual, augmented reality technology and 3-D printing.

S. El Rouayheb

Salim El Rouayheb wins 2018 Google Faculty Research Award

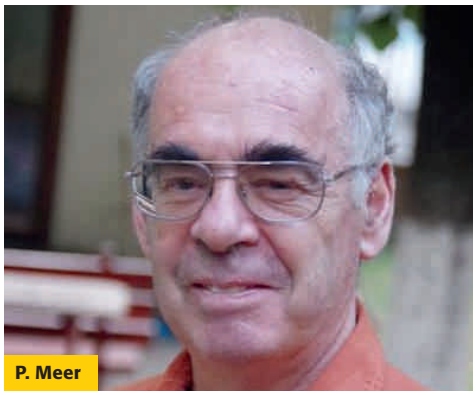
Congratulations to Assistant Professor **Salim El Rouayheb** for receiving the prestigious 2018 Google Faculty Research Award for his project titled "Towards efficient Single-Server Private Information Retrieval and Search." The Google Faculty Research Awards Programaims to recognize and support world-class faculty members pursuing cutting-edge research in areas of mutual interest to Google, with the goal of identifying and strengthening long-term collaborative relationships with faculty working on problems that will impact how future generations use technology. Google Faculty Research Awards are structured as seed funding to support one graduate student for one year and are awarded as an unrestricted gift. The award is highly competitive - only 15% of applicants receive funding - and each proposal goes through a rigorous Google-wide review process.

As part of this project, Dr. El Rouayheb has received a $89,096 award to study efficient single-server Private Information Retrieval (PIR) algorithms. PIR algorithms allow users to search an online search engine without revealing what they are searching for and thus protecting their privacy. This project addresses challenges in PIR by focusing on low-complexity single-server algorithms that leverage the users' previous queries and searches using tools from information theory and differential privacy. The obtained algorithms have the potential to be implemented in Google applications, such as Google Search and Google Drive, to provide desirable privacy guarantees without performance degradation.

Peter Meer Promoted to Distinguished Professor

The Rutgers University Board of Governors has approved the promotion of Dr. **Peter Meer** to Distinguished Professor.

Professor Meer received the Dipl. Engn. degree from the Bucharest Polytechnic Institute, Romania in 1971, and the D.Sc. degree from the Technion, Israel Institute of Technology, Haifa, in 1986, both in electrical engineering. From 1971 to 1979 he was with the Computer Research Institute, Cluj, Romania, working on R&D of digital hardware. Between 1986 and 1990 he was Assistant Research Scientist at the Center for Automation Research, University of Maryland at College Park. In 1991 he joined the Department of Electrical and Computer Engineering, Rutgers University, Piscataway, NJ. He has held visiting appointments in Japan, Korea, Sweden, Israel and France, and was on the organizing committees of numerous international workshops and conferences. He was an Associate Editor of the IEEE Transaction on Pattern Analysis and Machine Intelligence between 1998 and 2002, was a Guest Editor of Computer Vision and Image Understanding for a special issue on robustness in computer vision in 2000, and was a member of the Editorial Board of Pattern Recognition between 1989 and 2005.



P. Meer

He is coauthor of an award winning paper in *Pattern Recognition* in 1989, the best student paper in 1999, the best paper in 2000 and the runner-up paper in 2007 in the *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*. With coauthors Dorin Comaniciu and Visvanathan Ramesh he received at the 2010 CVPR the Longuet-Higgins prize for fundamental contributions in computer vision in the past ten years. His research interest is in application of modern statistical methods to image understanding problems. He is an IEEE Fellow.

In 2016, Professor Peter Meer was recognized as an AMiner Most Influential Scholar for his outstanding and vibrant contributions to the field of Computer Vision.

new grants

Waheed Bajwa

"Nonconvex Matrix Optimization: Geometry, Algorithms, and Distributed Implementations". This is an eighteen month, $1.2 million between Rutgers University, Colorado School of Mines and University of Wisconsin. Share of this award $327,716.

On his 'Robust, Decentralized Feature Learning From Big Data', Army Research Office Award. This is a three year $420,000 project.

Yingying Chen

"Enhanced Learning of Sensor Fusion for Human Authentication". This is a three year $351,162 project in collaboration with Robert Wood Johnson Medical School. Share of this award $251,162.

"Exploiting Physical Properties in Wireless Networks for Implicit Authentication". This is a three year $499,950 collaborative effort between Rutgers University and Indiana University. Rutgers' share is $339,950.

Yingying Chen and **Salim El Rouayheb**

"Secure Distributed Coded Computations for IoT: An Information Theoretic and Network Approach". This is a three year $1.2 million collaborative effort led by Rutgers University with University of Illinois at Chicago. Rutgers' share of this award is $800,000.

Salim El Rouayheb

"Towards efficient Single-Server Private Information Retrieval and Search", Google Faculty Research award. This is an $89,000 award. "Secure Coded Cooperative Computations for Internet of Battlefield of Things (IoBTs)". This is a $138,738 award. Salim El Rouayheb of Rutgers University in collaboration with Dr. Seferoglu of University of Illinois, Chicago.

Mehdi Javanmard

"Closing the Feedback Loop for Neural Stimulation-Based Therapeutics: Continuous Monitoring of Inflammatory Processes". This is an eighteen month $642,000 collaborative effort with University of Pennsylvania led by Rutgers University. "Acquisition of a High Resolution X-ray Computed Tomography Instrument for a Multi-User Imaging Facility". This is a $399,969 award

Laleh Najafizadeh

"Probing Neural Connectivity at Multiple Temporal Scales". This is a $72,644 award from the NSF-NCS (Integrative Strategies for Understanding Neural and Cognitive Systems) program.

Shantenu Jha

"SCALE-MS: Scalable Adaptive Large Ensembles of Molecular Simulations". This is a three year $2 million collaborative project between Rutgers, University of Virginia, Penn State and University of Colorado (Boulder) and the RADICAL Lab. Rutgers' share is $620,000.

"SBIR Phase II project Fast Fingerprinting and detection of materials using portable/hand-held devices and high performance computing for use in manufacturing and supply chain applications". This is a two year, $450,000 project in collaboration between RADICAL Lab and Rutgers-CBE.

"EAGER: REAL-D: Smart Decision making using Data and Advanced Modeling Approaches. A collaboration between RADICAL Lab and Rutgers CBE". This is a two year $200,000 award Rutgers' share is $70,000.

Janne Lindqvist

CAREER Award: "Science of Security Mobile User Authentication". This is a five year $507,568 award.

Ivan Marsic

"Activity Recognition for Reducing Delays in Fast-Response Teamwork". This is a four year, $1.2 million collaborative effort led by Rutgers University with Drexel University and children's National Medical Center in Washington, DC. Rutgers' share of this award is $700,000.

Dario Pompili and **Javier Diez (MAE)**

"Reliable Underwater Acoustic Video Transmission Towards Human-Robot Dynamic Interaction". This is a three-year $1 million collaborative effort led by Rutgers University with Northeastern University. Rutgers' share of this award is $500,000.

Emina Soljanin

"Covert/Secret and Efficient Message Transfer in (Mobile) Multi-Agent Environments". This is a three year $500,000 collaborative effort led by Rutgers University with NJIT. Share of this award $250,000.

Dipankar Raychaudhuri

"COSMOS: Cloud Enhanced Open Software Defined Mobile Wireless Testbed for City-Scale Deployment". This is a NFS award of $22M in collaboration with Columbia University and New York University. Rutgers is the lead institution.

alumninews

My Experience at Rutgers ECE

Christina Sergerholm

For me, the choice to study engineering at Rutgers was an easy one. My high school physics and chemistry classes affirmed my love of applied science and problem solving skills. Even more, both my mom and uncle possess electrical engineering degrees. So with a newly found passion and family ties to the field, I began my undergraduate career in engineering. The Introduction to Engineering course was a really valuable resource to understand what kinds of problems each engineering discipline tackled. Ultimately, I believe it was my Introduction to Computer Science class where I fell in love with programming. When I discovered how to generate a game of Connect Four in the command prompt with just a few lines of code, I was convinced that ECE was for me.

I'm very happy with the path I chose. The ECE department provided a lot of different types of classes covering both electrical and software based classes. It was really cool that Rutgers allowed us to take graduate classes (on topics like cloud computing and parallelism) as an undergraduate. A lot of the graduate level courses use technology that the real world uses on a day to day basis so it was really helpful to get that exposure. I also thought it was cool that we had access to a lot of different technologies and hardware. I especially enjoyed Digital Logic Design since we got to program a FPGA. I really appreciate that I got a broad view of working with hardware and software (and a combination of both).

Personally I'm very into the low level programming and computer architecture. I enjoy learning about how multithreading, memory management, and operating systems work. If I had to pick my favorite two classes, they would be Operating Systems and Systems Programming. When I wasn't studying, I took advantage of the large scale of Rutgers. I was a member and a mentor in the Society of Women Engineers. I was the Vice President of Eta Kappa Nu (the ECE honor society) and helped plan events. I also joined the club Ice Hockey team (a sport I did not play previously) and became the team's left wing and Vice President. I also spent a quite a few weekends working with the Rutgers Habitat for Humanity club, building homes. I met a lot of great people along the way.

As far as work before work, I worked as a Peer Leader for the CS department and a grading assistant/tutor for the ECE department. I really enjoyed teaching students, becoming a professor is definitely on my road map. I also worked at Carrabba's Italian Grille, I started as a busboy, then waitress and worked there up until senior year. I got the privilege of interning at TD Ameritrade twice, once on a backend infrastructure team, and once on a mobile app team. I really enjoyed the people and culture there. My junior year I was invited to an AT&T experience weekend in October and got to fly out to Texas to visit their headquarters. From there I was offered an internship for the following summer which I accepted. There I worked on cloud security and web development. Throughout all my experiences I learned valuable tech and life lessons. I figured out what I was interested in, in terms of subject areas as well as team culture.

My advice for students now who are looking into internships is to apply everywhere because every interview is good practice. Also, and I know this is a cliche, you should do what you are passionate about. When you find that subject, learning about it and excelling at it becomes a desire not a requirement.

I started working at Google in September 2017. I got hired with 30 other newly graduated college students in a program called Engineering Residency. It's a program that allows you to go on rotations for a year and try out two different teams. I'm really happy I started with this program because starting work in an unfamiliar place with new people is scary and it was nice to have a group of peers going through the same scenario. I converted to full time in February and have been on my current team since then. I work on a back end infrastructure team in Google Maps that is responsible for holding all of the data used to generate the map. I really enjoy my job because I am always challenged with new problems to solve. I'm very appreciative for the foundation Rutgers gave me. Thank you!

In the Spotlight:

ECE Alumna Rita Marty

Rita Marty currently serves as a Vice President in AT&T's Chief Security Office. Rita has over 15 years of experience and has held various positions in AT&T.

In her current role, Rita is responsible for developing the security architecture and lead the teams in defining the next generation security architecture to support key and emerging business initiatives including Domain 2.0, 5G, Indigo, Microservices, etc. This position supports AT&T's transformation to a cloud-based and data-powered entertainment and communication company and protects AT&T against evolving cyber threats.

Rita served as a member of the CTO Technology Council chartered to provide technology thought leadership for AT&T and the partner community that makes up AT&T Technology Ecosystem. She led strategic initiatives to accelerate innovation through internal rapid development efforts.

In her previous role, Rita was responsible for defining the target architecture for AT&T's Mobility Network and driving innovation and optimization in key Mobility growth areas including IOT. She also led various service development teams focused on design, development, and deployment AT&T's Global Network in Europe and Asia Pacific serving our multi-national enterprise customers. She also led the planning, development, and operations for the 2000 Sydney Olympics broadcast on NBC.

Rita earned BS and MS in Electrical Engineering from Rutgers University. She also earned an MBA in Finance from Rutgers University. She is a graduate of the AT&T Accelerated Development Program and the AT&T Leading with Distinction Leadership Program.

In addition to her technical contribution, Rita is an advocate in fostering the development of women in science and engineering. She served as a Public Relationship officier on the board of Women of AT&T. She continues to mentor women in engineering and science and to sponsor various events to recruit children to science, technology, and engineering, and math (STEM) fields.

Rita was a guest speaker in various events including AT&T's Cyber Security Conference, Globecom, CTIA, CES, WEEF & GEDC, etc. She was also featured in various publications including Forbes magazine, Light Reading, and Tune in Tuesday Internet Radio, etc. to highlight key transformational initiatives in AT&T.

Rita is the significant other of ECE alumnus Chris Marty who is a Managing Director at Two Sigma Investments in New York City.

ECE Alumna Sennur Ulukus named Anthony Ephremides Professor in Information Sciences and Systems

Professor **Sennur Ulukus** (ECE/ISR), has been selected to hold the Anthony Ephremides Chair in Information Sciences and Systems at the University of Maryland, College Park.

Prof. Ulukus received her Ph.D. degree in Electrical and Computer Engineering from the Wireless Information Network Laboratory (WINLAB) at Rutgers University, where she worked with Distinguished Professor Roy Yates. Her research interests are in wireless communications, information theory, signal processing, and networks, with recent focus on private information retrieval, timely status updates over networks, energy harvesting communications, information theoretic physical layer security, and wireless energy and information transfer.

Prof. Ulukus is a fellow of the IEEE, and a Distinguished Scholar-Teacher of the University of Maryland. She received the 2003 IEEE Marconi Prize Paper Award in Wireless Communications, a 2005 NSF CAREER Award, the 2010-2011 ISR Outstanding Systems Engineering Faculty Award, and the 2012 ECE George Corcoran Education Award. She is Distinguished Lecturer of the IEEE Information Theory Society for 2018-2019.

S. Ulukus

In 2007, Anthony Ephremides, Cynthia Kim Professor in Information Technology, and his wife, Jane, established a Fund in the A. James Clark School of Engineering for the creation of the Anthony Ephremides Chair in Information Sciences and Systems. The chaired professorship provides annual support for a faculty member in the field of Information Sciences and Systems in the Department of Electrical and Computer Engineering. The award to Prof. Ulukus of this Chaired appointment makes her the inaugural holder of this Chaired position.

industryadvisoryboard

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.

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