Elevating Quantum Technology in ECE

Quantum Technology is picking up speed in the Electrical and Computer Engineering Department. Find out what's next.

FOUR NEW DISTINGUISHED ALUMNI

THE JUNIPER NETWORKS LABORATORY

The new lab houses its own networking environment, which is isolated from UMD's production network

THE BUDDY SYSTEM: HUMAN COMPUTER TEAMS

Is that him? Is she the one?
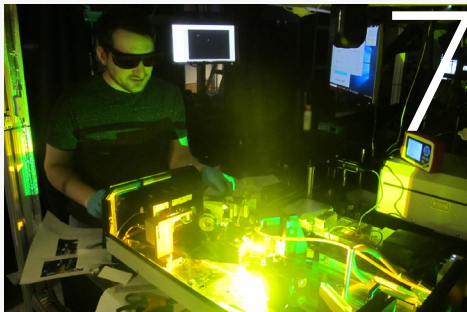
CONTENT

2019-2020 | Vol. 25 No. 1

About the cover: Researchers configure silicon rings on a chip to emit high-quality photons for use in quantum information processing. (Image credit: Emily Edwards)

message from the chair

Welcome to the Electrical and Computer Engineering Department (ECE) of the A. James Clark School of Engineering. As the Clark School celebrates its 125th Anniversary, the department celebrates our award winning faculty, students, and staff, new and revamped programs, a new state-of-the-art laboratory, and unwavering support of undergraduate and graduate education.

For this issue of *Connections*, we are pleased to feature Quantum Technology in ECE. You will read about the establishment of the Quantum Technology Center (QTC), a collaboration between the Clark School and the College of Computer, Mathematical, and Natural Sciences. A number of our new and longtime faculty members are involved in the center, which will translate quantum physics research into innovative technologies.

I am pleased to inform you that we have recruited three new faculty members this year, including Minta Martin Professor and Founding Director of the QTC, Ronald Walsworth, Associate Professor Yanne K. Chembo, and Assistant Professor Cheng Gong. These researchers bring expertise in quantum technology, optoelectronics, laser physics, 2D materials and devices, and energy-efficient nanoelectronics.

We aim to offer a variety of dynamic academic opportunities to all students and alumni, and as a result, we have teamed up with our colleagues in the Department of Computer Science to develop a cross-disciplinary Masters of Professional Studies in Machine Learning. We have also partnered with the Universities at Shady Grove to offer a Bachelor's Degree in Embedded Systems and Internet of Things, which will cater to transfer students. In addition, we are now offering a Machine Learning Minor that has been designed to provide a concentration of courses around the topics of probability and statistics, large data analytics, optimization techniques, and perhaps most importantly, a project course focused on industry-sponsored projects.

We welcomed 59 new graduate students this fall, who hail from 12 different countries. These Ph.D. and Master's students are conducting research in the areas of Circuits and Systems, Computer Engineering, Communications and Networking, Control, Robotics, and Dynamical Systems, Electronic Materials and Devices, Optics and Photonics, and Signal Processing. The department's faculty recently approved a new Ph.D. qualifying requirement that will consist of two research seminars, a course-based component, and an oral qualifying exam. The new Qualifying Exam will enable the graduate students to start conducting research almost immediately after arriving on campus.

Our ECE faculty members have won many prestigious awards this year and have been elevated as fellows to a variety of professional societies. To name a few, Professor K.J. Ray Liu has been named a Distinguished University Professor of the University of Maryland, the highest honor that can be achieved by a tenured faculty member. Professor Min Wu has been named Associate Dean for Graduate Programs of the Clark School and she has been awarded the esteemed Harriett B. Rigas Award from the IEEE Education Society. Professor Mohammad Hafezi was one of 31 scientists across the nation to be named a Finalist of the prestigious Blavatnik National Awards for Young Scientists.

ECE remains committed to strengthening undergraduate education. We have supplemented hands-on education through sponsored team competitions such as the Terps Racing Electric Vehicle Team and the 125 Mile EBikes! Design Challenge. Our Peer Mentoring Program sponsored by Texas Instruments is in its third year and is a fantastic opportunity for new students in the department to have the opportunity to be connected with a "Peer Mentor," an upper class ECE student who is trained to help new students transition into life at UMD. Moreover, we are excited to unveil the Juniper Networks Laboratory, sponsored by our newest corporate affiliate, Juniper Networks, Inc. The lab will support both undergraduate and graduate programs, and course topics will focus on networking, including virtualization and design, cloud computing, and data analytics.

It is my sincerest hope that you will take the opportunity to help ECE in whatever way is most purposeful to you. The time, expertise, and financial support of our alumni, whether personal or through industry sponsorship, are crucial to the success of our programs. To learn more about our department or to discuss any of the subjects outlined in *Connections*, please contact our Director of External Relations, Amanda Stein, at steina@umd.edu.

Thank you for your support.

Joseph F. JaJa

PROFESSOR AND INTERIM CHAIR

the 2018-2019 graduating class

243

B.S. Degrees were awarded
(67 in the fall, 176 spring)

48 students earned a citation from the University Honors College

24 students earned a citation from College Park Scholars

7 students earned citations from FIRE, QUEST, or Hinman CEOs

COMPUTER ENGINEERING

85%

employed or attending graduate school
(81% employed, 4% grad school)

Average Starting Salary

$91K

Top Employers for CE:

- Leidos
- Microsoft
- Amazon
- Booz Allen Hamilton
- Northrop Grumman

ELECTRICAL ENGINEERING

83%

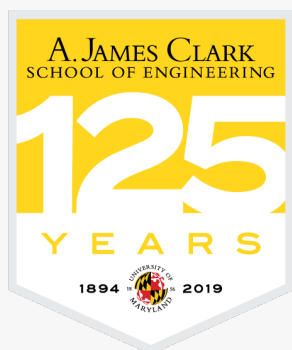employed or attending graduate school
(72% employed, 11% grad school)

Average Starting Salary

$80K

Top Employers for EE:

- Northrop Grumman
- JHU Applied Physics Lab
- Naval Air Systems Command (NAVAIR)
- Amazon
- Deloitte

The Electrical and Computer Engineering Department celebrates the Clark School's

125th Anniversary

ELECTRIC VEHICLE (EV) TEAM

The Terps Racing EV team is currently in the process of designing UMD's inaugural formula-style vehicle, running solely on electric power. In late May, the Formula SAE electric team traveled to the Formula North competition in Ontario, Canada.

Since its establishment in 1982, Terps Racing has participated in more than 60 races hosted by the Society of Automotive Engineers. Through this practical hands-on experience, students apply their academic knowledge and additionally gain team-building, collaboration, and leadership skills. Students also develop technical expertise in fabrication, computer-aided design (CAD), finite element analysis (FEA), computational fluid dynamics (CFD), and design analysis and testing.

Terps Racers are some of the school's most sought-after candidates by top employers upon graduation. Alumni are now employed by companies such as Blue Origin, Ford, Local Motors, NAVAIR, SpaceX, Stanley Black & Decker, and Tesla. ■

125-MILE EBIKES! DESIGN CHALLENGE

The inception of ECE's Electric Bike Capstone Course has expanded interest in electric bicycles among all A. James Clark School of Engineering students. To capture this interest, the 125-Mile EBikes! Design Challenge is offered as a part of the College's 125th Anniversary programs. The challenge requires student teams to be able to design, build, and test a bike that weighs less than 30 kilograms and has a range of at least 125 miles on a single battery charge. The winners will receive trophies and cash prizes, thanks to the generous donation of the Jimmy Lin Foundation.

In Fall 2018, more than 30 student teams from nearly all engineering disciplines registered to attempt to build such a bike. Teams acquired faculty and staff advisors and submitted proposals to be considered for subsidies

provided by the College. Ten teams received subsidies based upon their initial concepts as judged by a panel of faculty experts. The students have worked hard for the past year perfecting their designs, and now, seven teams are set to compete this month in the two-day competition on campus. Winners will be announced mid-October.

The winning team will be the fastest bike (without external battery charging), that can travel 50 miles without pedal assist, and 50 miles with pedal assist, to be tested indoors on a bicycle trainer. The last 25 miles will be under real-world conditions, where cyclists will traverse the UMD campus route.

The vision is for the challenge to showcase the creativity, resourcefulness, and design acumen of the students of the Clark School of Engineering. ECE Professor R.D. Gomez, the faculty proponent of the challenge, says, "Electric powered personal transportation systems are very much part of our future. Through this competition, we allow our engineering students to understand what it takes to push this technology forward and, in the process, experience the pleasure of achieving what has not been done before." ■

PHOTO: JOHN CONSOLI

Elevating
Quantum Technology in ECE

The ECE Department is at the forefront of the quantum revolution with Quantum Engineering, an outgrowth of electrical engineering.

Quantum mechanics is the body of scientific laws that define the eccentric behaviors of microscopic particles that make up the universe. Technologies based on the first century of quantum physics research range from MRI machines to lasers to GPS navigation. These technologies use quantum properties such as particles existing only at discrete energies and behaving like waves.

Today, a new generation of quantum technologies are emerging and moving rapidly toward commercial use. This "next-gen quantum tech"—including quantum computers, communication, sensing, and materials—exploits subtle but powerful quantum properties like entanglement and superposition. The University of Maryland, long a leader in basic quantum science, is now accelerating this trend with the launch of its Quantum Technology Center (QTC).

Founded jointly by the A. James Clark School of Engineering and the College of Computer, Mathematical, and Natural Sciences, QTC will translate basic quantum science research into innovative technologies.

"The time is now for translating quantum tech from the lab to the marketplace—and for training the quantum engineers who will help make that happen," says QTC founding Director **Ronald Walsworth.** "UMD is a top quantum science school. With QTC, we will extend our lead into quantum engineering and technology."

The center will be headquartered in the Clark School's E.A. Fernandez IDEA Factory, when it opens in 2021, with four to six faculty hires shared by engineering and physics.

Like UMD's current quantum research curricula, the QTC is expected to draw robust sponsorship from federal research agencies. With the impending computer revolution, IT giants, governments, and startups are all investing in quantum technology.

BlueFors dilution refrigerator with side axis optical view port. This system is used to cool down samples below 10 millikelvin while optically probing their characteristics.
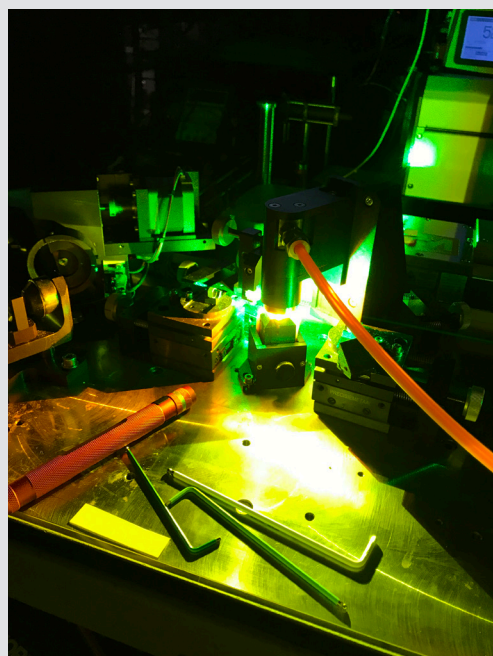
Showing the inside of a Sirah dye laser that is used to excite samples during orbital angular momentum absorption measurement.

Quantum at Maryland

More than 200 researchers at UMD are specializing in quantum science. Much of the effort has been led by the Joint Quantum Institute (JQI), founded by UMD and the National Institute of Standards and Technology (NIST) in 2006, with support from the National Security Agency.

The JQI is a close collaboration between the university and the federal agency, with most of its NIST labs located on the UMD campus. In 2014, UMD and NIST launched a second quantum partnership, the Joint Center for Quantum Information and Computer Science (QuICS), with support from NSA's Laboratory for Telecommunication Sciences.

A number of UMD electrical and computer engineering professors hold joint appointments in the quantum research centers and institutes, including Professors Mohammad Hafezi and Edo Waks. Both researchers are expecting another quantum revolution with applications in computation, communication, and sensing.
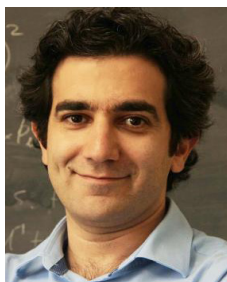
Hafezi, who also holds appointments in JQI and Institute for Research in Electronics and Applied Physics (IREAP), studies the fundamental behaviors of light–matter interactions down to the single-photon level. "We now can actually manipulate these things at the quantum level," he says. "It's time to ask the question, can we use these single-atom, single-electron, single-photon manipulations to make useful devices?"

Both Hafezi and Waks, who also holds appointments in JQI and IREAP, are among the UMD researchers facilitating the formation of a second revolution, with groundbreaking work on devices for quantum information processing and quantum networks.

For Hafezi and Waks, like many other UMD researchers, partnering with the U.S. Army Research Laboratory (ARL) is key. "Our collaborations offer organic ways to take the flow of knowledge and interesting technologies here in the university to the federal labs," Hafezi says.

In one collaboration, published in *Nature* in September 2018, Hafezi worked with ARL Research Scientist Elizabeth Goldschmidt (UMD Ph.D.) to demonstrate an innovative way to produce nearly perfectly matched pairs of photons in a room-temperature semiconductor chip—an important advance for research in quantum communications.

Hafezi and JQI Postdoctoral Researcher Sunil Mittal provided proficiency in integrating topological physics with light, while Goldschmidt provided her expertise in the characterization of quantum light. The effort also benefited from the use of nanowire detectors (superconducting devices that detect individual photons with very high efficiency) provided by ARL Researcher Qudsia Quraishi.

JQI Postdoc Sunil Mittal modulating input power of the dye laser during alignment.
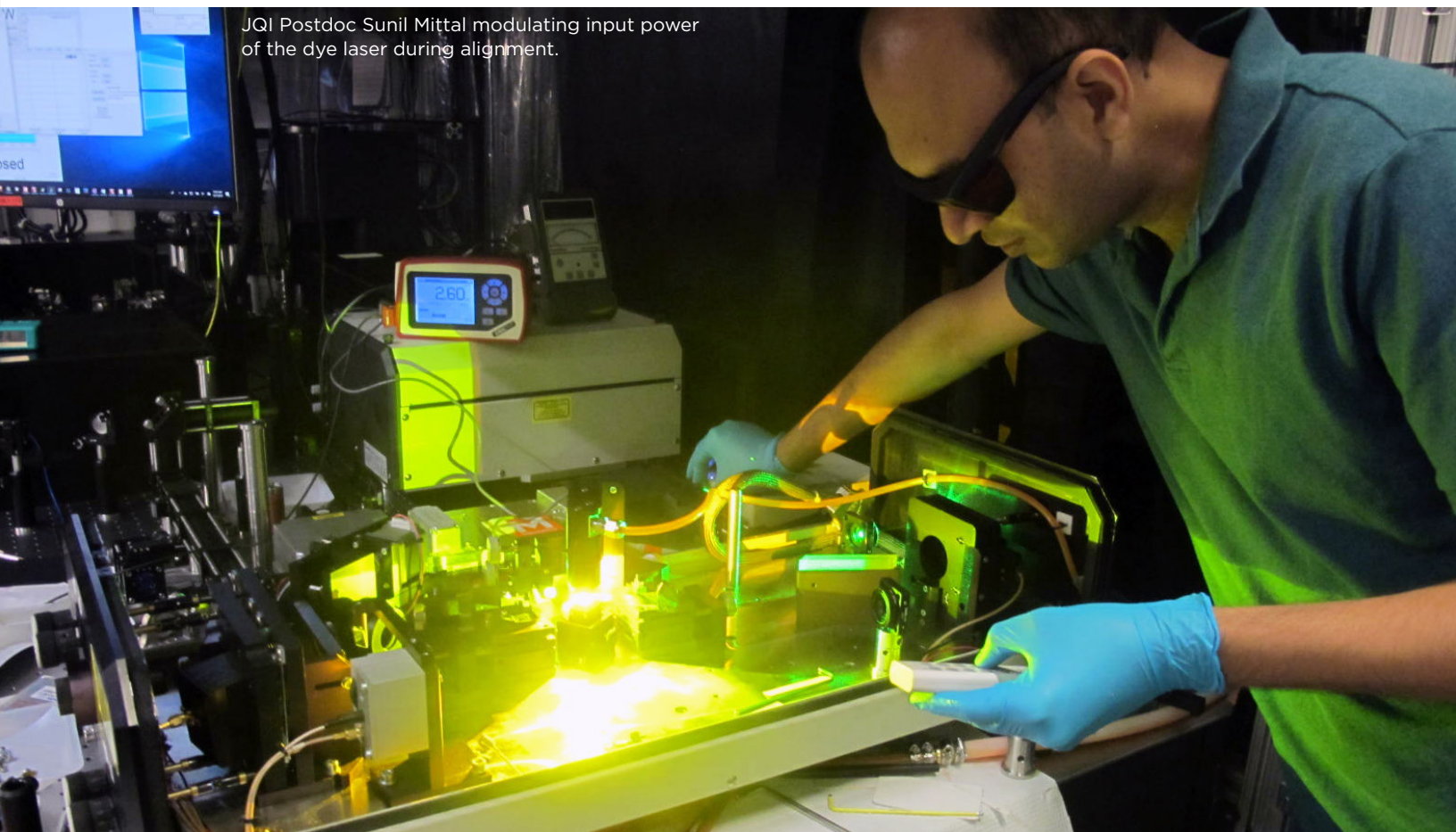
New ECE Faculty Focusing in New Fields

Quantum research is expanding beyond physics into materials science, engineering, computer science, chemistry, and biology. Scientists across these disciplines are looking for ways to exploit quantum physics to build powerful computers, develop secure communication networks, and improve sensing and imaging capabilities. In the future, quantum technology could also impact fields such as artificial intelligence, energy, and medicine.
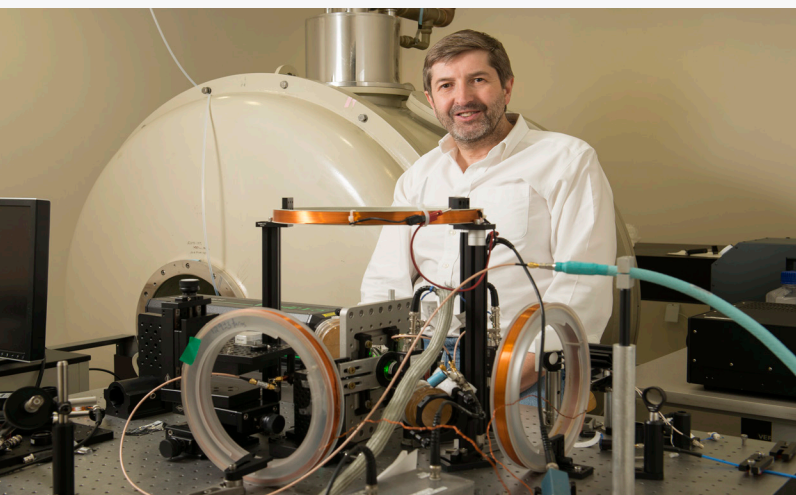
"Within the emerging field of quantum technology, electrical and computer engineering is leading the way because quantum effects are realized in electromagnetic phenomena such as computing, communication, and sensing," says Walsworth.

Walsworth joined the University of Maryland as a Minta Martin Professor of Electrical and Computer Engineering and as director of the QTC in August. He also holds an appointment in the Department of Physics at UMD. Walsworth is currently a senior physicist at the Smithsonian Astrophysical Observatory and was formerly on the faculty of Harvard University with affiliations in the Department of Physics and the Center for Brain Science. Walsworth is a pioneer in the field of quantum diamond sensing, and led the application of this rapidly emerging technology across many areas of the physical and life sciences. He received the Francis Pipkin Award in 2005 from the American Physical Society (APS) for his work in precision measurements and bioimaging. He is also a distinguished traveling lecturer for the APS.

Walsworth leads an interdisciplinary research group that develops precision measurement tools and applies them to problems ranging from quantum physics and astrophysics to geoscience and biomedical imaging. Various start-up companies have spun out of the Walsworth lab, including Hyperfine Research, which is developing low-cost portable MRI machines, and Quantum Diamond Technology, Inc. (QDTI), which is commercializing quantum diamond sensors for biomedical diagnostics. Ron has also served

on the Scientific Advisory Board of other tech companies and incubators, including Quantum-Si, 4Catalyzer, and Butterfly Network—which has brought to market a hand-held ultrasound that is read on an iPhone and costs less than $2,000.

Walsworth, along with other ECE professors, is developing curricula to train people on both the subtleties of quantum physics and the challenges of quantum engineering. These faculty are getting students involved directly in the conceptualization and realization of new quantum technologies—including the translational and entrepreneurship aspects.

Walsworth sees a bright future for quantum in ECE: "UMD leadership has made an impressive commitment to making the university a leader in quantum engineering and technology. The natural center for this exciting new direction is ECE—both in training the next generation of quantum leaders and in building bridges to other disciplines and the wider world. That's what engineers do, and I'm excited to be part of it."

Assistant Professor Cheng Gong also joined the ECE Department this past August. Before joining the UMD faculty, Gong was a Postdoctoral Researcher at the University of California, Berkeley. There, he led the 2D Materials & Devices subgroup in the Zhang Lab, which specializes in the emerging properties of two-dimensional materials such as graphene and transition metal dichalcogenides (TMDCs).
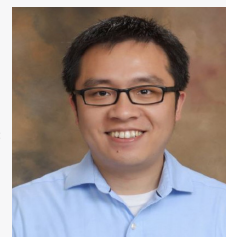
Gong's research focuses on 2D materials and devices, 2D magnetism and spintronics, energy-efficient nanoelectronics, light-matter interactions, and a variety of quantum phenomena.

Gong's sustained contribution to the field, particularly including his discovery of the first magnetic two-dimensional material, can be found in his 18 first-authored publications in high-profile journals such as *Nature, Science, Nature Electronics, Nature Communications, Proceedings of the National Academy of Sciences (PNAS), Nano Letters,* and *ACS Nano.*

"This is an exciting moment. ECE, together with other departments, are synergizing the depth of quantum physics and the strengths of multiple engineering disciplines at UMD, to aim at those most impactful advances toward practical quantum technologies," says Gong. "I look forward to what will happen in the coming years."

In addition, Distinguished University Professor **Christopher Monroe**, an international leader in isolating individual atoms for quantum computing and simulation, holds membership in JQI, QuICS, and QTC, and recently joined the ECE faculty. Since 2009, Monroe's group has investigated the use of ultrafast laser pulses for speedy quantum entanglement operations, pioneered the use of trapped ions for quantum simulations of many-body models related to quantum magnetism, and has proposed and made the first steps toward a scalable, reconfigurable, and modular quantum computer.
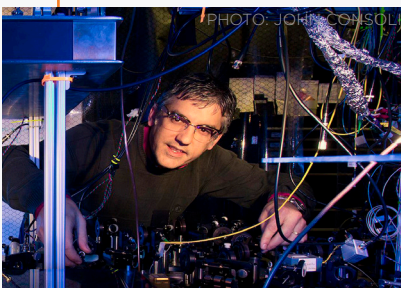
"We are on the verge of major breakthroughs in quantum technology, and the University of Maryland is leading the way in transforming quantum science into practical applications," says Joseph JaJa, professor and chair of the ECE Department. ■
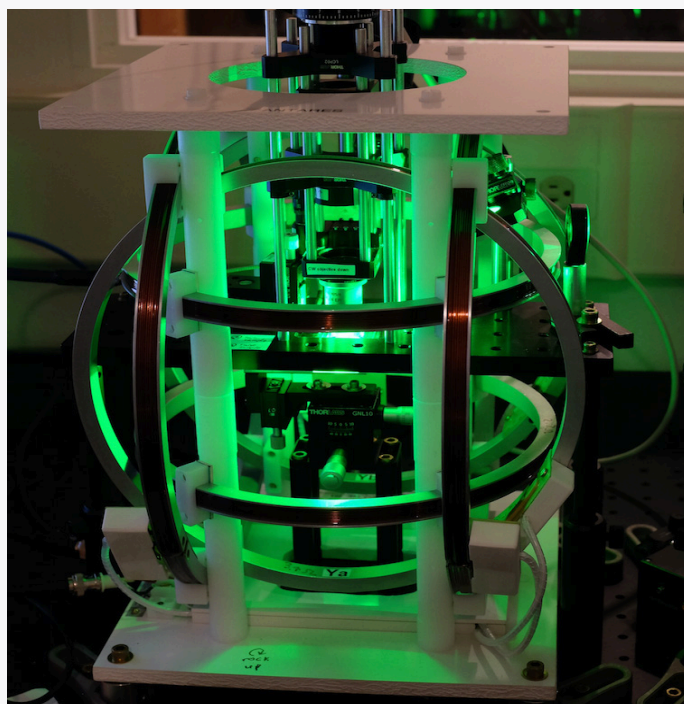
A Quantum Diamond Microscope (QDM). QDMs are now widely used by geoscientists to study microscopic magnetic features in ancient rocks and meteorites. Photo credit: Ronald Walsworth

NSF Awards $2M Grant to UMD-led Team to Develop Quantum-based Machine Learning Algorithms and Hardware

Researchers from the University of Maryland (UMD) and collaborators from the Massachusetts Institute of Technology (MIT) have been awarded $2 million by the National Science Foundation (NSF) for a quantum idea incubator aimed at developing quantum-based machine learning. The $26 million grant is funded by the Quantum Leap Big Idea Program and the Division of Electrical, Communications, and Cyber Systems in the Directorate for Engineering.

NSF funded the project, "Quantum Machine Learning with Photonics," as part of an initiative known as the Quantum Idea Incubator for Transformational Advances in Quantum Systems (QII - TAQS). QII-TAQS is designed to support interdisciplinary teams that will explore highly innovative and potentially transformative ideas for developing and applying quantum science, quantum computing, and quantum engineering.

"Our team is exploring a completely new approach to quantum computing that takes machine learning into the quantum domain," said electrical and computer engineering Professor **Edo Waks** (JQI/IREAP/QTC), who is the principal investigator of the grant. Co-principal investigators include UMD computer science Professor Andrew Childs (UMIACS/QuICS), and Professors Seth Lloyd and Dirk Englund of MIT.

In contrast to conventional approaches where computation is decomposed into logic gates, the investigators will focus on quantum computing architectures inspired by machine learning and deep learning. These architectures are naturally efficient and robust to noise, and are ideally suited to maximize the computational capabilities of currently available quantum processors which are composed of many noisy quantum bits. The project represents a highly multi-disciplinary effort that combines quantum hardware based on integrated and nonlinear optics, with algorithms and computer architecture and design. Success of the project could enable currently available quantum hardware to efficiently solve problems in a broad range of fields, such as medicine, biology, nuclear physics, and fundamental quantum science. ■

UMD Selected as Partner for New Research Consortium for Artificial Intelligence and Machine Learning

Machine learning researchers at the University of Maryland (UMD) are part of Northrop Grumman Corporation's (NYSE: NOC) newly launched research consortium known as Research in Applications for Learning Machines (REALM). The consortium has given $1.2 million in research funding to three multi-university team partners.

REALM is a unique industry-academia partnership advancing research, fostering collaboration, and addressing technological challenges in machine learning, cognition, and artificial intelligence.

The UMD-led team is exploring concepts such as learning from few labels, domain adaptation of object detection, tracking and recognition algorithms across multi-sensors, and building 3D models from aerial and ground-based images using generative adversarial networks.

The project is led by Distinguished University Professor and Minta Martin Professor of Engineering Rama Chellappa. He is joined by Professors Rene Vidal and Vishal Patel from the Johns Hopkins University, and Prof. Aswin Sankaranarayanan from Carnegie Mellon University. The collaborators will work on basic and applied research with other university researchers to address key customer applications, including multiple sensor track classification, identification and correlation; situational knowledge on demand; and quantitative dynamic adaptive planning.

"Over the last decade, machine learning and AI have become the dominant technologies in many sectors," said Chellappa, who holds appointments in UMD's Departments of Electrical and Computer Engineering and Computer Science and Institute for Advanced Computer Studies (UMIACS). "By giving this grant to the UMD-led team, Northrop Grumman is enabling the incorporation of machine learning and AI technologies for understanding multi-sensor and multimodal data."

The universities participating in the other two REALM projects are Carnegie Mellon University, Johns Hopkins University, Massachusetts Institute of Technology, Purdue University, Stanford University, the University of Illinois at Chicago, and the University of Massachusetts Amherst.

Northrop Grumman is a leading global security company providing innovative systems, products and solutions in autonomous systems, cyber, C4ISR, space, strike, and logistics and modernization to customers worldwide. ■

Dachman-Soled Receives Grant to Study Coding Schemes Used in Cryptography

Assistant Professor Dana Dachman-Soled (ECE/UMIACS/MC2) has received a three-year, $500K award from the National Science Foundation titled, "Meta Coding and Applications in Cryptography."

Coding schemes are used in cryptography to achieve secret sharing schemes with various properties. Secret sharing schemes are then used to construct secure multiparty computation protocols. Recently, coding schemes that are resilient to adversarial manipulation (or tampering) of the codeword as well as leakage of information about the codeword have been introduced and explored.

The project aims to unify the various types of coding schemes used in cryptography under a single framework. The goal is to then define and construct coding schemes that can be used to achieve secure multiparty computation protocols that remain secure under broader types of corruption patterns as well as to construct manipulation detection codes for broader types of tampering. ■

Radioactive Material Detected Remotely Using Laser-induced Electron Avalanche Breakdown

With additional engineering, a new methodto detect radioactive material, developed by physicists at the University of Maryland, could be scaled up to scan shipping containers at ports of entry—providing a powerful new tool for security applications.

Physicists at the University of Maryland have developed a powerful new method to detect radioactive material. By using an infrared laser beam to induce a phenomenon known as an electron avalanche breakdown near the material, the new technique is able to detect shielded material from a distance. The method improves upon current technologies that require close proximity to the radioactive material.

With additional engineering advancements, the method could be scaled up and used to scan trucks and shipping containers at ports of entry, providing a powerful new tool to detect concealed, dangerous radioactive material. The researchers described their proof-of-concept experiments in a research paper published March 22, 2019 in the journal *Science Advances.*

As radioactive material emits decay particles, the particles strip electrons from—or ionize—nearby atoms in the air, creating a small number of free electrons that quickly attach to oxygen molecules. By focusing an infrared laser beam into this area, the researchers easily detached these electrons from their oxygen molecules, seeding an avalanche-like rapid increase in free electrons that is relatively easy to detect.

"An electron avalanche can start with a single seed electron. Because the air near a radioactive source has some charged oxygen molecules—even outside a shielded container—it provides an opportunity to seed an avalanche by applying an intense laser field," said Howard Milchberg, a professor of physics and electrical and computer engineering at UMD and senior author of the research paper. "Electron avalanches were among the first demonstrations after the laser was invented. This is not a new phenomenon, but we are the first to use an infrared laser to seed an avalanche breakdown for radiation detection. The laser's infrared wavelength is important, because it can easily and specifically detach electrons from oxygen ions."

Applying an intense, infrared laser field causes the free electrons caught in the beam to oscillate and collide with atoms nearby. When these collisions become energetic enough, they can rip more electrons away from the atoms.

As the air in the laser's path begins to ionize, it has a measurable effect on the infrared light reflected, or backscattered, toward a detector. By tracking these changes, Schwartz, Milchberg and their colleagues were able to determine when the air began to ionize and how long it took to reach full ionization.

The timing of the ionization process, or the electron avalanche breakdown, gives the researchers an indication of how many seed electrons were available to begin the avalanche. This estimate, in turn, can indicate how much radioactive material is present in the target.

While the method remains a proof-of-concept exercise for now, the researchers envision further engineering developments that they hope will enable practical applications to enhance security at ports of entry across the globe.

In addition to Milchberg, Schwartz, and Woodbury, UMD-affiliated co-authors of the research paper include Phillip Sprangle, professor of physics and electrical and computer engineering with an appointment at IREAP, and Joshua Isaacs, a physics graduate student. ■
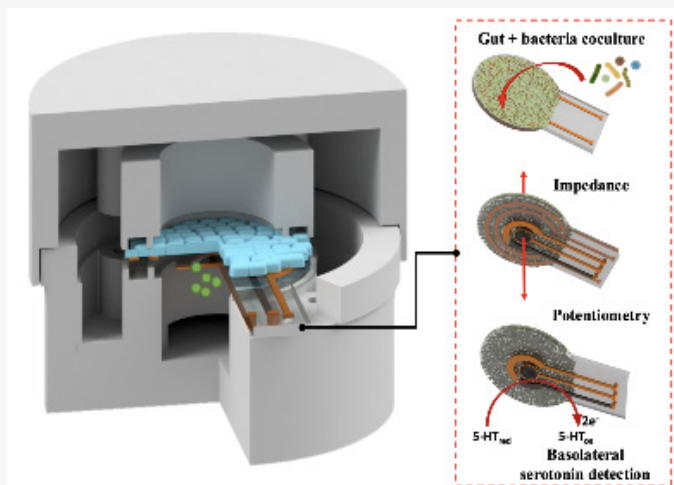
Credit: Matthew E. Wright/CMNS

NSF Awards $1M to Study Gut-Brain Link

A University of Maryland team has been awarded a three-year, $1 million grant by the National Science Foundation to investigate the complex effects of intestinal serotonin on both gut and brain health.

The project will include culturing a model of the gut lining to monitor the gut's creation of the neurotransmitter serotonin via multimodal integrated electrodes, then colonizing the model lining with different combinations of gut bacteria and using machine learning to process the simulated outcomes.

Serotonin regulates the link between gut and brain, affecting everything from bowel function to one's mood. While neuroscientists know generally that the gut microbiome stimulates the generation of gastrointestinal serotonin, it is less well understood how specific bacterial species influence serotonin's production and, subsequently, by what pathways this serotonin affects neural processes.

The award leverages UMD's expertise in electrical and computer engineering, bioengineering, molecular biology, neuroscience, physics and data science. The project's principal investigator is electrical and computer engineering Professor Reza Ghodssi. Co-principal investigators are bioengineering Professor William Bentley, psychology Associate Professor Jens Herberholz, and physics Professor Wolfgang Losert.

Pilot data for the interdisciplinary project was gathered with help from an award from the Brain and Behavior Initiative's Seed Grant Program. ■

NSF FUNDS SHAMMA, ESPY-WILSON FOR NEUROMORPHIC AND DATA-DRIVEN SPEECH SEGREGATION RESEARCH

Professor Shihab Shamma (ECE/ISR) is the principal investigator and Professor Carol Espy-Wilson (ECE/ISR) is the co-PI for a new three-year, $851K National Science Foundation Information and Intelligent Systems award, Neuromorphic and Data-Driven Speech Segregation.

Their research will investigate how the auditory cortex processes of the brain can be adapted, mimicked and applied to address the artificial intelligence (AI) signal processing challenge of robust perception in extremely noisy and cluttered environments. The neural representations of speech and music are of particular interest. The project will formulate algorithms inspired by the architecture of the brain to segregate and track targeted speakers or sound sources, test their performance, and relate them to state-of-the-art approaches that utilize deep artificial neural networks to accomplish these tasks. ■

GRADUATE STUDENTS AREA OF FUNDING

Approximately 59 new graduate students joined the Department of Electrical and Computer Engineering this fall. Students attending our programs are from Bangladesh, Brazil, China, Geece, India, Pakistan, Saudi Arabia, South Korea, Sri Lanka, Taiwan, Turkey, and the United States.

Our 10 new M.S. students and 49 Ph.D. students have chosen to specialize in the following research areas:

Circuits and Systems: 2
Computer Engineering: 8
Signal Processing: 20
Communications and Networking: 11
Optics and Photonics: 5
Control, Robotics, and Dynamical Systems: 9
Electronic Materials and Devices: 4
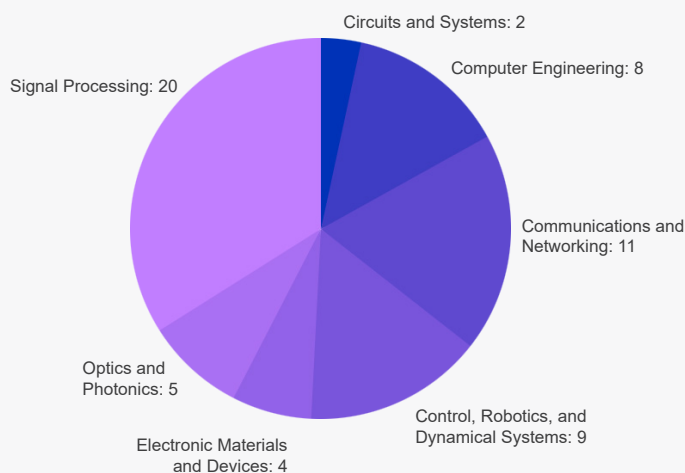
The Buddy System: Human-Computer Teams

Is that him? Is she the one?

The expert ability to visually identify human faces—a prized attribute among law-enforcement specialists—can inform forensic investigations and help maintain safe border crossings, airports, and public spaces around the world.

The field of forensic facial recognition depends on highly refined traits such as visual acuity, cognitive discrimination, memory recall, and elimination of bias. Humans, as well as computers running machine learning (ML) algorithms, possess these abilities. And it is the combination of the two—a human facial recognition expert teamed with a computer running ML analyses of facial image data—that provides the most accurate facial identification, according to a recent 2018 study in which **Rama Chellappa**, Distinguished University Professor and Minta Martin Professor of Engineering, and his team collaborated with researchers at the National Institute of Standards and Technology and the University of Texas at Dallas.

Chellappa, who holds appointments in UMD's Departments of Electrical and Computer Engineering and Computer Science and Institute for Advanced Computer Studies, is not surprised by the study results. "For this facial recognition task, like a lot of tasks in the future, humans will need a computer ML buddy to do it really well," he says.

Pairing human expertise at decoding subtle cues such as emotional signals, context, and remembered experience with ML's blazing computational power leverages the strengths of each. It also compensates for deficiencies. "Machines can mess up," Chellappa says. "A dog can be mistaken for a traffic sign by a machine if the algorithm is given poor-quality data. Human judgment and experience can easily spot that kind of error and correct it."

In the early days of computer vision research, Chellappa's labs followed the common research approach of mathematically connecting inputs of data to obtain outputs that enabled them to explore the underlying physics of image formation and geometry of objects. Mapping the contours and appearances of a face, for example, was a common task.

All this changed in 2012. That's the year the technique for layering input-output data emerged. This led to the ML approach known as deep learning, supported by an algorithmic configuration referred to as neural networks.

Deep learning affords greater ML accuracy than ever before by overcoming the constraints of limited amounts of data. The layering of data makes more data points available for analysis and powers more robust, accurate analyses of patterns and predictions. Around the same time, affordable advances in computing and graphics processing power also became available.

Combined, the confluence of the two—development of neural network deep learning and faster machine processing—led to the 2012 breakthrough that now powers technologies central to computer vision and facial recognition. And so much more, from driverless cars to voice recognition and chatbots.

Though deep learning contributes enormously to improved accuracy in facial recognition, Chellappa believes in the conclusion suggested by the 2018 study: the future is still human. Optimal accuracy in facial recognition and other ML-mediated tasks will likely come from humans and machines teaming up.

For example, he sees enormous potential to apply deep learning and the buddy system of human-computer teams to issues in medicine and human health. In a cardiac exam, the ML-enabled computer could make diagnostic suggestions from patterns in the patient's heart data and help predict patients at risk for a cardiac event. The human medical professional would analyze the machine's report and make the final diagnostic decision, and design the plan for how and when to treat.

Says Chellappa: "ML is remarkably powerful in identifying patterns and making predictions, especially when there is a lot of high-quality data, so I'm very excited about this deep learning potential in medicine to improve care." ∎

Dean Pines Elected to National Academy of Engineering

Darryll Pines, dean and Nariman Farvardin Professor of the A. James Clark School of Engineering at the University of Maryland, has been elected to the 2019 class of the National Academy of Engineering (NAE), among the highest professional distinctions accorded to an engineer.

The association cited Pines for "inspirational leadership and contributions to engineering education excellence in the United States." Pines is the second Clark School dean to be elected to NAE.

As dean of the engineering school with over 6,000 students, Pines has led the development and implementation of a strategy to improve teaching in fundamental undergraduate courses and raise student retention, achieve success in national and international student competitions, place new emphasis on service learning and grand societal challenges, promote STEM education among high school students, increase the impact of research programs, and expand philanthropic

contributions to the school. Most notably, Pines was instrumental in securing a $219.5 million investment—among the largest gifts ever to a public university—from the A. James & Alice B. Clark Foundation.

Pines's belief in the value of an inclusive and diverse community has underpinned his work. He served as director of the Alfred P. Sloan Doctoral Scholars Program and presently serves as secretary of the Board of Directors for the National GEM Consortium Fellowship Program. The percentage of women and underrepresented minorities in the UMD engineering undergraduate student body has grown to 25 and 16 percent, respectively, during his time as dean. According to Diverse Issues in Higher Education, the Clark School ranks among the top 10 in conferring the most B.S., M.S., and Ph.D. degrees to African American students.

Pines is currently leading an initiative to pilot a first-of-its kind, nationwide, pre-college course on engineering principles and design. The pilot program, Engineering For US All (E4USA), will test the effectiveness of a standardized educational curriculum across multiple states. The course, made possible through a $4 million NSF grant, is intended to eventually provide the equivalent of placement credit for an introductory college course. ■

Did You Know?

There are Already Three National Academy Members in the ECE Department:

**John Baras,
Professor**

John Baras was elected to the National Academy of Inventors (NAI) in 2015. He is the founding director of ISR and holds many U.S. patents and a software copyright in Internet protocols, networks, wireless networks, security and signal processing.

**Christopher Monroe,
Professor**

Christopher Monroe was elected to the National Academy of Sciences (NAS) in 2016. He is a scientific leader in trapping atomic ions and studying how to use their quantum properties for information processing.

**Percy Pierre,
Adjunct Professor**

Percy Pierre was elected to the National Academy of Engineering (NAE) membership in 2009 for his service as assistant secretary of the Army, contributions to engineering education, and leadership in creating the national minority engineering effort.

Liu Named Distinguished University Professor

Professor **K.J. Ray Liu** has been awarded a 2019 Distinguished University Professor Award. This award is the highest honor that can be achieved by a tenured faculty member in recognition of not just their excellence in teaching, but also of their significant contributions, both domestically and internationally, to their field of expertise and the distinction it has brought to the University of Maryland.

Dr. Liu is the Christine Kim Eminent Professor of Information Technology in the Department of Electrical and Computer Engineering. He joined the faculty of the University of Maryland in 1990, after receiving a Ph.D. in Electrical Engineering from UCLA. Previously, he earned a B.S. in Electrical Engineering at National Taiwan University. As the leader of the University of Maryland Signal and Information Group (SIG), his main fields of study are signal processing and communications, including wireless communications; network science, multimedia signal processing, information forensics and security, bioinformatics, and signal processing algorithms and architectures.

Prof. Liu has been recognized internationally with numerous awards, including: IEEE Signal Processing Society 2009 Technical Achievement Award, IEEE Signal Processing Society 2014 Society Award (the highest award bestowed by the Society), and the 2016 IEEE Leon K. Kirchmayer Technical Field Award on Graduate Teaching and Mentoring. For the IEEE 125th Anniversary in

PHOTO: STEPHANIE CORDLE

2009, he was recognized as one of seven scientists whom the organization believed would significantly contribute worldwide to the way humans interact with machines, the world, and each other. Prof. Liu is also recognized by Web of Science as a Highly Cited Researcher.

Within the University of Maryland, Prof. Liu has been awarded many honors. From the Clark School of Engineering he has received the Poole and Kent Senior Faculty Teaching Award, the Outstanding Faculty Research Award, and an Outstanding Service Award. From the Department of Electrical and Computer Engineering he has received the George Corcoran Award for outstanding contributions to electrical engineering education. As part of multiple teams, Prof. Liu has three times received the University's Office of Technology Commercialization Invention of the Year Award. ∎

Yanne K. Chembo Joins the ECE Department

Associate Professor **Yanne K. Chembo** joined the ECE Department in January 2019. He holds a joint appointment in the Institute for Research in Electronics and Applied Physics (IREAP).

Before joining the University of Maryland, Prof. Chembo was a Research Scientist at the French National Center for Scientific Research (CNRS). There, he led a research group focused on the exploration of nonlinear, quantum and stochastic phenomena in optoelectronics, microwave photonics, and laser physics.

Prof. Chembo's research interests include nonlinear and stochastic dynamics, quantum optics, laser physics and

information theory. In 2006, Prof. Chembo received a Ph.D. degree in photonics from the University of the Balearic Islands (Palma de Mallorca, Spain), and independently, a Ph.D. degree in nonlinear dynamics from the University of Yaounde I (Cameroon).

He has co-authored more than 150 articles in refereed international journals and international conference proceedings. He was a member of the Committee for Regional Development of the International Commission for Optics (ICO) from 2014 to 2017. He is a senior member of IEEE and OSA, an associate editor for the OSA journal Optics Express, and the IEEE Photonics Society Africa Initiative Representative. He was named Fellow of the International Society for Optics and Photonics in 2019. ∎

Khaligh, Dumitras, and Papamanthou Receive Academic Promotions

University of Maryland Electrical and Computer Engineering Faculty Members **Alireza Khaligh, Tudor Dumitras,** and **Charalampos (Babis) Papamanthou** have been promoted to full professor and associate professors, with tenure, respectively.

Dr. Khaligh's research focuses on modeling, analysis, design, and control of power electronic converters for transportation electrification, renewable energies, energy harvesting, and micro-robotics. He is an author/coauthor of more than 170 journal and conference papers. He is the recipient of numerous awards and recognition. Dr. Khaligh and his research team received the 2018 Invention of the Year Award for their development of an integrated power electronics interface for enhanced electric vehicle charging.

Dr. Dumitras's research focuses on data-driven security. He conducts empirical studies of adversary behavior, builds machine learning systems for detecting malware and attacks, and studies the security of machine learning in adversarial environments. His work has been widely cited in the media, including *The Economist, MIT Technology Review, Forbes,* and *The Register.*

Dr. Papamanthou's research focuses on computer security and applied cryptography, with a specific emphasis on technologies, systems, and theory for providing secure computations in the cloud. He is a recipient of an NSF CAREER award, a Google Faculty Research Award, a NetApp Faculty Fellowship, and other honors. ◼

Srivastava Named Seventh Director of ISR

PHOTO: AL SANTOS

Clark School of Engineering Dean Darryll Pines has named Professor **Ankur Srivastava** the seventh director of the Institute for Systems Research (ISR).

Dr. Srivastava holds a joint appointment as Professor in the Department of Electrical and Computer Engineering (ECE) and ISR. He brings expertise in computer engineering with particular interest in hardware security. In addition to leading a highly successful research program, he also has substantial experience in various administrative roles. He previously served as the Clark School as Associate Dean for Graduate Programs and as ECE's Associate Chair for Graduate Affairs.

ISR is an interdisciplinary research unit at the international forefront of research and education in the system sciences and systems engineering. ◼

Espy-Wilson Honored at UMD's First to ADVANCE Celebration

Professor **Carol Espy-Wilson** (ECE/ISR) was celebrated among 14 other women faculty trailblazers at the inaugural First to Advance celebration and photography exhibit held March 28, hosted by the University of Maryland ADVANCE Program for Inclusive Excellence.

The program honors a diverse group of women who were the first to be promoted or tenured, take on department chair roles or deanships, start research centers, or win local, national, and international awards among other important contributions.

Prof. Espy-Wilson is the first African American woman, and first African American, in the Department of Electrical and Computer Engineering to receive tenure and be promoted to full professor. ◼

Baras Named Fellow of the American Mathematical Society

Distinguished University Professor **John Baras** has been named a Fellow of the American Mathematical Society (AMS). The citation reads, "For contributions to the mathematical foundations and applications of systems theory, stochastic systems, stochastic control, network security and trust, mentoring, and academic leadership."

AMS Fellows are members who have made outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics. ∎

Faculty Spotlight: Romel Gomez

Gomez Receives Poole and Kent Senior Faculty Teaching Award

Dr. **Romel (Mel) Gomez**, Professor and Associate Chair for Undergraduate Education, received the 2019 Clark School Poole and Kent Teaching Award for Senior Faculty. He was honored at the University of Maryland's Spring Commencement this year on May 23. The award is bestowed annually to faculty members who have provided remarkable contributions to the field of teaching.

Since earning his PhD in Condensed Matter Physics from the University of Maryland College Park in 1990, Dr. Gomez has been a valuable addition to the teaching staff and the Department of Electrical and Computer Engineering. He has been fundamental in developing, improving and modernizing curriculum, and has also overseen the design and development of several labs which provide practical experience for students. In addition, he has also been instrumental in creating the engineering capstone course on electric bicycle design and the 125 Mile E-Bike Challenge. Currently, he is involved with the BS in Embedded Systems and the Internet of Things, which will be offered through the University of Maryland at The Universities at Shady Grove in Rockville, Maryland.

Past University of Maryland awards received include the Clark School Faculty Service Award (2014) and the Clark School E. Robert Kent Outstanding Teaching Award (2005), ECE Department George Corcoran Teaching Award (1998). He has also received several international awards in connection with education and research.

Gomez Inducted into the National Academy of Science and Technology of the Philippines

On July 11, Dr. Gomez was inducted into the National Academy of Science and Technology of the Philippines (NAST). Endorsed by the Department of Science and Technology, NAST was developed as the highest recognition and scientific advisory board of the Philippines. Dr. Gomez was elected "in recognition of his significant contributions in the field of magnetism, nanotechnology, surface science, and biochemical sensors."

In addition to his work in the Department of Electrical and Computer Engineering, Dr. Gomez has been active in the international scientific community and has worked extensively with the Filipino scientific community. He has served as the President and Board Member of the Philippine American Academy of Scientists and Engineers. He has forged collaborations with Filipino scientists and founded a program called VISSER (Versatile Instrumentation System for Science Education and Research) that was developed to provide state-of-the-art yet cost-effective scientific equipment for K-12 classrooms in the Philippines. He also developed and deployed an instrument for loop-mediated isothermal (DNA) amplification for early and low-cost of Dengue and other tropical diseases in the Philippines. ∎
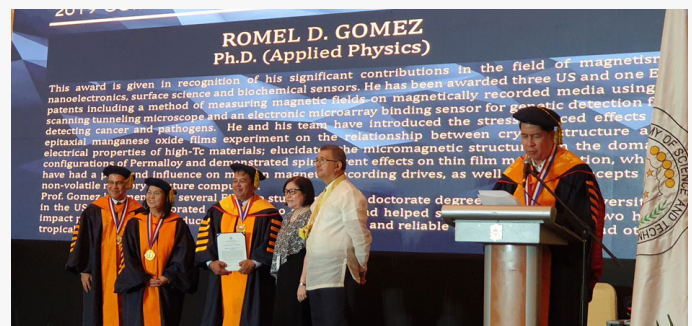
Faculty Spotlight:
Min Wu

This year, Professor Wu has been named Associate Dean for Graduate Programs of the A. Clark School of Engineering and she has been awarded the prestigious Harriett B. Rigas Award from the IEEE Education Society.

Professor **Min Wu** (ECE/ISR/UMIACS), the Clark School of Engineering's associate dean for graduate programs, is the 2019 recipient of the Harriett B. Rigas Award from the Institute of Electrical and Electronics Engineers (IEEE) Education Society. This honor is awarded annually to recognize outstanding female faculty who have made significant contributions to undergraduate education and the global engineering community. Professor Wu is being recognized for excellence and outstanding leadership in signal processing, education, and mentoring.

Distinguished University Professor K.J. Ray Liu nominated Dr. Wu for this award. "Dr. Wu is an outstanding role model for her strong passion and impactful contributions in research, education, service to the engineering community, and outreach," said Liu.

Dr. Wu joined the University of Maryland faculty in 2001 and established the Media and Security Team (MAST) that same year. She was also instrumental in establishing the "Women-in-ECE" program at UMD to help female students foster a sense of community and peer support, and served as its faculty advisor for more than a decade. She provided a substantial amount of mentoring of junior colleagues, both at UMD across multiple academic departments/colleges and through IEEE technical activities. She engaged more than 30 undergraduates in research and served as thesis advisor of 20 graduate students, including a number of female and underrepresented minority students.

Dr. Wu is well known for her innovative and high-impact research in security, forensics, and signal processing. She has authored 185 refereed journal and conference publications, and was granted 10 U.S. patents and five international patents, with 16 more pending.

She has been an active member of the IEEE and took on a number of leadership positions, including Vice President for Finance in the IEEE Signal Processing Society, Chair of IEEE Technical Committee on Information Forensics and Security, and Editor-in-Chief of IEEE Signal Processing Magazine. She has been honored with an IEEE Meritorious Service Award and the IEEE Distinguished Lecturer recognition. She has been named as a Fellow for outstanding technical contributions by both the IEEE and the American Association for the Advancement of Science.

From UMD, Dr. Wu has been awarded a Distinguished Scholar-Teacher Award, the George Corcoran Education Award, the Clark School E. Robert Kent Junior Faculty Teaching Award, and twice the Inventor of the Year Award. She has also been honored with a National Science Foundation Career Award and an Office of Naval Research (ONR) Young Investigator Award on information security and protection, and was named one of 100 top young innovators in the MIT Technology Review Magazine in 2004. In August 2019, she was appointed as associate dean for Graduate Programs of the Clark School of Engineering.

"I feel really honored being selected to receive this prestigious IEEE award named after Dr. Harriett Rigas - a woman pioneer in engineering and education," said Wu. "What the award recognizes is actually a teamwork: I like to convey my deep appreciation to the many students with whom I have had the privilege to teach, mentor, or collaborate and see them grow and succeed, and to a number of caring colleagues and mentors—male and female—who have helped me in various stages of life and career!" ■

Hafezi Named Finalist in Prestigious Blavatnik National Awards for Young Scientists

Associate Professor **Mohammad Hafezi** (ECE/JQI/IREAP/QTC) was named a Finalist of the 2019 Blavatnik National Awards for Young Scientists in the Physical Sciences & Engineering category by the Blavatnik Family Foundation and the New York Academy of Sciences.

Hafezi was among 31 of the nation's rising stars in science who competed for three Blavatnik National Laureate Awards in the categories of Chemistry, Physical Sciences & Engineering, and Life Sciences; he was one of 10 Finalists in Physical Sciences & Engineering.

Now in its 13th year, the Blavatnik National Awards for Young Scientists recognize the past accomplishments and the future promise of the most talented faculty-rank scientists and engineers aged 42 years and younger at America's top academic and research institutions.

Inspired by the concept of topology in mathematics and its prevalence in electronic quantum materials,

PHOTOS: BLAVATNIK FOUNDATION

Hafezi's innovative work has addressed a critical problem of inevitable nanofabrication defects. These imperfections have plagued the reliability and performance of optical devices in nanophotonics and quantum optics for years. Through his work, Hafezi has shown that, like electrons, photons under a given set of conditions can also be made insensitive to both the shape and defects in an optical device. This discovery has garnered immense interest in the optics community and spurred a new field of topological photonics.

The 2019 Blavatnik National Laureates and Finalists were honored at the Blavatnik National Awards ceremony on September 23rd, at the American Museum of Natural History in New York. ■

Ghodssi Receives Senior Faculty Outstanding Research Award from The Clark School

Herbert Rabin Distinguished Chair in Engineering **Reza Ghodssi** has been selected as the 2019 winner of the Senior Faculty Outstanding Research Award by the A. James Clark School of Engineering. This award was instituted in 2001 to recognize exceptionally influential research accomplishments by Clark School faculty.

Ghodssi holds a joint appointment in the Department of Electrical and Computer Engineering (ECE) and the Institute for Systems Research (ISR). He is the director of the MEMS Sensors and Actuators Lab (MSAL) and was the director of ISR from 2009–2017. Ghodssi is also affiliated with the Robert E. Fischell Institute for Biomedical Devices (Fischell Institute), the Fischell Department of Bioengineering (BIOE), the Maryland NanoCenter, the Maryland Energy Innovation Institute (MEII), and the Department of Materials Science and Engineering

(MSE). He is a founding co-director of the Brain and Behavior Initiative (BBI) within the university, which aims at revolutionizing the interface between engineers and neuroscientists by generating novel tools and approaches to understand complex behaviors produced by the human brain.

Ghodssi's interdisciplinary research interests are in the design and development of micro/nano/bio devices and systems for chemical and biological sensing, small-scale energy conversion and harvesting with a strong emphasis toward healthcare applications. His research has been funded by the National Science Foundation (NSF), the Army Research Office (ARO), the National Institutes of Health (NIH), the Maryland Innovation Initiative at TEDCO, and the R.W. Deutsch Foundation.

"I am indeed honored by this great recognition during the 20th anniversary year of my coming to the University of Maryland," Ghodssi said. "I share this award with all the talented and creative undergraduate and graduate students, as well as the postdoctoral researchers who have worked with me in the MEMS Sensors and Actuators Laboratory during this time." ■

faculty & staff NEWS

Walker and Young Recognized for 25 Years of University Service

This Spring, the Clark School hosted its Staff Reception and Service Awards Ceremony. This annual event recognizes the vital contributions of staff members and includes special recognition to staff members who have reached 20, 25, 30 or more years of service to the university community. **Edna Walker** and **LaShanna Young**, who are both celebrating twenty-five years with the university this year, were honored for their outstanding service.

Edna Walker has spent the past twenty-five years contributing to the success of the Computer Science Department, the Institute of Advanced Computer Studies, and the Department of Electrical and Computer Engineering. She joined ECE in 2016 as the Coordinator in the ECE Chair's Office. As the first contact for many visitors to the department, Edna oversees a variety of integral components to the program, including faculty appointments, promotion and tenure, and event planning.

LaShanna Young is the ECE Director of Payroll and Human Resources. She has been a valuable resource in the department for the past 19 years. Prior to joining ECE, LaShanna worked with the Smith School of Business, as well as St. Mary's College of Maryland. Her knowledge of university policies and procedures regarding payroll and human resources is noteworthy and has been extremely beneficial to the department. In addition, she volunteers her time extensively to numerous committees, pilot groups, and other activities throughout the campus.

Both LaShanna and Edna are valuable assets to the ECE Department. Their contributions and dedication to the University of Maryland have been recognized and are greatly appreciated. ■

Daniels and Shoukry Win George Corcoran Award for Teaching

Kevin Daniels and Yasser Shoukry are recipients of ECE's George Corcoran Award for Teaching. They have been honored for outstanding contributions to engineering education and teaching at the University of Maryland. The award is given for significant contributions to electrical or computer engineering through excellence in teaching and the advancement of the profession. ■

Young Wins ECE Staff Service Award

Electrical and Computer Engineering's Human Resources Director **LaShanna Young** has received ECE's 2019 Corcoran Staff Service Award. The award is given in recognition of her level of dedication, excellence in performance, and commitment to service to the department this year. ■

Bastopcu and Ozturk Win ECE Graduate Teaching Assistant Award

Melih Bastopcu and **Muhammed Ozturk** received this year's George Corcoran award for graduate teaching assistants (TAs). This award is given to students who show excellent leadership skills and commitment to education in their teaching assistant positions. ■

Goswami Wins ECE Graduate Student Service Award

Debdipta Goswami is the recipient of this year's George Corcoran award for Graduate Student Service. This award is given to nominees who demonstrate a firm commitment to the welfare of the department and of the students studying within it. ■

Wu Wins the Jimmy H.C. Lin Invention Competition Award

Min Wu has won the Jimmy H.C. Lin Invention Competition Award for, "An Anti-Piracy Framework for Deep Neural Networks." The Invention Competition Award promotes inventions in the ECE Department by providing an award to the faculty/staff/student team that achieves the highest level of recognition in the annual University of Maryland Invention of the Year competition. ■

Wakes Wins ECE Jimmy H.C. Lin Innovation Award

Edo Waks has won ECE's Innovation Award for patent 2015/0238110A1: Neuroparticle with a Spin-Torque Device. The Lin Innovation award is given to promote innovation among ECE students, staff and faculty by stimulating, encouraging and rewarding the invention and patenting process, and to help students, staff and faculty move their ideas forward through the complicated and often expensive patenting process. ■

Chance Glenn Sr. Named new University of Houston-Victoria Provost

PHOTO: THOMAS COLVIN

A. James Clark School of Engineering alumnus **Chance Glenn Sr.** (EE B.S. '91) is University of Houston-Victoria's new provost and vice president of academic affairs. His appointment began August 5, 2019.

As provost, he will serve as the chief academic officer of the university with the deans of UHV's three schools and University College reporting to him. He will also sit on the President's Cabinet and the university's Executive Committee.

Glenn is a highly qualified educator with almost two decades in the field. After earning his bachelor's from the Clark School in 1991, he continued on to earn his master's degree and doctorate from Johns Hopkins University before moving north to join the faculty at the Rochester Institute of Technology (RIT). In 2008, he became associate dean of graduate studies at RIT. Since 2012, he has served as dean of the Alabama A&M College of Engineering, Technology and Physical Sciences. Glenn also is president and executive director of the Alabama A&M University Research, Innovation, Science and Engineering Foundation.

Glenn has founded two tech companies aiming to advance the engineering industry. His second company, the Morningbird Media Corporation, created the Electronic Alchemy eForge 3D printing technology, which was a finalist in the 2019 experimental category in Fast Company's World Changing Ideas.

In addition to eForge, Glenn's accomplishments as an African American scientist and educator were acknowledged through a 2018 induction into the Indispensable Role of Blacks at JHU, a traveling and online Johns Hopkins exhibit honoring the contributions that people of color have made to the institution. ∎

Nima Ghalichechian Receives NSF CAREER Award

Alumnus **Nima Ghalichechian** (EE Ph.D. 2007) has received a National Science Foundation CAREER Award for "Understanding and Exploiting Non-Linear Behavior of Phase-Change Materials for Millimeter-Wave Applications." The five-year, $500K award will foster fundamental studies vital to future radio-frequency reconfigurable communication systems.

Ghalichechian is an assistant professor in the Department of Electrical and Computer Engineering and a member of the ElectroScience Laboratory at the Ohio State University.

At Maryland, Ghalichechian was advised by Professor Reza Ghodssi (ECE/ISR). ∎

Yan Sun Named IEEE Fellow

The Institute of Electrical and Electronics Engineers (IEEE) has elevated alumnus **Yan Sun** (EE Ph.D. 2004) to the rank of Fellow. She is being recognized for "contributions to trust modeling and statistical signal processing for cyber-physical security."

The IEEE Grade of Fellow is conferred by the IEEE Board of Directors upon a person with an outstanding record of accomplishments in any of the IEEE fields of interest.

Sun is a Professor in the Electrical, Computer and Biomedical Engineering Department at the University of Rhode Island.

At the University of Maryland, Sun was advised by Distinguished University Professor K. J. Ray Liu (ECE). ∎

Lawrence Carin Named Vice President for Research at Duke University

Alumnus **Lawrence Carin** (B.S. '85; M.S. '86; Ph.D. '89) has been named Vice President for Research at Duke University and will lead Duke's newly formed Office of Research.

Carin, a Duke engineering professor and one of the world's leading experts on machine learning and artificial intelligence, has served as Duke's vice provost for research since 2014. He will continue his current role of leading research strategy and development for schools reporting to the Provost and he will add university-wide responsibility for research policy, coordination with federal research sponsors, compliance, scientific integrity, and technology transfer.

Carin's new role is part of Duke's commitment to establishing a new, integrated leadership structure for research to provide clear and consistent policy guidance, oversight, and accountability for all research.

"My focus will be on culture change, in particular creating a sense of ownership within the entire institution with regard to research," Carin said in an interview with *Duke Today*. "I look forward to working with our faculty and leadership to further elevate our commitment to excellence in all aspects of research, including development, funding, pre- and post-award management, integrity, and accountability."

Carin is the James L. Meriam Distinguished Professor and

PHOTO: DUKE UNIVERSITY

former chair of the Department of Electrical Engineering. His early research was in the area of electromagnetics and sensing, but over the last fifteen years he has transitioned to applied statistics and machine learning.

The co-author of more than 400 academic papers, Carin's work has touched on such diverse fields as artificial intelligence, bomb detection, video analysis, neuroscience, cancer, infectious disease, voting behavior, and music. He has formed several companies and regularly serves on the program committee for such conferences as Neural Information Processing Systems (NeurIPS) and the International Conference on Machine Learning (ICML).

Carin was named a Distinguished Alumni of the Electrical and Computer Engineering Department in 2013 for his contributions to the fields of electromagnetics, applied statistics, and machine learning. ■

Xiaobo Tan Elevated to ASME Fellow
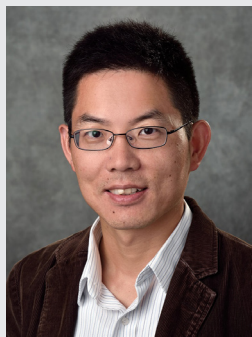
Alumnus **Xiaobo Tan** (EE Ph.D. 2002) has been named a Fellow by the American Society of Mechanical Engineers (ASME). The citation reads "for significant contributions to the development, modeling, and control of electromechanical systems in the areas of smart materials, soft robotics, and underwater robotics."

Tan is a Foundation Professor in the Department of Electrical and Computer Engineering at Michigan State University and director of the Smart Microsystems

Laboratory there. At Maryland, Tan was advised by Professor John Baras (ECE/ISR) and Professor P. S. Krishnaprasad (ECE/ISR).

An expert in automatic control systems, he has made significant contributions to modeling and control of smart materials, and is internationally recognized for his seminal work in developing fish-like robots for underwater sensing. He has successfully blended deep theoretical concepts into his research with practical approaches to provide innovative solutions to complex problems. His research is interdisciplinary, spanning controls, dynamics, materials, fabrication, and robotics. ■

Ahmadi and Forte Receive 2019 PECASE Awards

The White House named three Clark School alumni recipients of the Presidential Early Career Award for Scientists and Engineers (PECASE). The PECASE is the highest honor bestowed by the U.S. government to outstanding scientists and engineers who are beginning their independent research careers and who show exceptional promise for leadership in science and technology.

Alumnus **Amir Ali Ahmadi,** (BS EE and Math 2006) was nominated for the award by the National Science Foundation.

Ahmadi is professor of operations research and financial engineering at Princeton University, where he is associated with the Program in Applied and Computational Mathematics and the Center for Statistics and Machine Learning. Ahmadi's research interests are in areas of applied mathematics such as optimization, computational dynamics and control and computational complexity. As an undergraduate at the University of Maryland, Ahmadi worked with Professor Nuno Martins (ECE/ISR) and Professor André Tits (ECE/ISR). ■

Alumnus **Domenic Forte** (CE Ph.D. 2013). Forte's PECASE award, sponsored by the Army Research Office (ARO), will enable him to develop a "fingerprint" technology to secure electronic hardware systems.

Forte was part of the 2017 PECASE cohort, nominated by Dr. Cliff X. Wang, Division Chief for the Computing Sciences Division at the ARO.

Forte is an assistant professor in the Department of Electrical and Computer Engineering at the University of Florida, where he is a member of the Florida Institute for Cybersecurity Research. As a doctoral student at Maryland, he was advised by ISR Director Ankur Srivastava (ECE/ISR). ■

ECE Advisory Board Member Sonal Deshpande Retires after 33 Years with Northrop Grumman

ECE Advisory Board member and electrical and computer engineering alumnus Sonal Deshpande is retiring this year from Northrop Grumman, her employer for the last thirty-three years. She is leaving her position as Vice President of Quality & Mission Excellence for Northrop Grumman's Mission Systems sector.

Deshpande joined Northrop Grumman in 1986 as a hardware design engineer responsible for the design, testing and delivery of digital processors for several government programs. Over the years she progressed to other positions, including Vice President of Engineering, Manufacturing and Logistics, Vice President of Advanced Maritime and Integrated Air and Missile Defense Systems, and Vice President of Electronic Systems Logistics Services.

She has been a long-time supporter of STEM education by mentoring middle and high school students. She is an Executive Sponsor for the Advanced Cybersecurity Experience for Students (ACES) Program supported by the Northrop Grumman Foundation. And, in 2013, she received a special recognition at the Annual Women of Color Science, Technology, Engineering and Math Conference.

Deshpande earned a B.S. in Electrical Engineering from the University of Maryland and an M.S. in Electrical Engineering from Johns Hopkins University. She has also studied at the Harvard Business School General Management Program.

She has been an active member of the ECE Advisory Board for the past five years, and although she is retiring from Northrop Grumman, she will continue her membership on the ECE board. ■

Jiang, Marakby, Vaswani, and Wu named 2019 ECE Distinguished Alumni

This spring, the Electrical and Computer Engineering (ECE) Department inducted the 2019 class of distinguished alumni for their leadership and meritorious contributions to the field of engineering, their humanitarian efforts, and the application of their engineering education to other disciplines. At the eighth annual ECE Distinguished Alumni Award presentation on May 17, fellow alumni, faculty, staff, and students gathered to honor the recipients. This year, ECE's Distinguished Alumni are **Yimin Jiang, Sherif Marakby, Namrata Vaswani,** and **An-Yeu (Andy) Wu.**

Yimin Jiang received M.S. and Ph.D. degrees in electrical engineering from the University of Maryland, College Park in 1998 and 2000, respectively. While at Maryland, Jiang was advised by Professor John Baras (ECE/ISR), who nominated him for this award. In 2005, Dr. Jiang cofounded Availink Inc., a fabless semiconductor company focused on digital video broadcasting. As the company's CTO, he worked with the Academy of Broadcasting Science in China to develop the ABS-S Standard, which has been used in China since 2008. Availink was ranked the number one fabless semiconductor company by iSuppli in 2009. In 2014, he founded ColorV Inc., where he is currently Chairman of the Board of Directors and Chief Executive Officer. ColorV Inc. is a social media company that allows users to post short video clips. Its mobile app allows users to easily create and edit videos with advanced video processing, cloud computing and AI techniques. The app has attracted more than 30 million registered users.

In 2011, Dr. Jiang was named State Specially Recruited Expert, the highest title of honor established by China for the high-level experts introduced from overseas. He received the Hottest International Company recognition by Northern Virginia Technology Council in 2009, and the Patent Application Award from NASA in 2008. He has received the Science and Technology Advancement Award and, in 2007, he was ranked number one among First Class from China's State Administration of Radio Film and Television (SARFT).

Dr. Jiang is passionate about entrepreneurship in engineering. Along with his entrepreneurial career, he is also a successful venture capital investor. His investment interests focus on hardcore technologies and the Internet.

Sherif Marakby received an M.S. in electrical engineering from UMD in 1990. He was nominated for the Distinguished Alumni award by Professor Alireza Khaligh (ECE/ISR) for his extensive contributions to the automotive industry. Marakby started working at Ford Motor Company in 1990, proceeding to hold a number of positions and rising through the ranks to his current position of Chief Executive Officer, Ford Autonomous Vehicles. In addition to his time at Ford, he spent time as Uber's VP of Global Vehicle Program, returning to Ford after a year away.
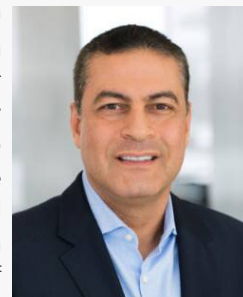
Marakby has applied his extensive background in electrification to several Ford programs over the years. His experience in the automotive industry took him around the world and focused on various elements of vehicular systems. Early in his career, he spent time working in manufacturing plants and held several engineering positions in electrical and body engineering. He was responsible for electronic components on all Ford vehicles globally, including Infotainment Systems, Driver Assist Features, and Connectivity. He spent two years at Ford of Europe working on Powertrain systems and components, and also worked as the Vehicle Line Director for the C-car developing the C2 platform. He then spent six years as Chief Engineer and Director developing Hybrid, Plugin Hybrid, and Battery Electric vehicles. He also served as Chief Program Engineer on several vehicles including the Ford Escape. In his current role, he is preparing Ford to compete with other automakers in the race for autonomous vehicle passenger and delivery service ready for mass service in the United States by 2021.

"I had the opportunity to focus on neural networks during my M.S. degree at UMD, before artificial intelligence became a key technology enabling many things in our lives today and in the future, including autonomous cars," Marakby said.

Marakby has received a number of recognition and awards over the years, including "Electrifying 100 EV Leaders" from *Automotive News* in 2012, and "60 Who Are Steering Self-Driving Vehicles" in 2016, and the Henry Ford Technology Award in 2010. He currently serves on the boards of Argo AI and the Michigan Science Center.

Namrata Vaswani received a B.Tech from the Indian Institute of Technology (IIT), Delhi, in 1999 and a Ph.D. from UMD in 2004, both in electrical engineering. While at Maryland, Vaswani was advised by Distinguished University Professor Rama Chellappa, who nominated her for this award. During 2004-05, she was a research scientist at Georgia Tech. Since Fall 2005, she has been with Iowa State University, where she is currently the Anderlik Professor of Electrical and Computer Engineering. Vaswani is a recipient of the Harpole-Pentair Assistant Professorship (2008-09), the Iowa State Early Career Engineering Faculty Research Award (2014), the Iowa State University Mid-Career Achievement in Research Award, as well as the

2014 IEEE Signal Processing Society Best Paper Award. In 2019, she was elevated to IEEE Fellow for contributions to dynamic high-dimensional structured data recovery.

Professor Vaswani's research is in Data Science, with a particular focus on Statistical Machine Learning, Signal Processing, and Computer Vision. She is internationally renowned for her pioneering work on online algorithms solving two dynamic structured big-data recovery problems: dynamic Compressive Sensing (CS); and dynamic Robust Principal Components Analysis (RPCA).

Vaswani has served the IEEE in various capacities, twice as an Associate Editor for IEEE Transactions on Signal Processing. In 2018, she was the Lead Guest Editor for an IEEE Special Issue of Proceedings on Rethinking PCA for Modern Datasets. She is currently serving as an Area Editor for IEEE Signal Processing Magazine and as the Chair of the Women in Signal Processing (WiSP) Committee of IEEE Signal Processing Society.

An-Yeu (Andy) Wu received his B.S. degree from National Taiwan University in 1987, and his M.S. and Ph.D. degrees from UMD in 1992 and 1995, respectively, all in electrical engineering. He was advised by Professor K.J. Ray Liu (ECE), who also nominated Wu for the Distinguished Alumni Award. After completing his studies at UMD, Wu joined the Technical Staff at AT&T Bell Laboratories in Murray Hill, New Jersey, working on high-speed transmission IC

designs. In 2000, he joined the faculty of the Department of Electrical Engineering and the Graduate Institute of Electronics Engineering, National Taiwan University (NTU), where he is currently a Distinguished Professor and Director of Graduate Institute of Electronics Engineering. He has made outstanding contributions to low-power/high-performance VLSI architectures for DSP and communication applications, adaptive/multirate signal processing, reconfigurable broadband access systems and architectures, biomedical signal processing, and System-on-Chip (SoC)/Network-on-Chip (NoC) plat-form for software/hardware co-design. He has published more than 250 refereed journal and conference papers in the above research areas, together with five book chapters and 20 granted U.S. patents.

Wu was elevated to IEEE Fellow in 2015 for his contributions to "DSP algorithms and VLSI designs for communication IC/SoC." From 2012 to 2014, he served as the Chair of VLSI Systems and Applications (VSA) Technical Committee (TC), one of the largest TCs in IEEE Circuits and Systems Society. He is a member of the Board of Governors of the IEEE Circuits and Systems Society.

From August 2007 to December 2009 he served as the Deputy General Director of SoC Technology Center, Industrial Technology Research Institute, Hsinchu, Taiwan. ■

Women in ECE

The purpose of the Women in ECE (WECE) group is to help provide a great educational experience for female graduate students by fostering a sense of community in the department and to provide opportunities, resources, services, and events of interest to current ECE students.

WECE conducts coffee hours and monthly luncheons for female graduate students to get together and network. The group also leads workshops to foster professional development in the context of being a female minority, and seminars with women alumni from ECE at UMD.

For details about events and how to get involved, contact WECE's:
- President **Neha Joshi** (nehaj@umd.edu)
- Vice President **Nadee Seneviratne** (nadee@terpmail.umd.edu).

Mallik and Ferlic Win Dean's Doctoral and Master's Student Research Awards

Created by Clark School Dean Darryll Pines, the competition recognizes distinguished graduate student researchers in order to help propel their careers and demonstrate the value of high-quality engineering research. Student entries were judged by members of advisory boards in department-level and final college-level competitions.

Ayan Mallik (EE Ph.D. 2019) won the first place Doctoral Student Research Award for his project titled: "Regulated Transformer Rectifier Unit for More Electric Aircrafts." Mallik was advised by Associate Professor Alireza Khaligh (ECE/ISR).

ECE Master's student **Nathaniel Ferlic** won second place Master's Student Research Award for his project titled: Forward Scattering Meter for Visibility Measurements." Ferlic is advised by Professor Chris Davis (ECE). ■

University Medal Awarded to Jerome Quenum

Jerome Quenum (EE B.S. 2019) was awarded the University Medal at the University of Maryland's 2019 Spring Commencement Ceremony. This award recognizes the most outstanding graduate of the year. The University Medal is awarded to the undergraduate who best personifies academic distinction, extraordinary character, and extracurricular contributions to the University and the larger public. This award is the highest honor the University can bestow on a graduate.

Originally from Benin, West Africa, Quenum was accustomed to studying by lanterns or candlelight when the electricity would go out. But after he missed a final phone call from his dying father in 2004, due to network instability, he decided to dedicate his life to improving the electrical and telecommunication infrastructure that connects people.

In 2013, Quenum moved to the United States and earned an associate's degree in electrical engineering from Montgomery College, where he graduated top of his class before continuing his education at the University of Maryland, College Park. It wasn't easy, and he went through many hardships while navigating the process to become a U.S. citizen.

Now, Quenum is pursuing a doctorate in electrical engineering at the University of California, Berkeley. As a member of the Army Reserve Officers Training at Corps (ROTC), Quenum will also be commissioned as a second lieutenant. ■

Yuntao Liu Receives Wylie Dissertation Fellowship

Yuntao Liu, an ECE Ph.D. student advised by Professor Ankur Srivastava (ECE/ISR), has won an Ann G. Wylie Semester Dissertation Fellowship.

The Ann G. Wylie Dissertation Fellowship is part of the University of Maryland Graduate School's Semester Dissertation Fellowship program, providing support to UMD doctoral candidates who are in the latter stages of writing their dissertations. The Wylie is full-time fellowship; its benefits include a $15,000 stipend, a candidacy tuition award, and a credit for mandatory fees and reimbursement for the semester.

Liu's research focus is hardware security, especially the security of deep learning hardware. ◼

Student Spotlight: Shruti Das

Shruti Das, a Computer Engineering junior from New Jersey, is in the Engineering Honors Program and is a 2019 Yurie Scholar in Engineering.

This year, she looks forward to pursuing more research opportunities available to undergraduates within the ECE department. Outside of her studies and interests in the AR/VR space, Shruti is involved in volunteer work and student life. She was the Marketing Director for Bitcamp 2019 and is currently the Co-Executive Director for Technica 2019. As Technica turns five this year and she looks forward to upholding its status as the world's largest all-women and non-binary hackathon hosting nearly 1000 students on UMD's campus each year.

During her freshman year, she founded a PERIOD. chapter in College Park to advocate for women without access to proper menstrual hygiene products. She is also a member of the Society of Women Engineers at the University of Maryland and the Association for Women in Computing. Attending the Grace Hopper conference was one of her favorite memories, and she is a huge advocate for women in STEM. ◼

Klawson Presents ENEE 101's Computer Vision Module at ASEE FYEE

Electrical engineering senior Daniel Klawson presented his paper and presentation titled, "Work in Progress: An Introduction to Computer Vision for First-Year Electrical and Computer Engineering Students," at the 11th annual American Society for Engineering Education (ASEE) First-Year Engineering Experience (FYEE) Conference in State College, Pennsylvania this past July.

The work-in-progress paper details one of ENEE101's newest modules: computer vision. ENEE101 is the introductory ECE course at UMD. and provides first-year students with a glimpse into the broad field of ECE through high-level hands-on labs, with the goal of increasing student retention rates and boosting performance in sophomore-year courses. Preliminary results have shown an upward trend in major retention and a downward trend in failures.

Klawson and co-authors, master's students Nathaniel Ferlic and Cheng Peng, present students with three hands-on labs using the familiar Microsoft Kinect hardware along with open-source computer vision software libraries. Klawson, Ferlic, and Peng introduce labs that cover depth sensing, hand tracking, facial recognition, and body detection. Each topic covers a single day of lab where the students are taught the basics of each concept and complete a C++ template with simple but elegant solutions, built and executed with Microsoft Visual Studio. The goal is to expose students to complex computer vision topics through easily understandable, real-life scenarios to help students realize the impactful applications of computer vision. By achieving this goal, students are better prepared for careers as scientists and engineers.

ASEE's FYEE is an opportunity for academic and industry representatives to discuss and share relevant topics in the first year engineering experience. ◼

NEW UNDERGRADUATE PROGRAM:
EMBEDDED SYSTEMS & INTERNET OF THINGS

The Embedded Systems and Internet of Things (ESIOT) program based at the Universities at Shady Grove is a new and exciting program from the Department of Electrical & Computer Engineering at the University of Maryland starting in Fall 2020.

With the rapid pace of growth in Internet of Things (IoT) products and applications, there is a pressing need for engineers with special skills in hardware and software design. It is critical that these engineers are well-versed with both analog and digital electronics and information systems.

The new Bachelor of Science in Embedded Systems and Internet of Things offered at the Universities at Shady Grove was created to address this demand. The program trains future engineers who are cognizant of the latest trends in circuits and hardware-oriented software, and who are capable of immediate contribution to the private and public sector institutions in which they will work. It is the first of its kind in the U.S. from a top-tier university.

Situated on the beautiful Universities at Shady Grove campus in Rockville, Maryland, students in the ESIOT program have a unique opportunity to experience small class sizes and individualized attention, while maintaining access to prestigious ECE faculty and resources from the A. James Clark School of Engineering at the University of Maryland, College Park.

ESIOT Admissions Information

The ESIOT major will be a transfer program, suited for students who have completed an associate's degree from a Maryland public community college. As an A. James Clark School of Engineering program, students must meet the Engineering LEP admissions requirements to be admitted to the program. The Embedded System major will follow a cohort course format, with a pre-set class schedule; the first cohort of students will be admitted for the Fall 2020 semester. ■
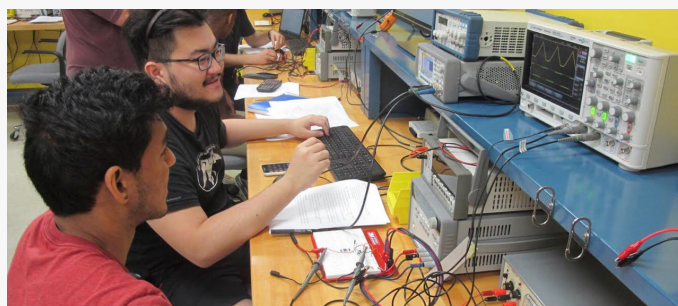
ACADEMY OF MACHINE LEARNING

About the Academy of Machine Learning
Machine learning combines probability and statistics, large data analytics, optimization techniques, and computer algorithms. The Academy of ML program is designed to provide a concentration of courses around these topics and incorporate a real-world design experience.   The program is open to all University students that meet the admissions requirements.

Program Requirements & Courses
The program will have 12-13 credits of required coursework. Prior to enrolling in the program, students will need to complete three citation admissions requirements.

Application Process
Students interested in applying to the program must have completed at least 60 semester credits, satisfied all course/grade requirements, and have a minimum grade point average of 3.2 at UMD for admissions consideration. The program will review applications holistically and will be looking for applicants with a strong academic performance. The program will accept applications for both fall and spring semesters.

Applying to the Program
The application for the Academy of Machine Learning will be open to apply for the Spring 2020 semester at the end of the Fall semester. For more information, visit our website: ece.umd.edu or contact: eceadvise@umd.edu.

GRADUATE PROGRAMS:

THE SCIENCE ACADEMY
Master of Professional Studies in Machine Learning

The Electrical and Computer Engineering (ECE) and the Computer Science (CS) Departments at the University of Maryland, College Park are launching a new Master of Professional Studies (MPS) in Machine Learning. This program will offer students the opportunity to engage in cutting-edge technical course work in machine learning and develop their problem-solving skills in the art and science of processing and extracting information from data. During their coursework, students will build solid foundations in mathematics, statistics, and computer programming, and explore advanced topics in machine learning such as deep learning, optimization, big-data analysis, and signal/image understanding. Students will also learn about applications of machine learning to computer vision, natural language processing, robotics, communications, data science, and other areas, and will have extensive hands-on experiences via projects and real-life examples.

The MPS in Machine Learning is a 30-credit, 10-course, non-thesis graduate program that will be run on 12-week-long terms. Students taking two courses per term will be able to finish the program in five terms, that is, about a year and a half. Classes will meet once a week per course in the evening hours fitting the schedules of working professionals.

Fall Term begins August 31, 2020. The registration deadline for international students is March 13, 2020. Domestic students should apply by July 1, 2020 for best consideration. The registration deadline for domestic students is July 31, 2020.

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A New Space for Networking:
The Juniper Networks Laboratory

The state-of-the-art lab will enable hands-on research and will offer undergraduate courses in networking and network virtualization, as well as revamp Master's in Telecommunications courses.

Students, faculty, and staff at the University of Maryland have a new addition to the A.V. Williams Building of the A. James Clark School of Engineering—The Juniper Networks Laboratory.

An official ribbon-cutting ceremony was held on September 25, 2019 to celebrate the completion of the lab, thanks to a generous gift and a growing partnership with Juniper Networks, one of the leading networking companies headquartered in Sunnyvale, California.

The lab will support both undergraduate and graduate programs in the Department of Electrical and Computer Engineering (ECE). Course topics will incorporate networking, including virtualization and design, and machine learning. Courses taught in the lab will be senior-level capstone design courses in ECE's undergraduate program and several classes within ECE's Master's in Telecommunications (ENTS) Program.

The 1,000-square-foot lab is designed for students and faculty members to be able to build, configure, and test computer networks using Juniper networking devices. It features 84 EX access switches, 56 SRX-240 routers/security devices, 30 MX5 routers and five servers. The lab houses its own networking environment, which is isolated from UMD's production network. This arrangement allows students to experiment safely and freely without affecting the network operations in the outside world. Using this new infrastructure, students will be able to gain hands-on experience interacting with the Junos operating system and learn how to configure and test various routing protocols, virtual LANs, firewalls, and routing policies. Advanced courses will provide rich opportunities to explore state-of-the-art topics such as software-defined networking, network automation, and network virtualization.

The investment from Juniper included funds for the construction of the redesigned networking lab space, state-of-the-art Juniper equipment, and an endowment to secure maintenance for the lab into the future.

"The new lab will create an exceptional environment for our undergraduate and graduate students to learn and experiment with the latest technologies in network design and automation, network virtualization, data center operations and management, and big-data analytics," said Professor Joseph JaJa, chairman of the ECE Department. "It is a truly unique resource that will substantially enhance the learning experience of our students."

The ECE Department has a long and rich history with Juniper Networks. The ENTS Program has been a member of the Juniper Networks Academic Alliance since 2012, and Juniper Networks has made several donations of equipment to the program in years past. Juniper is also a top employer of ECE and ENTS graduates, interns, and alumni. ECE Ph.D. alumnus and Executive Vice President and Chief Technology Officer (CTO) of Juniper Networks, Bikash Koley, was instrumental in securing the donation for this lab.

"We are thrilled to partner with the University of Maryland to open The Juniper Networks Laboratory," Koley said. "Networking in the cloud era requires highly skilled people, and yet a pressing shortage of skilled technologists is likely to increase in the next few years. IDC believes that this skills shortage continues to inhibit many enterprises from successfully adopting and deploying transformative network technologies. It is our responsibility to prepare the next generation of technologists, and this lab is one tangible way we are investing in the future."

As CTO, Koley steers Juniper's technology strategy and leads and executes the company's critical technology innovations. He is an industry-leading expert in software-defined networking (SDN), intent-driven networking, packet-optical integration, warehouse-scale computing, and large-scale data center interconnection.

Koley joined Juniper from Google in 2017, where he was a Distinguished Engineer and the Head of Network Architecture, Engineering and Planning.

PHOTO: JUNIPER NETWORKS

Prior to Google, Koley was the CTO of Qstreams Networks, a company he co-founded. He also spent several years at Ciena Corporation in various technical roles developing DWDM and Ethernet technologies. Koley received his M.S. and Ph.D. degrees from the University of Maryland in 1997 and 2000, respectively. In fall 2019, Koley will become a member of the Clark School's Board of Visitors, the lay-leader governing body of the A. James Clark School of Engineering.

Following the ceremony, a roundtable discussion was held on "Skilling for the Future." The discussion focused on the increase in university and government investment in STEM-focused education as more in-demand jobs open in STEM fields. Panelists included JaJa and Koley, as well as Leidos Civil Group CTO and UMD alumnus Tony Gehr, Davina Pruitt-Mentle, Head of the National Initiative for Cybersecurity Education, and Jeanita Pritchett, Academic Program Manager of the International and Academic Affairs Office, both from the National Institute of Standards and Technology (NIST). The panelists explored areas on STEM jobs vs. public service jobs, the future of programming, and how to prepare. ■

PHOTO: STEPHANIE CORDLE
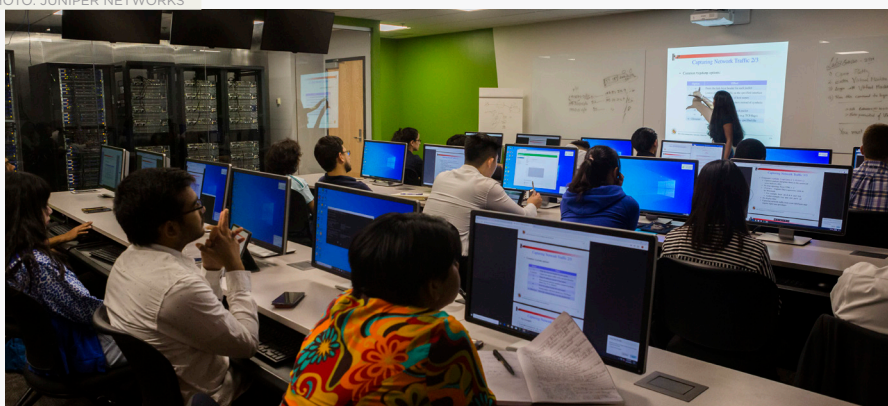
Six-Years Strong: Appian's Partnership with ECE

The partnerships between ECE and its corporate affiliates have long been beneficial to both sides. Appian Corporation is one such company. Based in Tysons Corner, Virginia, Appian is a cloud computing company that provides applications to organizations that improve customer experience, allowing companies to achieve operational excellence.

Appian has a solid history of recruiting and hiring ECE graduates and interns. Its campus recruiting program was developed in 2013 by Courtney Connolly (a UMD grad) with their University Talent Acquisition team. UMD was one of six inaugural schools chosen for talent recruitment by two of Appian's founders, Michael Beckley (CTO) and Matt Caulkins (CEO). Since then,

Appian has hired a large number of UMD alumni from multiple disciplines. Appian is also actively involved in hiring students for internships. The internship program is run by Vanesa Perez, who says she has been "thrilled with the UMD interns we received this past year," and she looks forward to "participating in career fairs, delivering tech talks, and partnering with student groups."

In addition, Omesh Agam, Chief Information Security Officer for Appian, is a member of the ECE Advisory Board. He is responsible for Appian's global information security and trust programs and oversees its compliance programs. With more than 15 years of experience in the technology and information security fields, his knowledge contributes to the Advisory Board's goal of maximizing potential for both the department and its students. ■

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ECE EXPRESSES SINCERE THANKS FOR THE FOLLOWING CORPORATE AFFILIATES WHO WILL SUPPORT OUR STUDENTS AND RESEARCH IN 2019-2020:

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HUGHES	NORTHROP GRUMMAN	THALES
JLG	pragmatics	UltiSat

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To learn how you can make a charitable contribution and have a measurable impact on the future of the Electrical and Computer Engineering Department, or to explore other options, contact Amanda Stein, ECE Director of External Relations.
steina@umd.edu | 301-405-8189