The Ohio State University | Department of Electrical and Computer Engineering

BITS & SPARKS

ALUMNI MAGAZINE | FALL 2020

OHIO STATE ECE

PATHWAYS

TO COMMUNITY TRUST

OHIO STATE ECE PROGRAM ENTERS TOP 25 | CYBERSECURITY

MACHINE LEARNING | HEALTHCARE

EE/ECE
Alumni Society

NOTE FROM THE EE/ECE ALUMNI SOCIETY PRESIDENT **ZIA MOHAMMED**

Time and change will surely show. How firm thy friendship ... OHIO

The ab ve quote from Carmen Ohio holds true even in these times. The past ear has been unprecedented with the ongoing COVID-19 pandemic, but our community has persevered. I'd like to express my gratitude for how the university has been able to provide resources for alumni, staff, and students to stay linked during these times.

Given the quarantine and social distancing measures, the desire to be connected during these times is difficult. To help bridge this gap and keep our alumni together, our ECE Alumni Society accelerated our digital shift. This hift not on y allowed us to continue holding events through Zoom, but opened up our events to alumni around the world. In early October, we held a virtual panel discussion with viewers from over three time zones! The panel fo used on how students, faculty, and staff are adjusting in the COVID-19 era. A replay of the panel can be found on our Ohio State ECE department Youtube channel.

Additionally, in October, we elected three new board members. It is my pleasure to welcome **Grace Crumrine**, **Kim Concillado**, and **Mary Berkley** to our Alumni Society Board. With the addition of new members and the staffing of new committees, we look forward to planning more virtual events and panels.

INTERESTED IN GETTING INVOLVED AT THE LOCAL LEVEL AND MAKING A DIFFERENCE?
Our committees are always looking for fresh faces to get involved and help lead events. Simply open your camera and scan the QR Code to the right.

https://ece.alumni.osu.edu/membership/

SCAN ME

Keep up to date on Ohio State ECE news and accomplishments by subscribing to our ECE Weekly newsletter at:
http://ece.osu.edu/ece-weekly-newsletter

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BITS & SPARKS FALL 2020

David D. Williams
Dean, College of Engineering

Kristina M. Johnson
University President

Hesham El Gamal
ECE Department Chair

Kathleen Coen
ECE Development Offic

Ryan Horns
ECE/IMR Communications Specialist

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Design and Layout

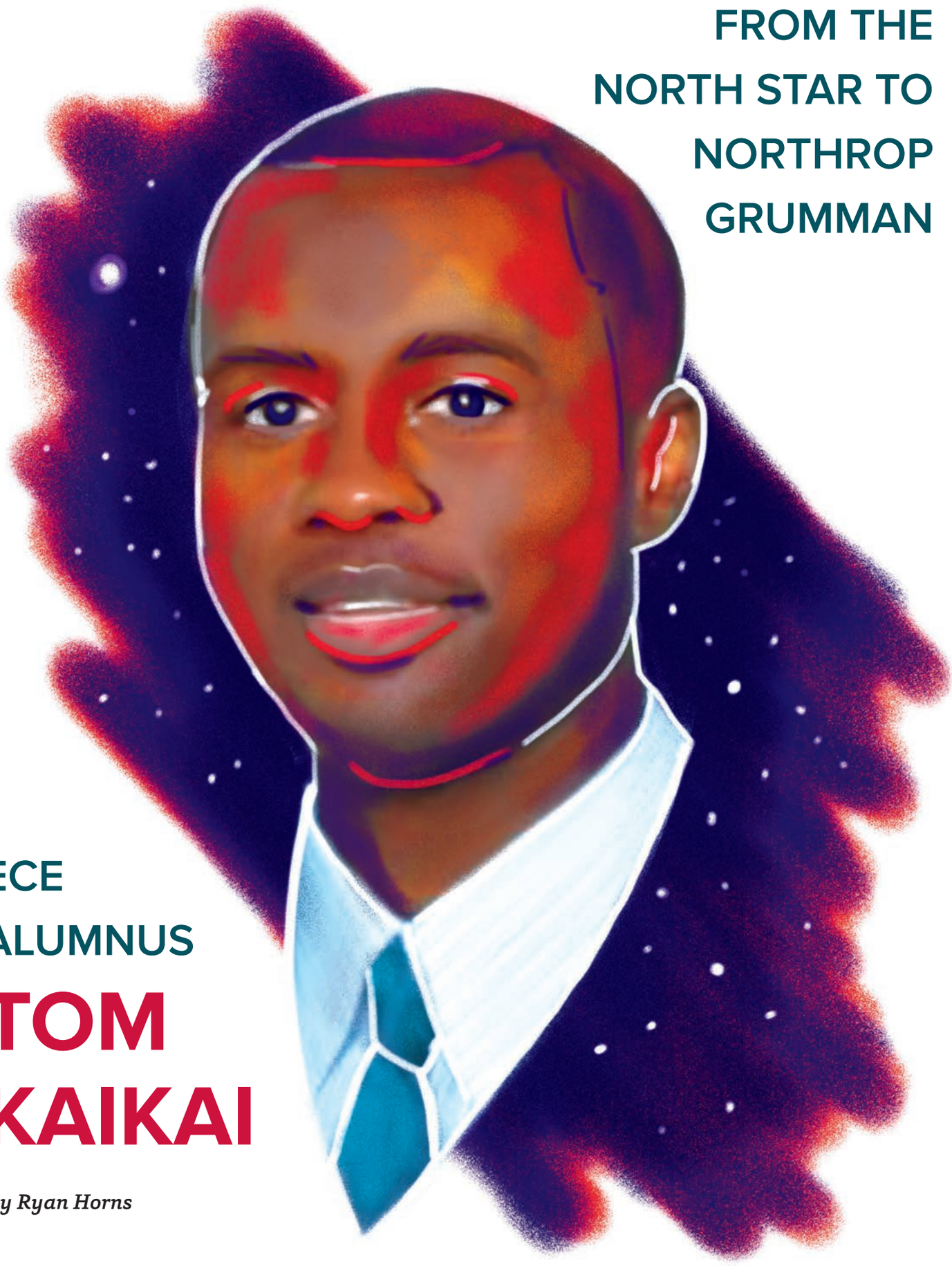
ALUMNI

"I FEEL LIKE IT'S A GUIDED LEARNING EXPERIENCE, THAT WILL SHAPE HOW MUCH YOU GET OUT OF IT."

ECE GRAD STUDENT
AND ENTREPRENUER,
RAMY TANTAWY

RAMY TANTAWY

FROM THE NORTH STAR TO NORTHROP GRUMMAN



ECE ALUMNUS

TOM KAIKAI

By Ryan Horns

KAIKAI'S CHILDHOOD HOME.

In Sierra Leone, a father sat and quizzed his son each night under the West African stars. He asked questions about life, questions about the world around them.

"Hey, what is that star next to the moon?" the father said.

As the boy answering those questions, Ohio State University Electrical and Computer Engineering alumnus **Tom Kaikai** learned the importance of education very early on.

The e was an understanding in his family. If education is the gateway to success, his parents made sure he and his siblings had the keys to open it.

It was also understood that his job was to use the resources they provided to the fullest extent.

"I have to attribute and give a lot of credence to my mom and dad for really accentuating the importance of education very early on in my life," Kaikai said. "In fact, there was a running joke around the house, if any one of us were not at the top of our classes, we essentially failed for that entire year. Second place was not an option given all the resources they provided. We absolutely had to be the top of our class."

Today, Kaikai lives in Maryland and is a Chief Engineer at Northrop Grumman Systems.

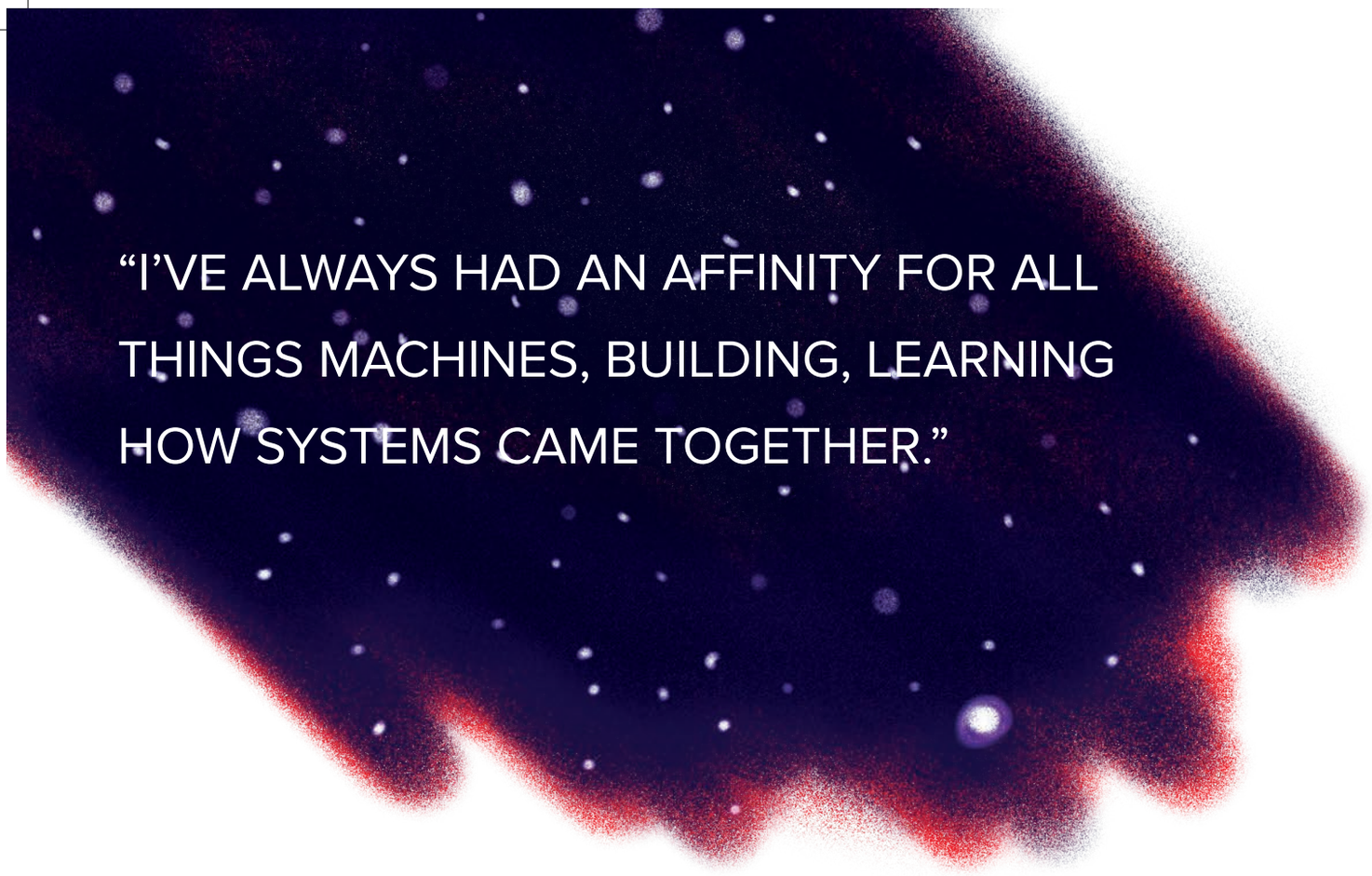
He said an innate curiosity ultimately led to his future in science and engineering.

"My dad was a lawyer. He and I used to have these quiz sessions. We would sit down, rather causally, and he would ask me random questions, about very general things," Kaikai said. "He told me about the Northern Star and how it was used for navigation in place of compasses back in the day. Even though he was a lawyer, those quiz sessions with him really peaked my interest in Science. I would take those moments with him and go to school the next day and brag about the new knowledge I had learned. So, I would share that knowledge and I was the smart kid in the class."

He said a big children's pastime was building little cars out of scraps and wires they could fin .

"In all of Africa, kids built these wire cars," he said. "Not everyone could affo d toy cars to play with. I was very good at that. I had kids come to me to help build them wire cars."

His reputation led to his involvement in African Child's Day. Each summer, the Sierra Leone government goes to diffe ent schools and selects some of the top students to participate as top official



“Basically, the kids run the country for the day,” Kaikai said. “I was fortunate enough one year where I was chosen to participate. We got quizzed, and coincidentally, one of the questions was ‘What’s the star closest to the Moon?’ Of course, I answered it and I was offe ed this really fancy job of being a bank manager.”

Kaikai laughed and said he actually turned them down, instead asking if he could drive the bulldozer at a construction site.

“That interested me – machines. I thought that was a lot cooler than sitting at a desk. This was all by the time I was 10 years old,” he said. “I’ve always had an affinity for all things machines, building, learning how systems came together.”

Th oughout the 1990s, the United States saw an increase in immigration from Sierra Leone, as families sought opportunities for their children to escape poverty and mass wartime atrocities associated with the ongoing civil war, which lasted from 1991 to 2002. By the end, more than 50,000 people had died and war crimes against the people spawned movies and documentaries, such as "Blood Diamond," "Cry Freetown," and "Ezra."

At the age of 14, Kaikai moved away from Sierra Leone to live with his uncle in New York City and fini h high school. His curiosity for knowledge continued in America.

“My uncle had a computer that we weren’t allowed to touch," he said. "I would take the processing unit and unscrew it and take it apart to see what was inside there and what made the graphics show up on the screen. I got in trouble a few times, but I learned a lot from that."

Much like building wire cars for friends, Kaikai quickly became the go-to guy for fixi g computers. This academic interest led him to City College in New York and later to The Ohio S ate University to pursue his education in ECE.

“The one great thing I really appreciated about Ohio State ECE, was within one program you had several different paths,” he said. “I ended up focusing on more of the high voltage power side of things. The program is great the way it’s set up and really prepares anyone for success who is going through it.”

After graduating from Ohio State, Kaikai was hired on at Northrop Grumman, where he started out as an RF engineer.

“I’ve been fortunate enough to not only excel in that, I now work as a Chief Engineer providing technical guidance to some of the smartest people in the world,” he said. “We come up with complex systems that are helping solve a whole lot of issues around the world."

At Northrop Grumman, the path is always leading toward the future of technology and engineering.

“We’re getting to a point where systems are going to have to be more adaptable. It’s going to require a lot of research into device packaging. I think that is where the future really lies," Kaikai said. "We’re in the middle of the fourth industrial revolution. In the future, AI and Internet of Thi gs are

really going to need to merge and be integrated in all systems. Driving your car, for example, it will be able to tell the diffe ence between a wall versus a person. That requires a ton of data processing and image processing, which gets into machine learning, deep learning and neural nets. All of this will require very high bandwidth and fast systems."

Kaikai's advice for student success at Ohio State ECE? Work hard.

"It's not the easiest program to get into. Although once you get in, engage yourself. Really embed yourself within the department," he said. "I got to know the professors. I got to know the administrators, as well as participated in the student organizations and IEEE."

Kaikai said ECE advisors and Professors like **Paul Berger** and **Betty Lise Anderson** guided him beyond the classroom, and Professor **Jin Wang** especially saw his potential.

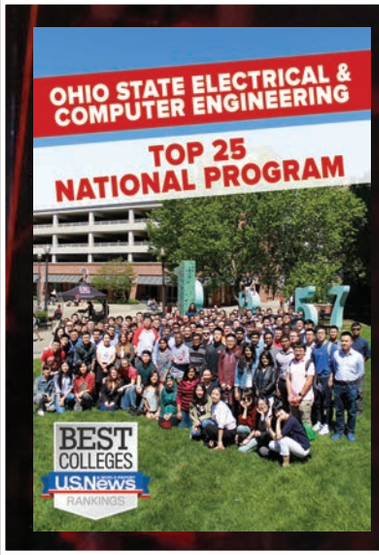
"I took a class with him and he very quickly believed in my abilities and gave me an opportunity to do graduate research with his students. I was very fortunate to be the only undergraduate student in his group," he said. "Working with some of the smarter folks, who were more experienced, I got to learn a lot, and to this day I owe a lot of my successes to him." ■

"THE ONE GREAT THING I REALLY APPRECIATED ABOUT OHIO STATE ECE, WAS WITHIN ONE PROGRAM YOU HAD SEVERAL DIFFERENT PATHS."

📷 TOP: THE NORTH STAR
BOTTOM: A SCENE FROM SIERRA LEONE

OHIO STATE ECE

TOP 25 NATIONAL PROGRAM



The Ohio State Electrical and Computer Engineering (ECE) program official entered Top 25 status nationwide, according to new collegiate rankings.

In the 2021 U.S. News and World Report, the Ohio State ECE program earned a positive boost in rankings.

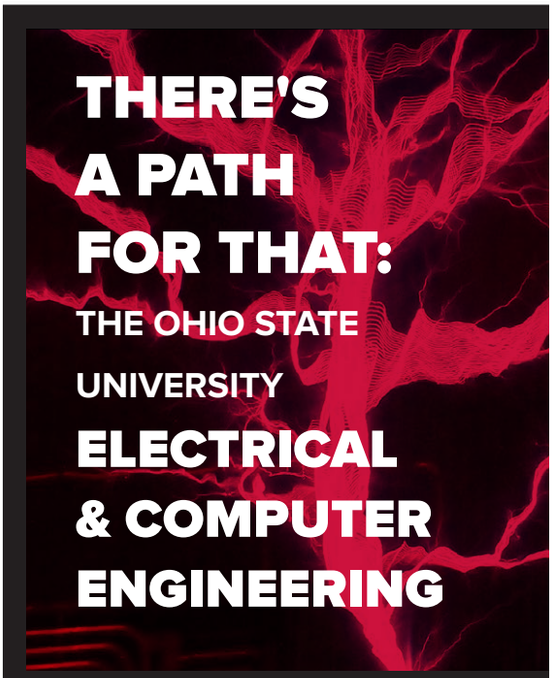
In the Best Undergraduate Engineering Schools rankings, Ohio State ECE earned a three-point jump from 27 to 24. The graduate program also saw an eight-point jump in ranking.

ECE Department Chair and Professor **Hesham El Gamal** said the national rankings are beginning to reflect more of what many faculty have known for years. Ohio State remains under ranked.

"A top 10 status is consistent with our quality," El Gamal said. "With our graduate ranking going up from 30 to 22, we can now proudly claim to be a holistic top 25 academic program."

Internationally, the Shanghai Ranking's Global Listing of Academic Subjects for 2020, placed Ohio State ECE at 21 (score: 200.3) within the United States and 32 worldwide among similar programs.

The Academic Ranking of World Universities is a quantitative listing, rather than peer assessment conducted in the US News and World Report. ARWU bases rankings on the number of alumni and staff winning Nobel Prizes and Fields Medals, number of highly cited researchers selected by Clarivate Analytics, number of articles published in journals of Nature and Science, number of articles indexed in Science Citation Index - Expanded and Social Sciences Citation Index, and per capita performance of a university. More than 1800 universities are ranked by ARWU every year and the best 1000 are published.



What is ECE? Learn more about what Ohio State offers in undergrad - ate and graduate programs.

https://go.osu.edu/osu-ece-vid

A BUCKEYE LEGACY: AN ALUMNI JOURNEY FROM DREAMS TO FRUITION.

In 1988, the author **David Macaulay** released the book, "The Way Thi gs Work," offeri g children and young adults a playful explanation of how complex machines work – as operated by wooly mammoths.

To this day, the book sits on the shelf of Ohio State University alumna **Kathryn Jablokow** as a reminder of an early fascination with technology that led to her lifelong pursuit of knowledge and mentorship.

"The book fascinated me. It included a wide variety of examples, from computers to gear systems to musical instruments to nuclear power," Jablokow said. "I've always been intrigued by how things work. Even as a child, I loved to solve math problems and learn about scientifi discoveries."

A professor of engineering design and mechanical engineering at Penn State University for many years, Jablokow just began another chapter in her life – a two-year term as director for the National Science Foundation's Engineering Design and Systems Engineering program in the Division of Civil, Mechanical and Manufacturing Innovation.

At NSF, Jablokow now finds herself at the center of engineering innovation in the United States. She is making recommendations about which proposals to fund; influenci g new directions in the fields of science, engineering, and education; supporting cutting-edge interdisciplinary research; and mentoring junior researchers.

However, her family story begins at Ohio State.

"We're an entire family of Buckeyes," Jablokow said.

Not only did she and her two older brothers graduate from Ohio State, her parents were Buckeyes as well.

Her father, Ohio State Professor **Herman Weed**, taught electrical engineering for 50 years at Ohio State, and her mother, **Sylvia Weed**, taught German in a local private school and still calls Columbus home.

"As a family, we talked about new ideas all the time, and that just continued to feed my curiosity as a problem solver," Jablokow said. "From the time I was two years old, my parents took me on many international trips. We lived in India, Egypt, and Germany for months at a time, and we visited more countries than I can count. Those experiences influen ed my views of the world and opened my eyes to the wonderful diversity of humanity and culture."

DR. KATHRYN JABLOKOW

"I WANT TO ENCOURAGE BOLD IDEAS THAT WILL TRANSFORM ENGINEERING, WHETHER IT'S THROUGH DIGGING DEEPER OR BREAKING BOUNDARIES — OR BOTH."

Professor Weed not only pioneered the biomedical engineering program at Ohio State, he traveled the world setting up similar programs through Project Hope.

"He was the Johnny Appleseed of biomedical engineering, and he passed it around the world," said **Cynthia Roberts**, Ohio State professor of BME.

Jablokow said she couldn't imagine a better job than teaching.

"Growing up, I didn't just want to be an engineer: I wanted to be an engineering professor," she said.

Jablokow ultimately earned her bachelor's, master's and doctoral degrees in electrical engineering in 1983, 1985 and 1989, respectively.

"Earning my degrees at Ohio State gave me confiden e that I had a strong engineering foundation and top-notch research skills," she said.

Looking back, two professors also helped pave the way toward her future: **David Orin** and **Robert Fenton.** Orin was her M.S. and Ph.D. advisor.

Jablokow told IEEE Spectrum how her time at Ohio State actually infl - enced her later shift toward the cognitive side of engineering.

"I was helping design walking machines at Ohio State that were big enough to carry humans as well as cargo," she said. "Along the way, I realized I had an even greater interest in the cognitive side of engineering design, from the perspective of both machines and engineering systems."

She went on to complete her Postdoctoral studies at RWTH Aachen University in West Germany, with the fall of the Berlin Wall as the cultural backdrop.

In 1990, Jablokow then joined the faculty of Pennsylvania State University and began collaborating with researchers investigating design cognition, which includes the application of cognitive psychology to help understand how engineers think and behave while they design and develop products and systems. She has been working in that area ever since.

Now as an NSF Program Director, Jablokow is helping to determine where the fields of engineering design and systems engineering go next in terms of research.

"I want to encourage bold ideas that will transform engineering, whether it's through digging deeper or breaking boundaries - or both," she said. "I'm very excited about the opportunity to have that kind of national impact and to mentor young investigators toward success, just as others did for me."

Her advice to new engineering students at Ohio State ECE? Be strategically reflect ve.

"Think about your own thinking; figu e out where you excel and what challenges you face," she said.

Jablokow encourages students to ask for help if they need it, to stay focused on their goals, and take time for themselves so their health remains at the forefront.

"Dr. Jablokow brings a wealth of research expertise and credibility in engineering design and complex systems to this position," said **Robert B. Stone**, division director, NSF Division of Civil, Mechanical and Manufacturing Innovation. "NSF thrives on the ability to tap top researchers from our nation's universities to come in and guide our research programs, keep them current and creatively shake them up a bit every now and then for the better. I know Dr. Jablokow can do all three of those things."

The NSF Engineering Design and Systems Engineering program supports fundamental research in design science and systems science, encompassing the problems, people, processes, products and environments of engineering design and systems engineering.

Jablokow is currently a professor of engineering design and mechanical engineering. She served as associate chief academic officer of Penn State Great Valley from 2017-2020.

Her research includes cognition-based design, ideation fl xibility, engineering innovation and high-performance design teams. Her teaching focuses on problem solving, creativity and invention, and she is a co-creator of a massive open online course (through Coursera) on creativity, innovation and change that has served 300,000 students since 2013.

Jablokow received the American Society of Mechanical Engineer's Ruth and Joel Spira Outstanding Design Educator Award in 2016. She is an ASME Fellow, a senior member of the IEEE, and a member of the American Society for Engineering Education. She is also a life member of Phi Kappa Phi and a member of Sigma Xi. ■

SYLVIA AND HERMAN WEED

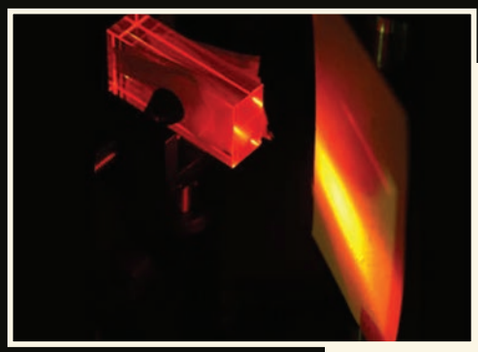
RESEARCH

"The vision of the Ohio State ECE Department is to be an exemplar of wellness, where our diverse students, sta , and faculty achieve creative excellence in a joyful, healthy, and inclusive environment."

– ECE CHAIR AND PROFESSOR
HESHAM EL GAMAL

ECE CHAIR AND PROFESSOR **HESHAM EL GAMAL**

THROUGH THE LIGHT



When **Enam Chowdhury** thinks of the universe, he sees an intense connection between our eyes and the light through which we perceive the universe.

A multi-disciplinary assistant professor of Electrical and Computer Engineering, Physics and Materials Science Engineering, Chowdhury just earned a boost in research funding to help explore this connection between light and perception.

His team of engineers and physicists earned a $1.056 million grant from the Air Force Offi e of Scientific Research for the proposal, “Femtosecond laser induced damage in extremes: from single cycle to atomic resolution.” The four-year project commences in autumn 2020.

The team will investigate how materials excited by intense laser fields behave on time scales as short as 1 femtosecond (1/1000 of a trillionth of a second) and on spatial scales as small as an atom using next generation, near-single-cycle-pulses and various other laser sources and ultrafast scanning tunneling microscopes (STM). High-performance computing will utilize new algorithms developed by Ohio State's Femto-Solid Laboratory to predict and explain the experimental results.

Chowdhury joined Ohio State in 2004 as a postdoctoral researcher in Physics. In 2006, as a Senior Research Associate, he was given the responsibility to develop a unique petawatt class laser (1000 terawatt) at Ohio State. In 2012, he and his team completed the construction of the 400 TW SCARLET laser system, which was one of the founding members of Department of Energy sponsored LaserNetUS laboratories. This was the fi st university-built dual CPA (Chirped Pulse Amplification) Ti:Sapphire petawatt class laser in the world.

Chowdhury’s journey into academics began as a child in Bangladesh, where his passion for science fi st developed through play-experimenting, reading and imagination.

“During my school years in Bangladesh, three books were key to my interest in science and technology,” he said, “a biography of the Wright Brothers, ‘One Two Th ee...Infini y’ by **George Gamow**, who discovered how elements formed after the Big Bang, and explained how scientific research opens the unique beauties in nature to our eyes, and **Stephen Hawking**'s ‘A Brief History of Time.’ My participation of yearly science competitions were also a big motivating factor, where I learned that experiments are fun. My science teachers at school played a very active role as well.”

Later, as a university scholar, Chowdhury learned how developing multi-disciplinary talents can provide even further insight.

“Eyes are the windows to the soul, and as humans, we experience the universe by seeing the universe, which means the universe connects to us, arguably the most intense way, through light,” he said. “My field studies how very intense light interacts with matter or materials, and how changes happen within a thousandth of a trillionth of a second."

He said the field has wide ranging ramifi ations on the fundamental understanding of the universe as well as numerous other applications.

“For example, we still do not know very accurately how extreme materials at the core of the sun interact with light from that region, and my sub-field of research on high energy density materials helps understand the sun better,” Chowdhury said.

On the applications side, he said, extreme light materials interaction ushers in new high energy table top particle accelerators, nuclear fusion energy, novel particle sources for materials

ABOVE: RESEARCH IMAGE OF A LASER

CHOWDHURY EARNS $1.05M GRANT TO STUDY MATERIALS IN EXTREMES

research, national security and radiation damage.

"On the optoelectronic side, my research impacts testing, and fabricating new materials via intense-laser materials interaction, functional and dynamic meta-surfaces for photonics applications, and future petahertz electronic devices," he said. "This fundamental research on extreme laser material modifi ation and damage can be highly controlled when ultra-short time duration laser pulses are used. Such research has had a large impact on society by advancing material processing, modifi ation, surface engineering, opto-electronics and photonics, measurement, manufacturing and surgery."

Members of the Ohio State team include Professors **Douglass Schumacher** and **Jay Gupta** from Physics and **Alok Sutradhar** from Mechanical and Aerospace Engineering.

For students interested in pursuing this field of research, the focus of the team includes femtosecond laser induced damage fundamentals and applications, probing laser damage with atomic spatial and femtosecond temporal resolution, high energy density conditions, non-equilibrium metastable phases; Non-perturbative laser interaction with solids, harmonic generation, dynamic meta-photonics; Ultra-intense laser materials interaction, relativistic interactions, particle acceleration and novel NDE source generation for material investigation. ■

Story by Ryan Horns | ECE/IMR Communications Specialist | Horns.1@osu.edu | @OhioStateECE

📷 ENAM CHOWDHURY

NSF Awards $1.1 Million Project to Track the American Obesity Crisis Through Wearable Skin Sensors

By Ryan Horns

Statistically, over the past 20 years, Americans are becoming increasingly more obese. This national public health crisis is causing a continued proclivity toward early death and disease.

A collaborative team of researchers, including Ohio State University Electrical and Computer Engineering Assistant Professor **Asimina Kiourti**, have an idea to trace obesity rates through the skin. Their research proposal just won a four-year, $1.1 million grant from the National Science Foundation's Smart and Connected Health program to develop wearable skin sensors to monitor metabolism and weight management.

According to the Centers for Disease Control and Prevention, from 1999 through 2018, the prevalence of obesity in the United States increased from 30.5 percent to 42.4 percent, and the prevalence of severe obesity increased from 4.7 percent to 9.2 percent. Obesity-related health risks include heart disease, stroke, type 2 diabetes and certain types of cancer, which are leading causes of preventable, premature death.

Bodies release a small amount of volatile organic compounds (VOCs) through the skin, including acetone, which is known to correlate with metabolic rates and fat burning.

The research initiative, which Kiourti co-leads with Ohio State University Materials Science Professor **Perena Gouma** and Mechanical and Aerospace Professor **Manoj Srinivasan**, aims to apply novel engineering approaches to continuously monitor acetone levels. Rutgers University Materials Science Professor **Lisa Klein** is also a key part of the team.

In this project for NSF, their wearable sensor technology will be easy to use, noninvasive (no microneedles) and is not dependent on sweat. From a Materials Science Engineering perspective, Gouma developed a sensing material (chemo-actuator) that deforms when exposed to acetone: the stronger the acetone concentration, the more pronounced the deformation.

Kiourti said she began working with Gouma on the project in 2018, utilizing her team's ECE focus on identifying a way to convert these mechanical/shape deformations into electrical signals.

"By doing so, we envisioned a new device that would use skin-released acetone as a biomarker to monitor fat metabolism," Kiourti said. "My group's effo ts demonstrated that even the most fl xible strain sensors available in the market and in the published literature were unsuitably rigid and impeded motion of the chemo-actuator when embedded upon its surface."

Th y brainstormed a unique solution to monitor its deformation in a seamless way.

"Our proposed idea is an electromagnetic-based transducer that embeds conductive e-threads into the chemo-actuator: we have preliminary results demonstrating feasibility and will further advance the idea as part of this research," Kiourti said.

As the sensor deforms, the e-threads are designed to generate varying voltages; using the map of sensor deformation versus generated voltage. This ties voltages to sensed acetone levels. One PhD student in ECE will be tasked with further adding wireless capabilities to the sensor, powered by harvesting radio frequencies from the air. This voids the need for a bulky battery.

Gouma said all components of the wearable skin strip will be isolated from the environment via advanced water and gas-proof glassy materials. Human subject experiments will be performed to obtain an accurate dynamical relationship between acetone and fat metabolism, and for calibrat-

ASIMINA KIOURTI

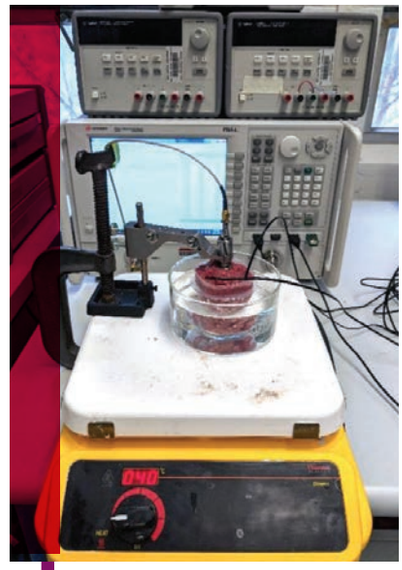
ing and testing the wearable technology. Th project also includes a social networking component to process skin acetone measurements from individuals in a group and provide useful feedback on behavioral modifi ations.

"Our objective is to transform health and medical practices through noninvasive, personalized, affo dable and continuous diagnostics," she said, "allowing users to monitor their fat metabolism and control their weight loss, and share their results through smart connected networks, thereby helping manage obesity or metabolic disorders."

The goal of the federal interagency Smart and Connected Health program is to accelerate the development and integration of innovative computer and information science and engineering approaches to support the transformation of health and medicine. Approaches that partner technology-based solutions with biomedical and biobehavioral research are supported by multiple agencies of the federal government including the National Science Foundation and the National Institutes of Health. ■

To learn more about how ECE students and faculty are teaming up with health and medical scientists, head over to http://ece.osu.edu

From Arctic Ice To The Hospital Room, Ohio State Radiometry Research Earns NIH Grant



The same technology The Ohio State University used to measure Arctic ice temperatures from space, could help doctors maintain more accurate patient temperatures during lifesaving surgeries.

Electrical and Computer Engineering (ECE) Assistant Professor **Asimina Kiourti** and Research Scientist **Alexandra Bringer** recently earned a $145,000 grant from the National Institutes of Health for their proposal, "Non-Invasive Wideband Radiometer for Accurate Core Temperature Monitoring."

Kiourti said the two-year research effo t began in July.

The Ohio State team also consults with Wexner Medical Center Cardiovascular and Tho acic Anesthesiologist **Hamdy Awad,** an associate professor of anesthesiology.

"This technology eventually will save lives in the operating room," he said.

Incidents of hypothermia affect 50- to 90-percent of surgical patients, which can increase the likelihood of cardiac arrest, blood loss leading to transfusions, and infection.

Radiometry has previously proven beneficial to studying climate science from space and Arctic ice floe act vity.

Kiourti said the same technology should be applied to medical research as well.

"We have pioneered biomimetic antennas with unprecedented bandwidth and transmission efficie y. We have also successfully employed ultra-wideband radiometry to accurately infer the temperature of layered ice sheets – these models have never been attempted for medical radiomtry," the research abstract states.

Maintaining a patient's proper core temperature while under anesthesia, especially in regards to burn or stroke patients, is important to prevent accidental hypothermic death. In other cases, anesthesia may induce malignant hyperthermia; if not recognized and treated early, this condition can be fatal.

Currently, thermometers are either invasively attached inside the body, or are placed directly upon the skin. Neither method is ideal for maintaining patient safety or measurement accuracy while monitoring core temperatures.

With the NIH funding, Kiourti and team will apply their pioneering biomimetic antenna research to find out if a real-time, non-invasive, and accurate core temperature thermometer is possible.

"This study is signifi ant because it reveals previously nonexistent knowledge on wideband radiometer models/algorithms and antenna designs for non-invasive and accurate core temperature monitoring," the abstract states.

The team will soon begin developing the antenna designs and algorithms for the wideband radiometer for testing on phantom tissues (a combination of ground beef and fat, among other materials) mimicking layers of the human head.

Kiourti said the preliminary work laid out by Ohio State PhD students **Jack Blauert** and **Katrina Guido** is instrumental in this regard.

"We envision this radiometer to be a much-needed addition to the operating room," Kiourti said. "The expectation is to eventually link the device to other non-invasive monitors." ■

Story by Ryan Horns, ECE/IMR Communications Specialist | Horns.1@osu.edu | @OhioStateECE

Radiometry research photo.

INSTITUTE FOR CYBERSECURITY AND DIGITAL TRUST

LEADING TOWARD DATA SECURITY

From Apple and Google, to the entire City of New Orleans, the hacking hits just kept coming in 2019. One industry publication labeled ongoing national cybersecurity issues "a hot mess," while another ominously refered to 2020 as the "threatscape" that lay ahead.

What's the one bright spot in all of this for students at The Ohio State University? The career openings for data security graduates are unprecedented.

On Jan. 17, the Office of Research launched plans to embrace this opportunity with the new Institute for Cybersecurity and Digital Trust (ICDT). Co-led by Ohio State's Electrical and Computer Engineering (ECE) Chair and Professor **Hesham El Gamal** and Chief Information Security Officer **Helen Patton**, the goal is to organize the university's collective data security assets and team up with partners statewide.

Morley Stone, senior vice president for the Office of Research, gave the green light for the project. With more than 25 years of cross-disciplinary experience in research and development, he also previously served as chief technology officer at the Air Force Research Laboratory (AFRL) at Wright-Patterson Air Force Base in Dayton.

Th ee years ago, he said, AFRL had two people working in the cybersecurity realm. Today, there are more than 100, with 17 new job openings.

"Thats just a reflection of this insatiable need they have for graduates who have skills in this area," Stone said.

The reason is because the U.S. Department of Defense updated its Top 10 priorities for 2020, he said, and Cybersecurity came in at No. 2. The de-

mand for data security research proposals to fund is growing.

Don Boian, an accomplished technology leader and award-winning information security expert, is the Cybersecurity Outreach Director for Huntington Bank. He provided the national perspective.

"A couple months ago there were 504,000 open positions in cybersecurity at companies across the United States," he said. "In Ohio, there are 17,700 open positions, with 5,130 open positions in Columbus alone. The need ill only increase."

Boian said the cybersecurity and data protection world is rapidly evolving. The threats, the capabilities and Ohio State's collective need for talent and groundbreaking research must continue to evolve as well.

"Trust is at the core of cybersecurity, and the impact Ohio State can have in this area is immense," Boian said. "This is a huge initiative that we need to take on in order to secure our state."

Within its fi st year, the Office of Research reported, ICDT will create a strategic plan to work across departments and define strengths, then develop a cyber range at Ohio State for product development, testing, training, educational and outreach opportunities.

The university has defined over 40 faculty from five colleges researching various components of cybersecurity who will cooperate.

For his part, El Gamal admitted he is learning to collaborate more in order to help sculpt new related research and curriculum at Ohio State.

"I actually need to talk to political scientists and social psychologists? You really don't understand. Those people may not actually agree that linear algebra is the source of all knowledge," he joked.

El Gamal talked about the journey getting to know Ohio State's faculty and students involved in cybersecurity, and feels honored getting to learn about their collective work. Internationally-respected cybersecurity professor and information theorist, **Aylin Yener**, also joined the ECE department in 2020 as part of the university's goals.

Patton has worked in cybersecurity for decades, admitting it's not an easy line of work. Most Chief Information Security Officers last, on average, two years in their roles. She said every time a company is hacked the CISO gets the boot fi st.

"The reason I do security goes back to the mid-1990s," Patton said. "Y2K, the northeast power outages, 9/11, all those seminal moments we have as a culture around safety and security and trust. If I had to sum up why I do security, I would say 'vanilla ice cream.'"

Patton strives for dependability and reliability.

"I want to be able to park in the same spot every time I come to work. I want to have a boring, reliable, not noteworthy life. Cybersecurity issues stop me from doing that," she said.

In the financial sector, Patton said, the end game is pretty clear. At Ohio State, however, the security concerns run across the board.

"What's the crown jewels at Ohio State? Is it our patients? Is it our research data? Is it our plants, or our research labs? Is it our students? Is it our financial data?" Patton said. "What I have found over time is I can't solve this issue myself. I can't solve it as a practitioner. You can't solve it as a researcher. You can't solve it as a student. We need to come together to be able to do that."

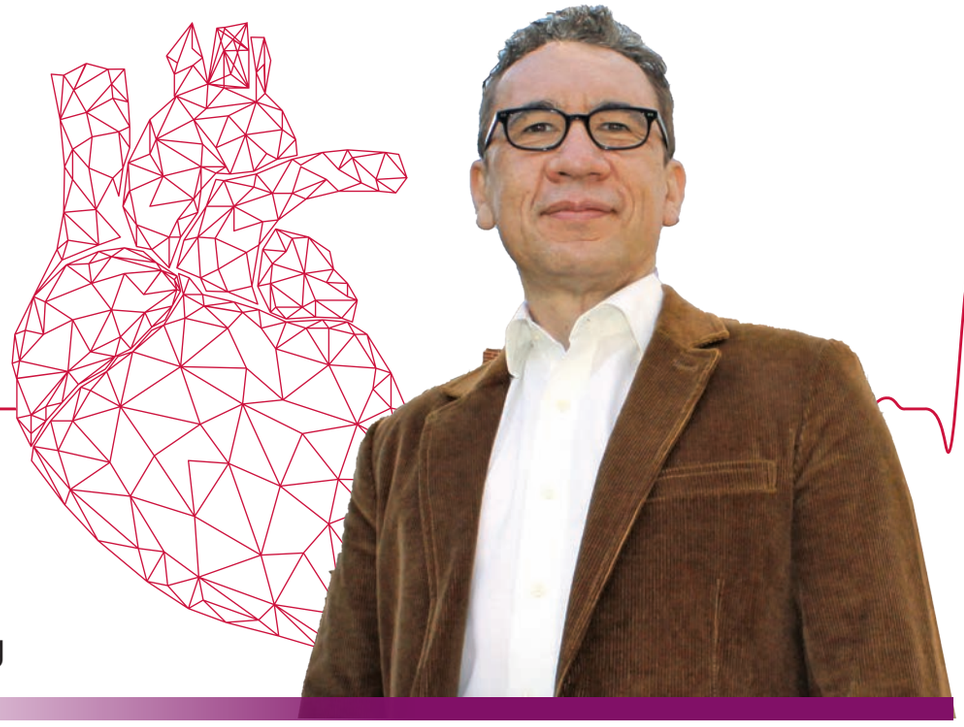
Patton also had a good-natured quip for her colleagues.

"If any faculty member sends me another email about how often I make you change your password, we'll have words," she said.

Story by Ryan Horns, Communications Specialist | Horns.1@osu.edu
@OhioStateECE

Watch Helen Patton and Hesham El Gamal discuss ICDT:
https://go.osu.edu/icdt-vid

NSF AWARD



SenSE program combines sensors and deep machine learning to treat heart failure

With the pandemic a rightful focus worldwide, it is important to know scientists and engineers remain diligent in the treatment of other life-threatening and costly issues.

Congestive heart failure affect nearly six million Americans, with 670,000 diagnosed annually. It remains one of the leading causes of hospital admission, re-admission and death in the United States and is one of the costliest disease syndromes to treat.

In this effo t, the National Science Foundation just awarded The Ohio State University a three-year $750,000 proposal to team leader and Electrical and Computer Engineering (ECE) Professor **Emre Ertin**.

The SenSE Program (Multimodal Sensor Systems for Precision Health Enabled by Data Harnessing, Artificial Intelligence, and Learning) team also includes co-investigators **Ping Zhang**, who shares joint appointments in Ohio State's Department of Biomedical Informatics (BMI), and the Department of Computer Science and Engineering (CSE), as well as **John Fisher**, a senior research scientist at MIT.

Ertin said Ohio State ECE postdoctoral researchers, **Siddharth Baskar** and **Nithin Sugavanam**, are also "key to the success of the program."

For NSF, the team outlines a new plan to combine sensors and deep machine learning to not only assess hospitalization risks for congestive heart failure patients, but also factor in patient data from multitude of sources, including Electronic Health Records, to provide a more precise medical regimen.

"In this project, we will pursue proactive approaches to healthcare, supported by innovations in noninvasive multimodal sensor systems, paired with interpretable deep learning models, for assessing the risk of chronic disease progression," Ertin said.

Ever rising healthcare costs and the growing population of aging adults with chronic conditions necessitates new predictive, personalized and proactive approaches to cardiovascular health. He said it's not enough to predict the risk of decompensated heart failure through late symptoms like weight gain and labored breathing.

The SenSE program aims to design, create and validate an easy-to-use sensor patch, combining four key tools to assess real-time cardiac and lung functions: Electrocardiogram (ECG), Bio Radio Frequency (RF), Bio-Impedance, and Seismocardiogram (SCG).

The new technology, Ertin said, reduces the need and high cost of surgeries typically required for implanted monitors, which can result in extended hospital stays.

Ertin said the joint sensor models developed in this project will provide insights into the noninvasive measures related to cardiovascular health, previously only available through implanted sensors and catheterizations in surgery.

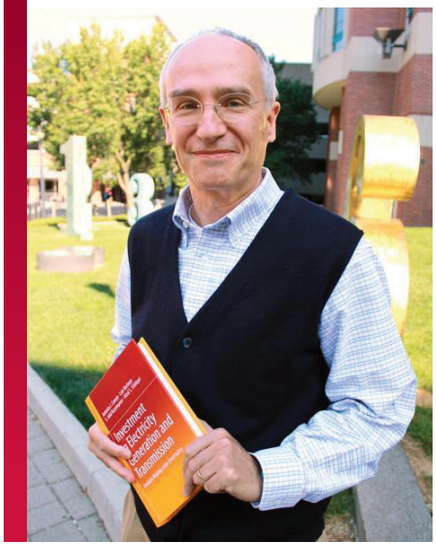
Noninvasive measurements from the sensor patch are then paired with data from a patient's electronic health records and deep learning models to achieve long-term therapy targets.

"The design of the sensor patch will explore new techniques, by integrating signals from a wide range of frequency bands, into a single fl xible board operating autonomously under a power budget," he said.

The award earned by Ohio State is provided via the Chemical, Bioengineering, Environmental and Transport Systems (CBET) division of NSF. It supports innovative research and education in the fields of chemical engineering, biotechnology, bioengineering, and environmental engineering, and in areas that involve clean and sustainable energy. ■

Story by Ryan Horns | Communications Specialist | Horns.1@osu.edu | @OhioStateECE

EMRE ERTIN



OHIO STATE JOINS $2.44 MILLION DOE ELECTRIC EFFICIENCY INITIATIVE

The Ohio State University joined a new $2.44 million grant from the U.S. Department of Energy (DOE) to help utilities and wholesale electricity markets improve efficie y and reliability while reducing emissions and costs.

The Duke University-led initiative comes at a time of needed transformations to tackle climate change. The DOE Advanced Research Projects Agency-Energy (ARPA-E) accepted the team's proposal, "A Grid that's Risk-Aware for Clean Electricity (GRACE)," which taps the expertise of researchers from academia, industry and government.

Ohio State Electrical and Computer Engineering (ECE) Professor **Antonio Conejo** said his team's role involves work in design.

"Our contributions pertain to two research and development areas, modeling of power systems and developing optimization tools for decision making in these systems," he said.

Conejo is a professor in ECE and Integrated Systems Engineering. He is an IEEE Fellow.

Dalia Patiño-Echeverri, Gendell Family Associate Professor of Energy Systems and Public Policy at Duke's Nicholas School of the Environment, is leading the three-year project.

"Our goal is to make a meaningful and tangible contribution to the transformation of the U.S. electricity sector into a cleaner and more efficient system," she said

The GRACE team will design an energy system management (EMS) framework enabling U.S. electricity providers to better anticipate and manage uncertainty in the performance of conventional and renewable power generators in their systems. This will help improve the short-term operational efficie y systemwide and guarantee its reliability at the lowest possible environmental and economic cost.

"Operating under conditions of uncertainty places burdens on any business or enterprise. For electricity system operators, these burdens are compounded by a changing climate, uncertain demand and variable and unpredictable performance of conventional and renewable power generators," Patiño-Echeverri said.

To help relieve some of these burdens, the GRACE framework will use specially developed algorithms allowing energy managers to characterize risk for assets within their systems – for instance, how and when weather conditions might affect solar or wind power generation, or when short-term spikes in consumer demand might require redirecting available power supplies, tapping reserves or bringing new resources on line.

The framework will reportedly be ready for integration into industry practice by summer 2023.

Aside from Conejo at Ohio State, co-principal investigators on the GRACE team include **David Brown**, associate professor of business administration at Duke's Fuqua School of Business, **Jordan Kern**, assistant professor in the Department of Forestry and Environmental Assets at North Carolina State University; and **Ali Daraeepour**, a postdoctoral research associate at Princeton University's Andlinger Center for Energy and Environment.

"Our goal is to make a meaningful and tangible contribution to the transformation of the U.S. electricity sector into a cleaner and more efficient syste "

Other co-principal investigators are **Pavel Etingov**, staff research engineer at the Pacific Northwest National Laboratory (PNNL); **Veronica Adetola**, chief research scientist in the Electricity Infrastructure and Buildings Division at PNNL; **Arnab Bhattacharya**, operations research scientist at PNNL; and **Hong Chen**, senior consultant and project manager at PJM Interconnections LLC, and secretary of the Institute of Electrical and Electronics Engineers' Power & Energy Society's Technical Council.

Eric Rohlfi g, energy executive in residence at the Duke University Energy Initiative, will serve on the GRACE advisory committee, along with **Jim Smith**, Jack Byrne Distinguished Professor in Decision Science at Dartmouth College, **Mark Oliver**, manager of short-term planning at Duke Energy, and **Charles Rossmann**, forecasting and model development manager at Southern Company.

Conejo has published over 165 papers in SCI journals and is the author or co-author of books published by Springer, John Wiley, McGraw-Hill and CRC. He was the principal investigator of many research projects finan ed by public agencies and the power industry. ■

Story by Ryan Horns | Communications Specialist | Horns.1@osu.edu | @OhioStateECE

ANTONIO CONEJO

AWARDS

2020 GRADUATE TO WATCH

WENJING DENG

On May 3, 2020, The Ohio State University's College of Engineering welcomed thousands of new alumni into its legacy. To help celebrate their achievements, a few members of the class were highlighted for combining their passions with Ohio State's offeri gs to engineer an extraordinary education.

Though the COVID-19 crisis changed their senior year in unimaginable ways, these resilient Buckeyes not only triumphed over hardship, they also learned positive lessons that will benefit them—and us—in the future.

One electrical and computer engineering (ECE) major was among those spotlighted.

ECE student **Wenjing Deng** likes to be challenged. At Ohio State, the student-athlete was driven to excel in both the classroom and the pool.

Deng helped Ohio State's Synchronized Swimming team win three straight national championships in 2019, 2018 and 2017. In addition to the overall awards, she was part of the gold medal winners in the team (2017-2019) and trio (2019) categories, plus she was an Academic All-Big Ten Champion and a two-time Big Ten Distinguished Scholar.

"You have to put everything you can into the sport and I like that a lot," said Deng, who began synchronized swimming at age 9. "I was really pushing my boundaries and exercising myself to be at a high level mentally and physically."

Originally from Whitby, Canada, Deng wasn't sure if she wanted to pursue swimming as well as a rigorous academic program like engineering in college. But after receiving a scholarship from Ohio State, she decided to go for it.

Deng was also a Texnikoi engineering honorary officer, an Engineering Ambassador, a member of the 2018 Ohio State Homecoming Court, and completed three internships. But she is most proud of the teamwork, self-improvement and networking skills she gained as a Buckeye.

"Ohio State has such a wide variety of things to do and I get bored easily, so I'm happy that I was able to get involved in a ton of things outside of engineering," Deng said. "That was really exciting for me."

As part of the combined BS/MS program, Deng received both bachelor's and master's degrees in ECE. It's a program she highly recommends.

"The professors have really been conducive to our learning. Th y expect a lot from us, but they give us the time to actually learn it," said Deng, describing the graduate level classes she took. "The classes are small and we can have a discussion. That s where I feel I've learned the most."

After graduation, Deng joined automated equipment manufacturer R.P. Gatta near Cleveland. Although the end of her senior year presented another challenge, she learned from that as well.

"I really like school and I like learning. Knowing that I went to my last lecture and I didn't even realize it, I wish I enjoyed every moment a little bit more," Deng said. "It's important [to be] present and enjoy whatever you're doing."

Story from Candi Clevenger, College of Engineering Communications, clevenger.87@osu.edu

WENJING DENG

A Record Three ECE Students Win 2020 Graduate School Presidential Fellowships

For the first time in the electrical and computer engineering (ECE) program, a record three students were announced among the winners of the distinguished 2020 Graduate School Presidential Fellowship at The Ohio State University

Daniel Lepkowski, Kaiyi Ji and **Towhidur Razzak** were selected as winners for their achievements to date. The award provides students with one year of full-time financial support as they complete their dissertations.

All three received glowing praise from their professors over the years for their work at Ohio State.

For Lepkowski, earning the fellowship dovetails his Ph.D. achievements in Solid State Electronics and Photonics working under Professor **Steve Ringel.**

Razzak said he grew up with a fascination with computers and how they work.

"I have been an avid gaming computer builder since middle school and loved doing physics and math. This made me decide to pick electrical engineering as a profession," he said. "I especially enjoyed learning about semiconductor physics and devices, which ultimately drove me toward semiconductor device research."

This focus, he said, led him to pursue joining Professor **Siddharth Rajan**'s research team.

"In my opinion, Rajan is one of the best minds in the world right now, in terms of device research. He has deep insight and understanding of semiconductor materials, device physics and applications, which is what made me decide to study under him," Razzak said. "From the time I joined his group, he has been instrumental in all of my research achievements and progress."

Rajan said he was so happy Razzak was recognized with the Graduate School Presidential Fellowship award.

"Towhid's work, which has been supported by AFOSR and DARPA, has pushed the boundaries of performance by bringing some truly new ideas into semiconductor electronic devices," Rajan said.

In addition, Rajan said, Razzak was featured in Semiconductor Today, has already edited a book, and is a super-user at Nanotech West helping staff with advanced clean room equipment and training.

Specifi ally, Razzak's research focus is essential for next generation telecommunications. His work explores the design and fabrication of novel ultra-wide bandgap (UWBG) devices to realize high power density electronics operating in the mm-wave spectrum (30 – 300 GHz).

"We have been able to achieve state of the art devices and have demonstrated the highest experimentally observed breakdown electrical field in any semiconductor to date," he said.

The primary goal of Ji's research is to develop fast, principled and scalable optimization algorithms for modern large-scale machine learning and deep learning.

Towhidur Razzak

Kaiyi Ji

Daniel Lepkowski

"In the era of big data, deep learning has become a powerful tool for various artificial intelligence and machine learning applications, with a broad impact on various areas, including computer vision, pattern recognition, robotics, natural language processing, and online advertising," he said.

When Ji came to Ohio State, his fi st research actually focused on cache networking. He also learned some cutting-edge techniques in both machine learning and deep learning.

"I discovered I was willing and very interested to try some projects related to deep learning," he said.

Ji chose to contact Professor **Yingbin Liang**'s group, which he said is very active and successful in this fiel .

"Considering my strength in math, and with some advice from Prof. Liang, I started to work on deep learning from two perspectives," he said.

Ji researches algorithm acceleration for large-scale deep learning applications, and theoretical justifi ation of widely-used deep learning frameworks.

"During this process, I was continuously motived by the results of my projects and positive feedback from other researchers along this direction. I am very grateful to my advisor Prof. Liang for findi g me such a suitable research direction," Ji said.

Each of the three presidential fellowship winners agreed findi g successful paths within the Ohio State ECE program is the goal.

Ji said he pays very close attention to the advice and instructions from his advisors and professors, because they have much more experience and professional vision. From there, he said, it comes down to findi g a new independent pathway to focus his attention upon.

"Good research work often takes us a long time, from findi g a topic, to writing a paper," Ji said. "During this period, we should make a good time plan for pushing us to fi - ish each part of our project on time."

Razzak agreed, saying students should focus on staying motivated.

"In my opinion, perseverance at all times is the key to succeed," he said. "It can be a fun experience if one thinks of hardship as a way to learn important life lessons and build discipline."

For mental health, Ji tries to go swimming and plays basketball with friends two or three times a week.

"Such a rest time definitely helps me relax from the intensive Ph.D. work, and gives me sufficien energy every day," he said. ■

Story by Ryan Horns, ECE/ IMR Communications Specialist, Horns.1@osu.edu

1 Manmeet Singh

2 Jacob Compaleo

3 Nidhin Kalarickal

2020 JOHN D. AND ALICE NELSON KRAUS MEMORIAL

GRAD STUDENT POSTER COMPETITION WINNERS

The setting might be diffe ent this year, but the honor remains the same.

Winners of the 2020 John D. and Alice Nelson Kraus Memorial Graduate Student Poster Competition were announced this summer.

The virtual event, showcasing Electrical and Computer Engineering graduate school research contributions, was held between Aug. 10 and 24. Event organizer, **Qudsia Tahmina**, said having the poster competition held virtually this year was important, in order to continue serving students the best way possible.

"This competition has encouraged our graduate students to overcome the anxiety, due to the cancellation of several events and conferences this year. Successful completion of this competition proves that it is the motivation that matters and perseverance to achieve the goals," said Tahmina, an ECE assistant professor of practice. "I applaud their willingness to participate in this competition, even with reduced research activities and lack of accessibility to their labs."

The fi st place winner of the competition, **Manmeet Singh**, took home the top prize of $500 for his research, "A Digitally-Assisted Buck-Boost Converter with Seamless Mode Transitions and Fast Dynamic Response for Extending Battery Life in Mobile Devices." Singh is advised by Professor **Ayman Fayed.**

According to Singh's abstract, operating switching power converters from an input voltage as low as 2.3V in devices operating from Li-Ion batteries can extend the running time of the device by as much as 20 percent compared to the common practice of shutting down the device when the battery drops to 2.7V.

However, since many of these devices require power supplies that are higher than 2.3V, but lower than the maximum voltage of a Li-Ion battery (i.e. 5V), designing these power converters becomes challenging. This work presents a noninverting buck-boost converter to address this challenge. The converter uses digital adaptive slew-rate control and hysteretic mode detection to achieve fast dynamic response and seamless/noise-immune mode transition between the buck, boost, and buck-boost modes of operation. The converter is fabricated in 0.13-µm CMOS, and supports 2.3–5V input and 1.5– 3.6V output. It achieves 91.7 percent peak efficie y and over 80 percent efficie y at 1-mA load across all conditions.

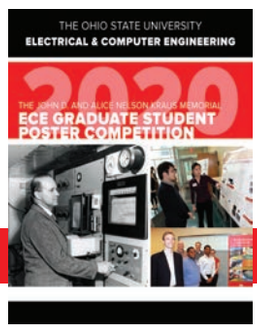
In second place, **Jacob Compaleo** won $300 for his work entitled, "Application of Sparse Representation to Bartlett Spectra for Improved Direction of Arrival Estimation." His advisor is Professor **Inder Gupta**.

For decades, the abstract explains, obtaining accurate direction of arrival (DOA) estimation of the signals incident on an array of antenna elements has been an area of great interest. In this poster presentation, a new technique for high-resolution direction of arrival estimation is presented. The method utilizes the traditional Bartlett spectra and sparse representation to locate emitters in single and multiple emitter scenarios. Using Monte Carlo simulations, the work shows show an approach that achieves accurate DOA estimations that are unbiased and a variance that approaches the Cramer-Rao lower bound. This method outperforms the popular MUSIC algorithm when angular separation between emitters is small, signal SNR is low, and a small number of snapshots are used in DOA estimation.

Nidhin Kalarickal won third place and $100 in the competition this year for the research, “Electrostatic Engineering Using High Permittivity Materials for Ultra-wide Band Gap Transistors.” His advisor is Professor **Siddharth Rajan.**

Maintaining high average fields between the gate and drain terminals is imperative in achieving near theoretical performance in ultra-wide band gap semiconductors. The research abstract explains how peak electric fields occurring at the corner of gate/field plate makes this highly challenging. The paper reports on a field management strategy to reduce the peak electric field at the drain side corner of the gate by using a composite dielectric layer consisting of a high-k/low-k heterojunction overlapped over the gate electrode. Utilizing this strategy helped achieve a record average breakdown field of 5.7 MV/cm at a gate-drain spacing of 1.15 um along with an improved power figu e of merit of 586 MW/cm2. The reported work shows the effect veness of integrating high-k dielectrics with ultra-wide band gap materials in signifi antly improving breakdown performance.

"Judges have been tremendously helpful in evaluating posters and video presentations and providing valuable feedback. All-in-all, it was a unique and fun experience this year and I look forward to the future competitions," Tahmina said. ■



Find the full breakdown of participants and research presented this year in the 2020 Online Program.

JIN WANG RECEIVES JAPAN’S NAGAMORI AWARD

Electrical and Computer Engineering Professor **Jin Wang** was named a recipient of the prestigious Nagamori Award.

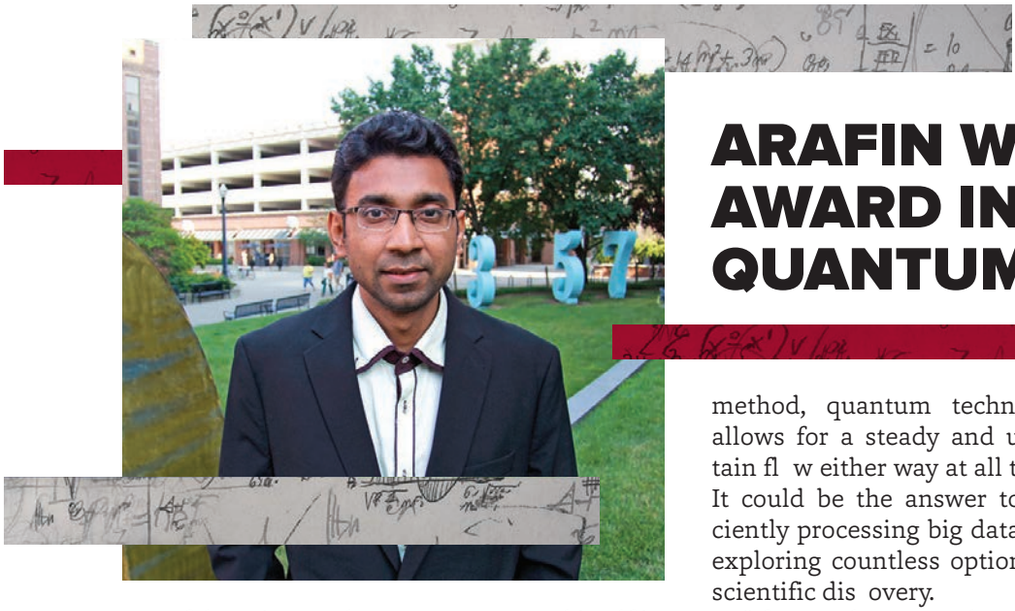
The Nagamori Foundation created the award to bring vitality to technological research of motors, and related fields, such as generators and actuators, and also to support the researchers and development engineers who made outstanding achievements in these fields

Wang received the award in recognition of his contributions to wide bandgap (WBG) power electronics-based electric machine drives. He has been one of the leading experts and an early advocate for implementation of WBG power devices for applications, including electric vehicles, medium voltage drives and electric aircrafts. He has published nearly 200 journal and conference papers, which have been cited 6,986 times, and has been awarded nine patents. Before joining Ohio State, Wang was a core power electronics engineer at Ford Motor Company, where he worked on the traction drive design of the Ford Fusion Hybrid.

Wang received the IEEE Power Electronics Society Richard M. Bass Young Engineer Award in 2011 and the National Science Foundation’s CAREER Award in 2011, among many other national accolades. At Ohio State, he earned the Ralph L. Boyer Award for Excellence in Undergraduate Teaching Innovation in 2012, the Lumley Research Award in 2013 and the Harrison Faculty Award for Excellence in Engineering Education in 2017.

He created and chaired the 1st IEEE Workshop on Wide Bandgap Power Devices and Applications (WiPDA) in 2013, which has since become one of the premium global events for the WBG research community.

The Nagamori Foundation was established in 2014 by Nidec Corporation Founder, Chairman and CEO **Shigenobu Nagamori** to contribute to the scientific and industrial development inside and outside Japan by commending those who engage in R&D activities, domestic and overseas, in the area of research and technology. The Foundation's main activity is to promote researches related to motors, actuators, and power generators, address a major challenge of “creating affluen lives” and “perpetually conserve the global environment,” and operate the Nagamori Awards, a system to commend those who have made an innovative technological development. ■



ARAFIN WINS EAGER AWARD IN THE QUANTUM RACE

If there is one clear aspect to reveal itself in a post-pandemic world, it is humans need more help figuri g out uncertain systems faster. This is where quantum technology comes in.

In this realm where physics and engineering collide, **Shamsul Arafin** found his niche. For his research effo ts at The Ohio State University, he recently earned funding to help advance the building blocks of quantum technologies.

The National Science Foundation announced Arafin won a nearly $166,000 EArly-concept Grants for Exploratory Research (EAGER) award for his proposal, "Toward Monolithic Optically-Pumped Single-Photon Sources Based on Deterministic InGaN Quantum Dots in GaN Nanowires."

As an Assistant Professor in Electrical and Computer Engineering, Arafin joined Ohio State's Materials and Manufacturing for Sustainability (M&MS) Discovery Theme in 2018

"The long-term objective of the proposed research is to achieve bright and ultra-spectrally pure single-photon sources that meet aggressive performance specifi ations," Arafin explains in his abstract.

Single-photon sources are one of most useful basic building blocks for many future quantum technologies. In particular, leading to revolutionary new communications, computing and sensing possibilities, if successfully developed.

To understand the proposal, it helps to explore how Arafi 's passion for learning the foundations of energy was sparked at a young age. This led to a fascination with both electrical engineering and physics, which defines the pursuit of quantum technology.

As Wired reported earlier this year, "Quantum Computers will change the world (if they work)."

Rather than powering computers through strict on/off functions, or the traditional 0/1 method, quantum technology allows for a steady and uncertain fl w either way at all times. It could be the answer to efficiently processing big data, and exploring countless options for scientific dis overy.

"If you ask a normal computer to figu e its way out of a maze, it will try every single branch in turn, ruling them all out individually until it finds the right one," Wired reports. "A quantum computer can go down every path of the maze at once. It can hold uncertainty in its head."

This is important because quantum computers could easily outperform the most powerful modern supercomputers. Such technology would rapidly accelerate the development of artificia intelligence, batteries for electric vehicles, solar lighting, cheaper medication and even help find a cure for Alzheimer's – or, in the current situation, allow for the faster development of vaccines.

The problem is current quantum computers remain unreliable. To date, science has yet to reveal a quantum light source that simultaneously combines robust design, coherent, tunable, bright, focused and efficient power.

"This project aims to develop a single-photon source that can meet these aggressive performance specifi ations," Arafin sai .

NSF's EAGER funding mechanism helps power the effo ts of research that tests the boundaries of conventional thought. It supports exploratory work in its early stages for untested, but potentially transformative, research ideas or approaches.

According to NSF, this work often involves "radically diffe ent approaches, applies new expertise, or engages novel disciplinary or interdisciplinary perspectives."

Success in this realm could remove constraints leading toward next-generation quantum photonic technologies to advance diffe ent disciplines of science and engineering, such as optics, materials science, electrical engineering, physics, and chemistry.

"In this EAGER proposal, we explore a new and unique technique for the growth of nitrogen (N)-polar GaN NWs with InGaN quantum dots deterministically placed inside using a bottom-up approach via plasma-assisted molecular beam epitaxy," Arafin explains. "The proposed research will lead to deeper fundamental insights into mechanisms and processes involved in scalable quantum photonic devices and integrated circuits. This inherently interdisciplinary research combines material science, quantum physics, chemical engineering and electrical engineering to generate new fundamental knowledge in several scientific field "

To learn more about related opportunities in this realm of science, explore the Ohio State Institute for Materials Research and Solid State Electronics and Photonics program. ■

Story by Ryan Horns | ECE/IMR Communications Specialist | Horns.1@osu.edu | @OhioStateECE

Krishna Earns 2020 SPIE Aden & Marjorie Meinel Technology Achievement Award for Infrared Tech

Sanjay Krishna, George R. Smith Chair in Engineering and professor of Electrical and Computer Engineering at The Ohio State University, recently earned the 2020 SPIE Aden and Marjorie Meinel Technology Achievement Award for his pioneering work and impact in the infrared fiel .

The award recognizes technical accomplishments in the fields of optics, electro-optics, photonic engineering and imaging. SPIE, the international society for optics and photonics, has worked to advance light-based technologies since 1955.

"Looking at the list of past award winners, I am very humbled and honored to have been chosen for this prestigious award," Krishna said. "The award raises the level of awareness of the potential impact that this work is having on our fiel . The dual color superlattices could help us obtain absolute temperature measurements which would be helpful for several commercial applications in fields like health and medicine, manufacturing metrology, etc."

Krishna received the award in November for his presentation of the fi st demonstration of single-color and dual-color nBn superlattice detectors and focal plane arrays. His work in the field of infrared technologies has advanced imaging capabilities by allowing increased sensitivity and operating temperatures, while lowering costs. Thi work has led to applications among manufacturers in both industry and defense.

"The e are three important contributions that a good university research group can make," said **Michael T. Eismann**, editor-in-chief of SPIE's Optical Engineering journal and chief scientist at the Air Force Research Laboratory's Sensors Directorate. "The fi st is advancing the frontiers of science using simple concepts based on fundamental understanding of the physics. The second is the advancement of this science to make a real technological impact that could be useful for real-life application. And the third is the legacy of high-quality students and researchers that one has trained in their research group. Professor Krishna has made a signifi ant impact in all these areas."

Krishna is an SPIE Fellow and has previously received the society's Early Career Achievement Award for his technological contributions to infrared detector development.

Krishna joined Ohio State though the Materials and Manufacturing for Sustainability Discovery Theme in 2017. He is on the leadership team of the newly established IIT Bombay-Ohio State Frontier Science and Engineering Research Center, a shared research center that fosters cutting-edge collaborative projects related to advanced technologies.

Krishna co-founded SK Infrared, LLC., a Columbus-based startup that engineers innovative infrared detection devices capable of detecting everything from military threats to early-stage skin cancer.

Story by Mike Huson, Institute for Materials Research Public Relations Coordinator

In a nod to his own mentors who helped him along the way, Krishna presented a challenge to students in his SPIE Award acceptance speech.

Write down four questions on a piece of paper.

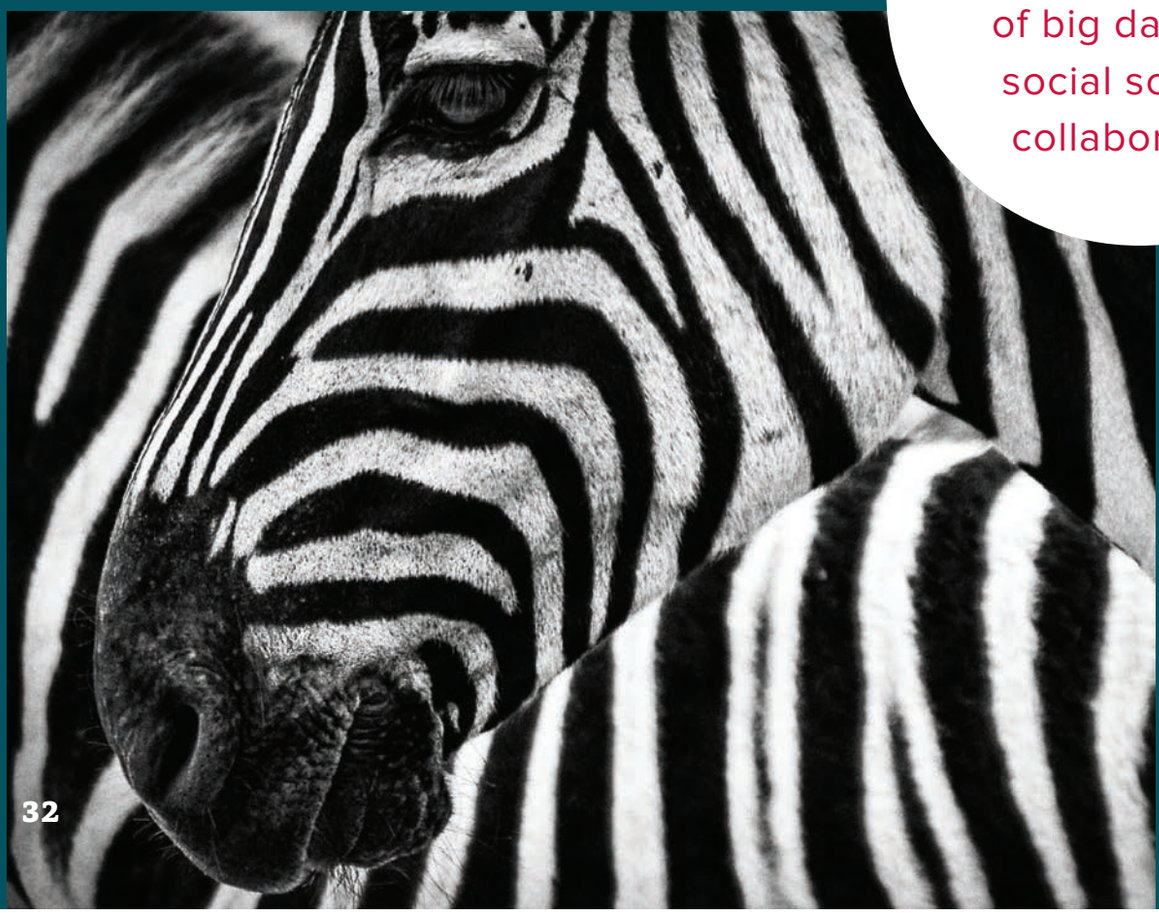
1. What am I good at?
2. What do I really love to do?
3. What can I be paid for?
4. What does the world need?

Find his full acceptance speech online at: https://go.osu.edu/krishna-spie-vid

ECE SPOTLIGHT

TANYA BERGER-WOLF

New ECE professor defines the future of big data and social science collaboration



Revelations in big data analytics opened up new realms of strategy for economic, technological and scientific industries. Managing that process across the board is where a professor at The Ohio S ate University found her niche.

Tanya Berger-Wolf joined the university in 2020 as faculty director of the Translational Data Analytics Institute, (TDAI) within Ohio State's Discovery Themes initiative. She is a professor of Computer Science and Engineering; Evolution, Ecology and Organismal Biology; as well as Electrical and Computer Engineering (ECE).

While scientists ponder how COVID-19 will change population and societal behavior going forward, the need for data analytics - and experts in it, such as Berger-Wolf - has grown exponentially.

A computational ecologist, she works at the unique intersection of computer science, data science, wildlife biology and social sciences. She creates computational solutions to address questions such as how environmental factors affect the beh viors of social animals (humans included).

For its role at Ohio State, TDAI involves up to 200 affili - ed faculty across the university.

"This is the intellectual and physical hub of data research," Berger-Wolf said about the institute. "If there is data anywhere in your research, we're a part of it and the TDAI community is a part of it. We have research activities focused around communities of practice. I think every one of them has intersections with ECE."

Many of its associated fields include Computational Health and Life Sciences, Computational Social Sciences, Foundations of Data Science, Responsible Data Science; Smart Communities and Distributed Sensing; and more recently, Responsible Data Science.

Berger-Wolf said her field also very much engages with Ohio State's newly launched Institute for Cybersecurity and Digital Trust.

She is also a founding member and project lead for Wildbook (a project of the non-profit Wild Me), an open source software platform that supports the use of AI, computer vision, citizen science and collaboration to accelerate wildlife research to understand and counter widespread wildlife decline.

Berger-Wolf came to Ohio State via the University of Illinois at Chicago, where she was a professor of computer science and headed the Computational Population Biology Laboratory. Prior to her time there, she was an NSF postdoctoral fellow at the University of Mexico and at the Center for Discrete Mathematics and Theo etical Computer Science (DIMACS), a collaborative project of Rutgers University, AT&T Labs – Research, NEC Laboratories America, Nokia Bell Labs, Perspecta Labs, and Princeton University. ■

Story by Ryan Horns | ECE/IMR Communications Specialist | Horns.1@osu.edu | @OhioStateECE

WILDBOOK

'Wildbook' site lets users upload pictures of endangered Grevy's zebras in Kenya to identify and track the animals in a bid to save the dwindling species

The e are only 3,000 Grevy's zebras left in the world and 95% live in Kenya

Wildbook is an online platform that uses AI to identify individual zebras from among thousands of photos submitted by volunteers

This all ws experts to track and monitor the zebras living in the wild

It can judge the size of the zebra population and its gender and age breakdown

Grevy's zebra stripes, unique as fi gerprints, allow for easily identifi ation.

Machine Learning & Citizen Science & Conservation Research

Wildbook for Zebras applies computer vision algorithms and deep learning to identify and track individual zebras across hundreds of thousands of photos. We help researchers collaborate with each other and citizen scientists contribute to the effo t. A.I. scales and speeds research and conservation. ■

MARVIN WHITE HONORED WITH IISS LIFETIME 'PIONEERING ACHIEVEMENT AWARD'

Marvin White's pioneering technological contributions and patents span decades in the field of engineering. Many are still found today in personal cameras, satellite imaging systems; even the Hubble Space Telescope.

An influential professor of electrical and computer engineering at The Ohio State University, White's life work was recently honored with the Pioneering Achievement Award at the 2019 International Image Sensor Society (IISS) conference held this summer in Utah.

ECE Associate Chair **Betty Lise Anderson** said she is not surprised by the attention White's work earned.

"Marv is a phenomenal teacher, and really, really cares about students. I know he schedules office hours in classrooms in the evenings to maximize his availability," she said. "Plus he is an expert, not only in solid state physics, but also electronics. And as far as I can tell, remembers anyone he ever met. He's always telling me stories about interesting people he's known throughout his career."

Born in 1937 in Bronx, New York, White began his educational journey in the 1940s, during the tail end of the Great Depression. His immediate family had no previous scientists, so he became a fi st-generation engineer, eventually earning his Ph.D. from Ohio State in 1969. From the countless odd jobs he took, paying his way through school, to a successful career in both industry and academia, White's legacy in engineering is respected on numerous levels.

The IISS Board of Directors praised White's "pioneering achievements in image sensor technology, judged by at least 10 years of hindsight as a foundational contribution" toward solid state nonvolatile memories in cell phones and other devices.

White joined the Ohio State faculty in 2010 after many years teaching at Lehigh University in Bethlehem, PA, where he was the Sherman-Fairchild Professor of Electrical and Computer Engineering and Director of the Sherman-Fairchild Center for Solid State Studies. He also served two decades at Westinghouse Electric Company, as well as serving stints at the National Science Foundation and Naval Research Laboratory. He has authored or co-authored over 300 technical papers, contributed chapters to four books and has 27 U.S. patents. He has mentored 37 Ph.D. students.

Serving a key role in modern imaging systems, White's development of the Correlated Double Sampling (CDS) noise reduction technique for image sensors remains essential. He advanced award-winning research used in high sensitivity solid state cameras and imagers, which remain widely applied in consumer and technical applications, and he made major contributions to the progress of semiconductor devices.

White is a member of the U.S. National Academy of Engineering, an IEEE Life Fellow, and served as a distinguished national lecturer of the IEEE Electron Devices Society. He has received several awards for his contributions to the development of high-sensitivity, solid-state cameras and imagers and for major contributions to progress in semiconductor devices including the IEEE Electron Devices Society's 1997 J. J. Ebers Award, and the IEEE 2000 Masaru Ibuka Consumer Electronics Award. In 2011, he received Ohio State's Distinguished Alumnus Award. ■

EMRE KOKSAL NAMED 2019 'INVENTOR OF THE YEAR' AT BIZTECH AWARDS

Columbus Business First celebrated its 2019 BizTech Award winners with an event on Dec. 4, and engineering faculty and alumni of The Ohio State University's Department of Electrical and Computer Engineering (ECE) were in the spotlight.

ECE Professor **Emre Koksal**, cofounder and CEO of the cybersecurity company DAtAnchor Inc., was named "Inventor of the Year," at the ceremony held in Columbus.

DAtAnchor helps organizations protect and store their data through automated cryptotechnology, blocking it against breaches, while meeting compliance requirements of regulated industries.

"If you look at all serious breaches, at some point there's a human error," Koksal told Business First. "You cannot control the behavior of humans. If you look at the Equifax breach, the Target breach, it starts with someone making a mistake. We eliminate that initial mistake."

Koksal developed DAtAnchor with a $70,000 grant under a commercialization program jointly funded by Ohio State and Ohio Thi d Frontier.

Also recognized during the BizTech Awards were Ohio State ECE alumni involved in the wireless power technology company, **Nikola Labs**, which won "Outstanding Innovation" this year. Company CEO, **Will Zell**, was also named "Executive of the Year." ECE Professor **Chi-Chih Chen** serves as lead inventor and Professor **Robert Lee** serves as a director and founding partner on the company's Advisory Board, which also includes ECE alumnus **Rodolfo Bellesi.**

The Innovation Studio at Ohio State's College of Nursing also won "Nonprofit of the Year." ■

"You cannot control the behavior of humans. If you look at the Equifax breach, the Target breach, it starts with someone making a mistake. We eliminate that initial mistake."

CULTURE

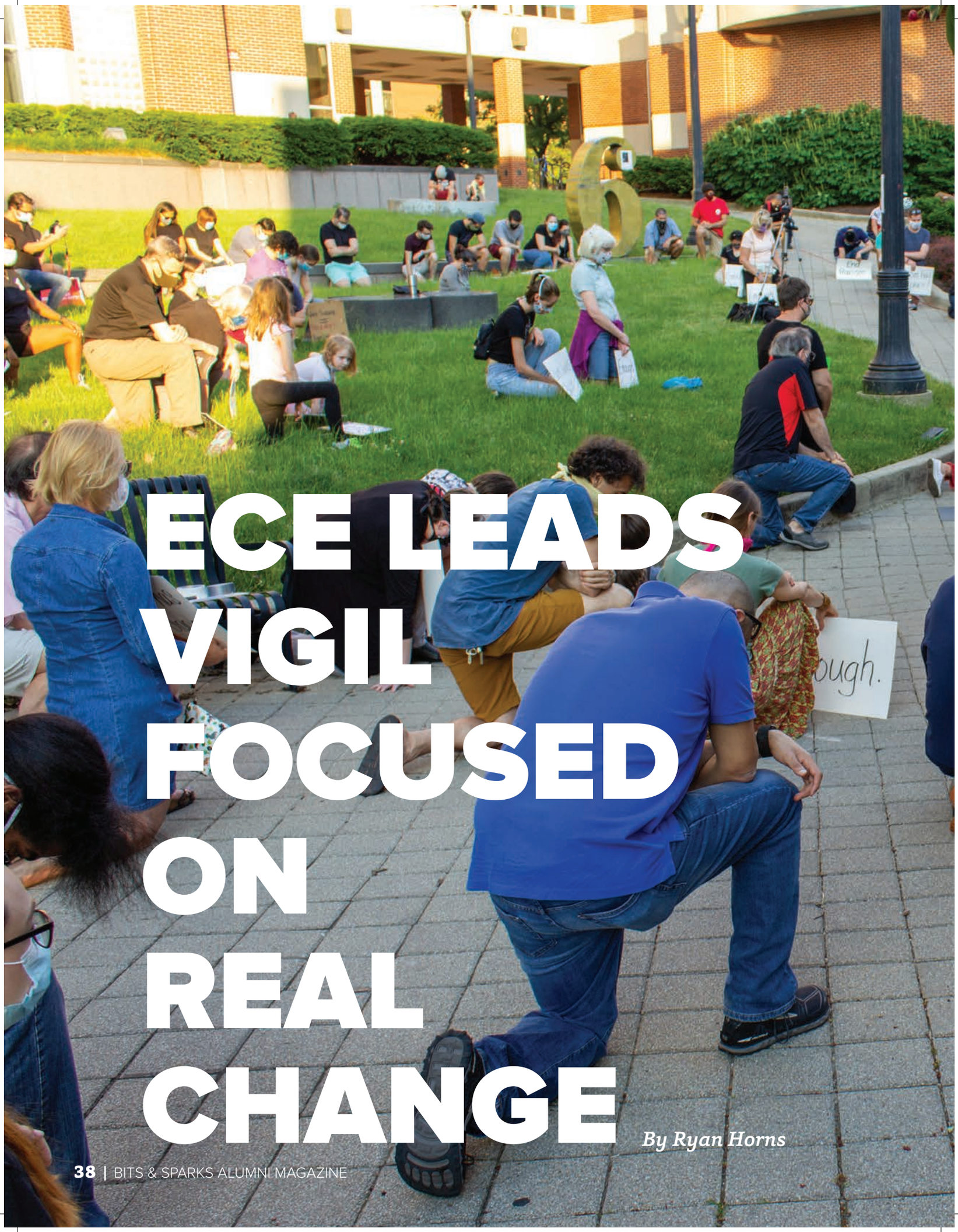
ECE: POWERING TOMORROW

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING SPRING GRADUATE & UNDERGRADUATE

V I R T U A L
CLASS *of* 2020!

When the COVID-19 pandemic struck the United States in early March, students returned from Spring Break to find their schools closed, jobs gone and a new worldwide reality to adapt to. Similarly, faculty and staff were tas ed with entirely re-defining how they teach overnight.

In the hopes of retaining some normalcy and connection, we quickly planned for the traditional class photo to take place over zoom. In many ways, the experience became even more personal. Watch now: https://go.osu.edu/sp2020classvid



ECE LEADS VIGIL FOCUSED ON REAL CHANGE

By Ryan Horns

COLLEGE OF ENGINEERING STUDENTS GATHERED AT THE LIGHT VIGIL. *By Mike Huson*

When public artist Barbara Grygutis created the Garden of Constants sculptures adjacent to Dreese Labs at The Ohio State University, she was exploring how colors and numbers change perspectives, revealing new meaning over time.

This is p ecisely why faculty, staff and students of the Electrical and Computer Engineering (ECE) program held a vigil on the evening of Friday, June 12, to honor **George Floyd** and the countless other innocent lives lost to senseless brutality. As word of the planned vigil spread, departments across the College of Engineering joined in support.

ECE Chair **Hesham El Gamal** spoke about the need for real and persistent change, not only in welcoming more people of color into the program, but ensuring their time as students is nurtured rather than unknowingly challenged in any way.

Enrollment numbers for engineering programs predominantly reflect white male students. While the ECE department's award-winning STEM Outreach program has visited disadvantaged schools and youth programs across Ohio, reaching thousands of students, it can only do so much.

ECE Professor **Betty Lise Anderson**, who leads the program with student volunteers,

Continued on page 40

COLLEGE OF ENGINEERING STUDENTS GATHERED AT THE LIGHT VIGIL. *By Mike Huson*

Continued from page 37

already knows the importance of increasing the presence of engineers visiting school districts all across the state, including libraries, clubs and anywhere else they are requested. After schools begin to reopen from the pandemic closures, students interested in volunteering for the program can contact Anderson to assist with upcoming semesters.

El Gamal said undoing systemic racism is an effo t they must continue to make happen through real culture change. He said the word culture has its roots in farming. It means to nurture.

"It must touch the lives of all students, staff and faculty. It's a long process that requires dedication and commitment from us all," El Gamal said.

ECE Professor **Kevin Passino** quoted Dr. Martin Luther King Jr., saying, "The time is always right to do the right thing."

Right now, he said, everyone there is trying to live up to this.

Ohio State Chemical Engineering Student and Research Assistant, **Jiaoni Li**, who spoke at the vigil, said she knows how difficult it is to find a level playing field as a minority student herself. It is even more challenging for black students, she said, to find support or internship opportunities. She hopes the rally is not just about gathering

COLLEGE OF ENGINEERING STUDENTS GATHERED AT THE LIGHT VIGIL. *By Ryan Horns*

"WE STAND STRONG WITH OUR BLACK COMMUNITY. BLACK LIVES MUST MATTER. WE NEED TO LEARN TO LISTEN, NOT JUST HEAR AND SPEAK. WE MUST EDUCATE OURSELVES. STANDING BY IN SILENCE, OR NOT BEING ABLE TO LEARN ARE A FORM OF RACISM."

photos and saying some quotes.

"People want to make a change," she said. "We need solid programs. People don't realize institutional racism does exist. Education is the foundation for human rights."

All students should have a platform to show their abilities, she said.

Passino asked the audience to name the woman who was born a slave, but went on to self-educate and earned her Bachelors and Masters in Mathematics at a university in Ohio, where she later taught. As a lifelong activist for civil rights, she published a book on black feminism, became a Ph.D. and even had a commemorative stamp made in her honor. She is known as the Mother of Black Feminism. People should know her name, **Anna J. Cooper**, and her legacy.

ECE Lecturer **Saeedeh Ziaeefard** said in a statement that silence is not acceptable.

"We stand strong with our black community. Black lives must matter. We need to learn to listen, not just hear and speak. We must educate ourselves. Standing by in silence, or not being able to learn are a form of racism. We seek to be better allies. We condemn any form of racial injustice and implore our university administration and the City of Columbus to support all students and citizens," she said.

Student **Kamila Thompson** is majoring in ECE as well as biomedical engineering. She appreciated the statement and support from the department, but spoke about the challenge of being the only voice at the vigil for her classmates affected by racism in the College of Engineering.

"George Floyd's death was a breaking point for a lot of people. I, myself, have never cried before for being black. The e is something about it that I can't explain. I have never seen so much emotion from black people across the world. His murder really made us want to demand change. This emotion made some people incredibly angry, or it made some people incredibly sad. It made me incredibly sad," she said.

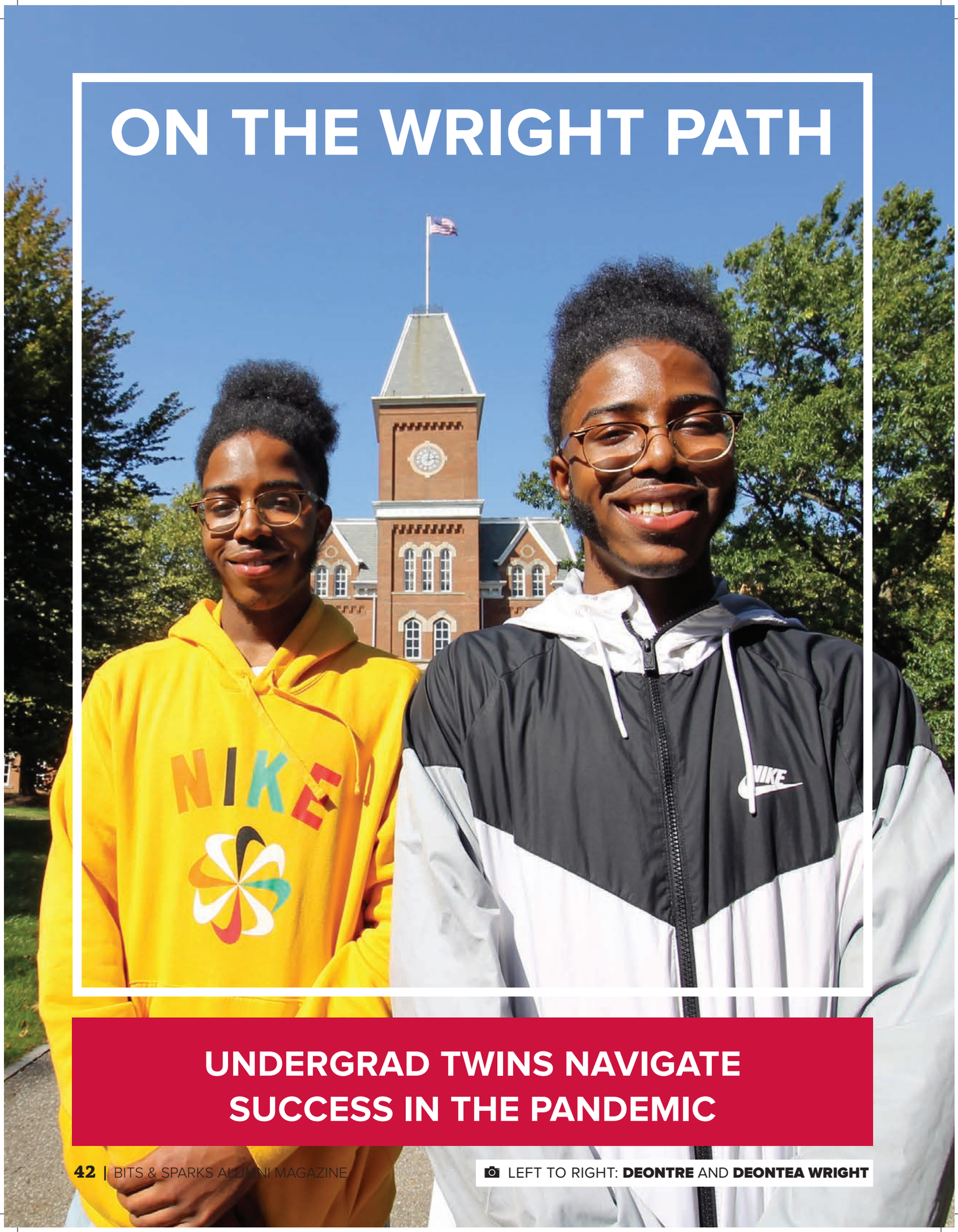
Not only was there not enough time for anyone to grieve, Thompson said, they were immediately tasked with organizing protests and speaking on behalf of all black society, in front of a lot of people.

"I'm a student. Not only is it a lot of pressure, but it's not fair. We are hated on and discriminated against because our skin is brown, and somehow it has become our job to fix it," Thompson sai .

For allies of racial justice, she asked everyone to think about how they may be involved in systemic racism, whether knowingly or unknowingly; to have empathy for people who are hurting right now, to listen to black people trying to explain their experience, and to find more ways to include black people in their lives.

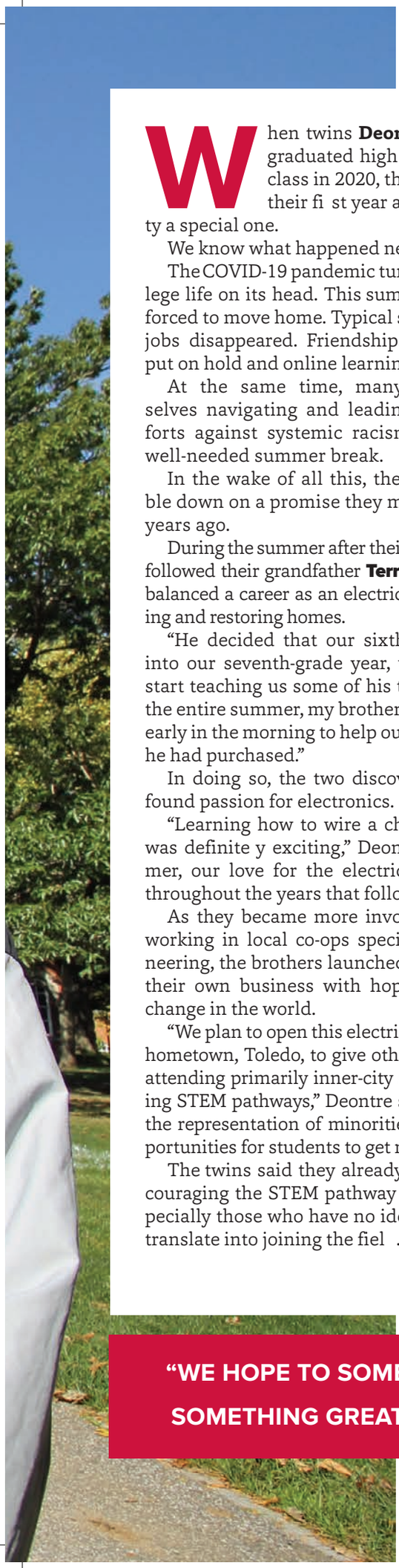
"The most important thing is to not be silent. All of this discussion and all of this action will be for nothing if all of our allies are silent the next time racism presents itself," Thompson sai . ■

ON THE WRIGHT PATH



UNDERGRAD TWINS NAVIGATE SUCCESS IN THE PANDEMIC

LEFT TO RIGHT: **DEONTRE** AND **DEONTEA WRIGHT**



When twins **Deontae** and **Deontre Wright** graduated high school at the top of their class in 2020, they were prepared to make their fi st year at The Ohio State University a special one.

We know what happened next.

The COVID-19 pandemic turned the foundation of college life on its head. This summer, many students were forced to move home. Typical service industry and retail jobs disappeared. Friendships and relationships were put on hold and online learning became the new reality.

At the same time, many students found themselves navigating and leading nationwide protest efforts against systemic racism, instead of enjoying a well-needed summer break.

In the wake of all this, the Wrights decided to double down on a promise they made to one another many years ago.

During the summer after their sixth grade year, the twins followed their grandfather **Terrence Wright** around as he balanced a career as an electrician at Chrysler, while buying and restoring homes.

"He decided that our sixth-grade summer, heading into our seventh-grade year, would be a great time to start teaching us some of his trades," Deontre said. "For the entire summer, my brother and I would wake up very early in the morning to help our grandfather redo houses he had purchased."

In doing so, the two discovered they shared a newfound passion for electronics.

"Learning how to wire a chandelier at the age of 11 was definite y exciting," Deontae said. "After that summer, our love for the electrical field accompanied us throughout the years that followed."

As they became more involved in volunteering and working in local co-ops specializing in electrical engineering, the brothers launched plans of a dream to start their own business with hopes of one day making a change in the world.

"We plan to open this electrical engineering firm in our hometown, Toledo, to give other individuals growing up, attending primarily inner-city schools, a chance at learning STEM pathways," Deontre said. "We want to increase the representation of minorities in STEM and create opportunities for students to get more involved."

The twins said they already know fi sthand how discouraging the STEM pathway can seem to students, especially those who have no idea how their talents could translate into joining the fiel .

"We hope to someday offer students, like us, a chance at joining something greater than ourselves. A chance to inspire others," Deontre said.

Following the pandemic and protests, this promise they made only reaffirmed their pl .

As student jobs disappeared over the summer, the Toledo Blade caught up with the twins for their volunteer work helping children in the community.

"Our goals have not been re-orientated due to the current pandemic and ongoing systemic racism at hand," Deontre said. "In fact, these issues have fueled us to achieve our goals even more. With the loss of fully operational jobs, and children with nowhere to go, we want to do more. It is important to us that we create a place of work not only for ourselves, but for generations to come."

Th y are encouraged to see how systemic racism is a problem that society is final y facing head on, but they feel there is still a lot that needs to be done. Their goal is to help pave a path for the future.

"The change cannot happen unless everyone tries their best at making an honest effo t. My brother and I plan to make a change by creating a comfortable space that pushes for diversity in the workplace." Deontae said. "Everyone who works hard should have the same opportunities, whether generational wealth is a factor or not. You can't wait for systemic racism to end. You have to stand up against it and be willing to make an effo t for a better future. If you don't fight for yourself nobody will."

As far as the teamwork needed to make it all happen, the twins are a perfect match.

"I believe what kept my brother and I, Deontae, working together as a great team all these years is our friendly competition that began at an early age. My brother and I were always taught that there may be people more smart, talented, or even stronger than you, but you can never let anyone work harder than you," Deontre said.

By taking this motto into their daily lives, the twins continue to push and offer support to one another, when needed. It ultimately helped create an even stronger bond of brotherhood.

"Sometimes, obstacles could be as simple as agreeing on how to handle a situation, whether it be academic or personal, but we always managed to come together and help one another succeed. We believe that our goals and ambitions are what allow us to overcome challenges and our dreams are what keep us going," Deontre said. ■

Story by Ryan Horns | ECE/IMR Communications Specialist | Horns.1@osu.edu

"WE HOPE TO SOMEDAY OFFER STUDENTS, LIKE US, A CHANCE AT JOINING SOMETHING GREATER THAN OURSELVES. A CHANCE TO INSPIRE OTHERS."

LIANG GUO'S REVOLUTIONARY NEURAL INTERFACE ENGINEERING

Much like electrical circuits, the human brain communicates by electrical pulses. Finding ways to recreate, repair and harness such biological intelligence could provide the foundation of incalculable future engineering and medical breakthroughs.

At The Ohio State University, Electrical and Computer Engineering Assistant Professor **Liang Guo** has steadily collected signifi ant research into this realm, leading to his fi st edited book, "Neural Interface Engineering: Linking the Physical World and the Nervous System."

"This book represents the subarea in the field of neural engineering, which I have been exploring and practicing over the past seven years here at Ohio State," Guo said.

Such bioengineering research has already earned Guo numerous awards and funding. With this new book, however, he is now able to share the highly specific knowledge with graduate and advanced degree students worldwide.

"Writing a specialized book is quite diffe ent from writing a paper, as there is a long delayed gratifi ation," Guo said. "I also appreciate the contributors' dedication and effo ts over this long journey, without which this exciting book could never come out."

The book provides an introduction and summary of representative major neural interfacing technologies used to directly transmit signals between the physical world and the nervous system, with the ultimate goals for repairing, restoring and even augmenting body functions. It covers the classic noninvasive and invasive approaches for neural interfacing, as well as recent emerging techniques, including advanced implantable neural electrodes, nanomaterial-assisted and genetically engineered neural interfaces.

The original idea for creating the book, Guo said, arose while organizing a symposium dedicated to bioelectronics and neural interfaces at the 2018 Materials Research Society Spring Meeting.

"I thought it would be worthwhile to go a step further to summarize and introduce this hot area to a broader audience," he said. "This was the motivation to start this book project about three years ago."

Worldwide, research areas such as bioelectric medicine and neurotechnologies have become one of the hottest scientific and technological frontiers attracting enormous academic and public interests.

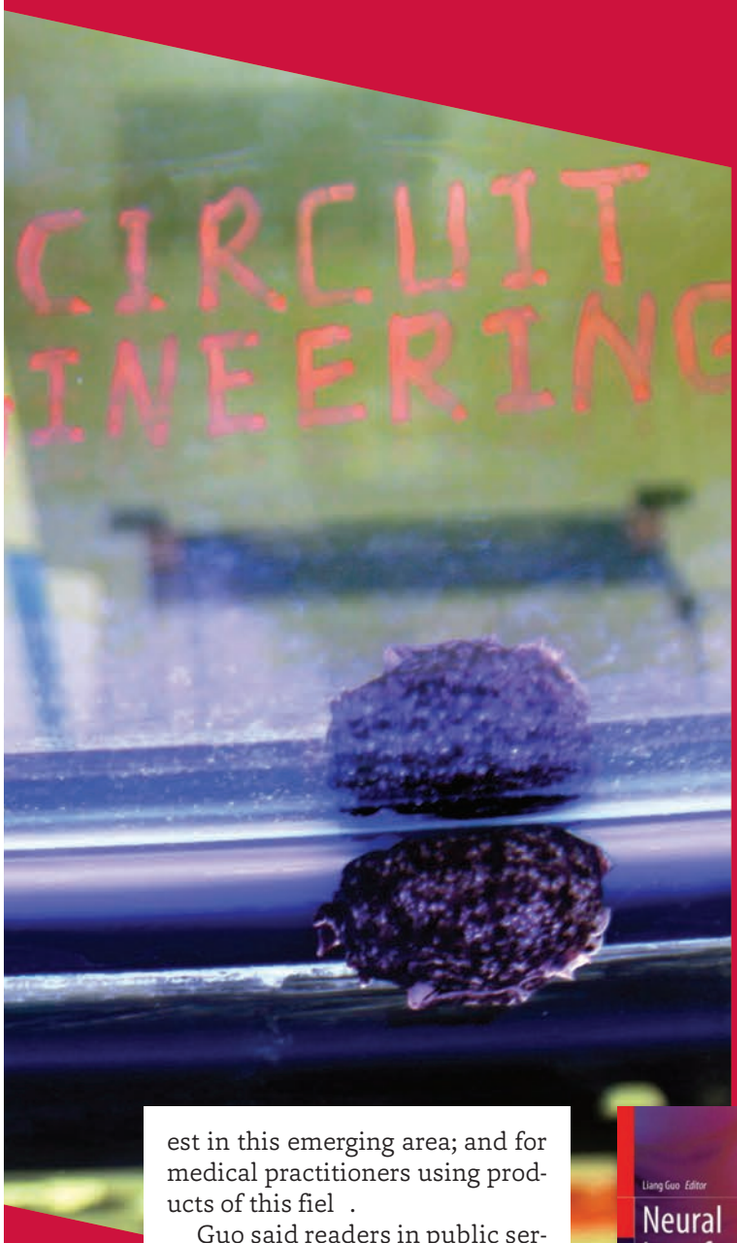
In the book preface, Guo explains how governments, private foundations, and many industrial giants like Facebook, Google, and GlaxoSmithKline are generously and enthusiastically investing in this venture as well.

As the projected technological market is expanding unprecedentedly, he said, interests in further learning the neurotechnological developments are growing fast in both the technical community and the general public.

"In developing such body-machine symbiotic systems, the scientific community recognized the neural interfaces as the technological bottleneck hindering further advances of the fiel ," Guo writes. "As a result, tremendous effo ts have been invested on neural interface engineering, leading to booming of this area over the past decade with a variety of exciting new developments. This book thus focuses on this important topic of neural interface engineering."

He said chapter authors on each topic are carefully selected among leading and practicing scientists.

The target audience for the new book includes graduate and advanced undergraduate students of bioengineering, biomedical engineering, applied physiology, biological engineering, applied physics, and related fields; as well as for biomedical engineers, neuroscientists, neurophysiologists, and industry professionals wishing to take advantage of the latest and great-



est in this emerging area; and for medical practitioners using products of this fiel .

Guo said readers in public services and government funding agencies may also find this book useful in learning the latest in the fiel .

At Ohio State, students interested in pursuing similar academic pathways can seek out ECE classes such as Guo's ECE 5070 Introduction to Neuroengineering and Neuroprosthetics, and Prof. **Asimina Kiourti**'s ECE 6011: Bioelectromagnetics. ■

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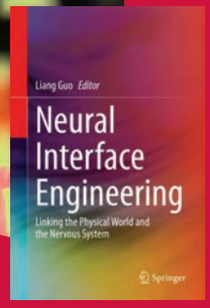

LIANG GUO
By Ryan Horns.

OHIO STATE COLLEGE OF ENGINEERING, 150 YEARS OF RESEARCH

ECE Professor Jin-Fa Lee is a leading authority in computational electromagnetics. He is credited for developing the first ever commercial-level toolset, later marketed under the program name HFSS.

For years, such codes, based on the finite element method, were not possible from solution convergence difficulties; the numerical solution was untrustworthy. Lee overcame this issue by introducing novel vector finite elements that avoided the spurious modes or nonphysical solutions, which plagued the solvers originally adapted from mechanical to electrical engineering applications. Because of Lee's contributions, the finite element ode HFSS is now the most successful in the world, and the standard package used to design radio frequency circuits and communication/radar/radio devices. Joining Ohio State's faculty and the ElectroScience Laboratory in 2000, Lee is an IEEE fellow and was awarded Ohio State's Distinguished Scholar Award in 2012. ■

FUTURE SO BRIGHT

OHIO STATE COMPUTER VISION RESEARCH

IN THE WORLD OF COMPUTER VISION RESEARCH, THE OHIO STATE UNIVERSITY IS RISING TO HOLLYWOOD LEVEL PROPORTIONS.

Out of more than 6,500 research papers submitted from around the world, just 26 were nominated for CVPR Best Paper Award and highlighted at the virtual international awards event in June.

The event is considered the premier international annual computer vision research expo.

Among those in the finals this year was Ohio State Electrical and Computer Engineering Professor **Aleix Martinez** and his team for the research, "Computing the Testing Error without a Testing Set."

The paper is co-authored with University of Barcelona colleagues **Ciprian Corneanu** and **Sergio Escalera**.

"These are the Oscars of computer vision," Martinez said. "We did not win the award, but being nominated is already a great accomplishment."

According to the team's abstract, Deep Neural Networks (DNNs) have revolutionized computer vision, expanding object recognition, facial expression analysis, and semantic segmentation, to name but a few.

To help explain this, know that artificial intelligence is when a machine is programmed to make informed decisions on its own. This technology is what helps decide how much water goes into a clothes washer, or provides the right amount of cash at an ATM. Similarly, machine learning involves programming to predict the right outcomes by providing access to relatable data.

Deep learning, however, is a field within machine learning and artificial intelligence, which deals with algorithms inspired from a human brain to aid machines with intelligence without explicit programming. This led to technology like Siri or Alexa, offeri g real-time responses to questions, or autonomous vehicles; even those apps which change your face to look like an elderly man or a cat.

According to the research, the current top DNN designs are mostly created by trial- and-error and lack consistency.

"Using a sequestered testing dataset may address this problem, but this requires a constant update of the dataset, a very expensive venture," the abstract states.

In their research proposal, the team created an algorithm to estimate the performance gap between training and testing that does not require any testing dataset.

"Specifi ally, we derive a number of persistent topology measures that identify when a DNN is learning to generalize to unseen samples," the team explains. "This allows us to compute the DNN's testing error on unseen samples, even when we do not have access to them. We provide extensive experimental validation on multiple networks and datasets to demonstrate the feasibility of the proposed approach." ■

Story by Ryan Horns
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KRISTINA M. JOHNSON *appointed* 16TH PRESIDENT *of The* OHIO STATE UNIVERSITY

Accomplished ECE Professor, leader and entrepreneur began her tenure on August 24.

Editor's Note: Th s story has been edited to reflect a change in Kristina M. Johnson's start date as Ohio State's 16th president.

The Ohio State University Board of Trustees appointed **Kristina M. Johnson**, PhD, as the 16th president in university history. Johnson, who served as chancellor of the State University of New York (SUNY) since 2017, brings more than 30 years of experience as an academic, business and policy leader.

"We are pleased beyond measure to welcome Dr. Johnson to Ohio State," said board chair **Gary R. Heminger**. "Her range of knowledge, service and accomplishments across sectors and throughout her career is nothing short of remarkable.

"She is uniquely positioned to make an immediate impact – building on Ohio State's momentum and advancing our mission to uplift lives through academic excellence."

As SUNY's chancellor, Johnson led a system of 64 public colleges and universities – including five academic health centers and three hospital systems – with 1.3 million students, 30,000 faculty and 90,000 employees overall. Prior to that, she founded and served as CEO of several successful science and technology companies, served as under secretary of energy at the U.S. Department of Energy (DOE) and held academic leadership positions at institutions such as Johns Hopkins University, Duke University and the University of Colorado at Boulder.

Johnson has close family ties to Ohio State and Ohio. Her grandfather graduated from Ohio State in 1896, played right guard on one of the early football teams and was a member of the Tesla Club. Family lore has it that Johnson's grandfather met her grandmother on the Columbus campus.

"Ohio State has always been a special place to me – well beyond its standing as one of the most respected teaching, research and patient-care institutions in the world," Johnson said. "I am humbled to be selected to lead this great land-grant university, and I look forward to meeting with students, faculty and staff to begin our work together."

At SUNY, Johnson launched a system-wide student success initiative that increased two-year community college graduation rates by 22%, cut in half the number of students requiring remediation before starting college credit-bearing coursework, saved students $47 million in textbook costs over three years and established a goal to hire 1,000 underrepresented minorities and women in STEM by 2030. She worked with New York's Empire State Development to form industry partnerships with IBM, Applied Materials and Cree totaling $4.6 billion with associated programs that helped advance SUNY research expenditures by $100 million year over year.

PHOTO : THE OHIO STATE UNIVERSITY

"SHE BRINGS DEEP ACADEMIC EXPERIENCE, EXPERTISE AND INCREDIBLE VISION TO OHIO STATE."

Johnson also partnered with the New York Power Authority to procure 100 percent renewable electricity at SUNY by 2023.

In her role as provost and senior vice president for academic affai s at Johns Hopkins, she led a university-wide strategic planning process, built up the Carey Business School and launched the MOSAIC Initiative to recruit underrepresented faculty. As dean of the Pratt School of Engineering at Duke, she led a strategic planning process that increased undergraduate enrollment by 20 percent, doubled the number of graduate students, tripled research expenditures, increased the school's endowment tenfold, and led to the construction of the Fitzpatrick Center for Interdisciplinary Engineering, Medicine and Applied Sciences. Also at Duke, Johnson worked to increase the percentage of women faculty from 6 percent to 19 percent. She hired 55 faculty members, including 19 early-career award winners and three members of the National Academy of Engineering.

Johnson succeeds **Michael V. Drake,** who has served as president since June 2014.

At Ohio State, she will lead and further shape the university's strategic plan as well as Time and Change: The Ohio State Campaign, an effo t to engage 1 million supporters in the areas of student success, discovery, and healthy, vibrant communities.

Johnson was recommended to the board by the Presidential Search Committee, chaired by trustee **Lou Von Thaer** and composed of a selection subcommittee and a 20-member advisory subcommittee of students, faculty, staff and stakeholders.

"Kristina has had a remarkable career, and she has demonstrated accomplished leadership in academic, corporate and government settings," Von Thaer said. "The Ohio State presidency is her dream job, a top national university with the scale to impact students, the state and national economies."

Johnson also served as a professor in the Electrical and Computer Engineering Department at the University of Colorado at Boulder and director of the National Science Foundation Engineering Research Center for Optoelectronic Computing Systems at the University of Colorado and Colorado State University. During her tenure at the University of Colorado at Boulder, Johnson co-founded and served as CEO of ColorLink, which focused on innovations in microdisplays and color polarizing technology. The company would become part of RealD, responsible for the Real3-D system used in more than 300 movies, including "Avatar."

The technology developed by Johnson and ColorLink was recognized by the National Inventors Hall of Fame and the John Fritz Medal (2008), which is among the most prestigious honors in engineering with past awardees that include **Thomas Edison, Guglielmo Marconi** and **Orville Wright**.

From 2009 to 2010, Johnson was the under secretary of energy at the DOE, managing a $10.5 billion energy and environment portfolio as well as an additional $37 billion in energy and environment investments from the American Recovery and Reinvestment Act. She worked with over 100 DOE scientists and engineers to create an energy plan to reduce carbon emissions by 83 percent by 2050. After leaving the DOE, Johnson co-founded and served as CEO of Cube Hydro Partners, a clean-energy infrastructure company that builds and operates hydropower plants in North America. During her tenure, the company grew from one to 19 plants, powering 150,000 homes with clean energy in five states. Cube Hydro Partners was sold in October of 2019 for $1.12 billion.

Johnson has published nearly 150 referenced papers and proceedings. Along with the John Fritz Medal, her awards include the Society of Women Engineers Lifetime Achievement Award (2004) and the Woman of Vision Award for Leadership by the Anita Borg Institute for Women and Technology (2010). She is a member of the National Academy of Engineering, the National Inventors Hall of Fame and the National Academy of Inventors, and holds more than 100 U.S. and international patents.

"Dr. Johnson is a widely recognized scholar and inclusive leader," said **Susan Olesik**, professor of chemistry and biochemistry and co-chair of the presidential search's advisory subcommittee, which collected input from the broader university community through public forums, online engagement and other outreach efforts.

"She brings deep academic experience, expertise and incredible vision to Ohio State," Olesik said.

Johnson earned her BS, MS and PhD in electrical engineering at Stanford University, where she was a varsity athlete in field hockey and founded the club varsity lacrosse team. Johnson has been awarded five honorary degrees and has served on several corporate boards. She is currently on the board of directors of Cisco Systems, Inc.

Johnson is married to **Veronica Meinhard**, a native of Caracas, Venezuela, and a four-time All-American swimmer at her alma mater, the University of Florida. Meinhard has 26 years of experience in higher education philanthropy and administration. She held leadership roles at both the University of Florida and the University of Maryland, College Park, before founding Juniper Philanthropy Partners. ■

ECE LEADERS NAMED AMONG 2020 EXCELLENCE IN ENGINEERING AND ARCHITECTURE ALUMNI AWARD WINNERS

Stanley E. Harrison

Timothy M. Pinkston

Allen M. Lo

Several representatives of The Ohio State University Electrical and Computer Engineering (ECE) community are included among the winning 21 recipients honored with 2020 Excellence in Engineering and Architecture Alumni Awards.

The full alumni list includes South Africa's fi st female nuclear engineer, a military jet propulsion systems designer, one of the developers of the Materials Genome Initiative, a nationally renowned historic preservation expert and an entrepreneur enhancing the lives of disabled Ohioans.

The awards recognize exceptional alumni from across the College of Engineering who have achieved distinction in their fields or through their extraordinary service contributions since graduating from Ohio State. A celebration of the 2020 winners will be held in 2021, once it is safe to gather in person.

"We are delighted to honor these alumni who better their communities and our world through their extraordinary professional achievements, innovation and service," said **Dean David B. Williams**, the Monte Ahuja Endowed Dean's Chair. "Th y represent the best and brightest graduates from across the College of Engineering and inspire us all."

A face familiar to the ECE department won the Lifetime Achievement Award for Leadership, which will be presented to innovator **Stanley E. Harrison** (BS '58, electrical engineering). During his 20-year career at BDM Corporation, Harrison developed new technologies for the Department of Defense. After retiring as president and COO in 1988, he served as founding dean of the Harry F. Byrd Jr. School of Business at Shenandoah University. A longtime supporter of his alma mater, he established the Harrison Faculty Award to recognize excellence in engineering education and created an endowed scholarship that supports up to four engineering students from Gallia, Jackson and Meigs counties in southern Ohio.

"The Ohio State University has been the basis for my professional life as an engineer, research scientist, entrepreneur, corporate operation executive and educator at the university level," Harrison said.

Other college award winners this year include acclaimed computer system architecture and interconnection networks researcher **Timothy M. Pinkston** (BS '85, electrical engineering) is the George Pfleger Chair in Electrical and Computer Engineering and vice dean for faculty affai s in University of Southern California's Viterbi School of Engineering. With over 100 technical publications, he has made key research contributions for abating interconnection network routing inefficiencie and preventing deadlock.

Allen M. Lo (BS '90, electrical engineering) is deputy general counsel for product, IP and legal operations at Facebook, where he leads a team of over 250 responsible for providing legal counsel and protecting company intellectual property rights. Previously, Lo was deputy general counsel for patents at Google, where his team played a central role in the smartphone patent wars. ■

ECE Priorities

RECRUIT OUTSTANDING FACULTY:

The new faculty we are recruiting will perform cutting-edge ECE research to impact our future in autonomous vehicles, smart robotics, cancer treatment, concussion prevention/diagnosis, energy systems, and the internet-of-things. Support from our alumni is crucial for helping us to provide startup funds and endowed chair support to enable these innovations and endowed chair positions to attract outstanding new faculty.

STUDENT-LED INNOVATION:

Our graduate students are the driving force behind Ohio State's research progress. Their success builds not only their future career, but also the university's reputation and our nation's critical technologies. Support from our alumni helps us to provide fellowships for the graduate program that enable these students to concentrate on their research rather than day-to-day financial concerns

UNDERGRADUATE ACCESS:

Department scholarships enhance the ability of our students to pursue their dreams of an ECE education. These are especially important during freshman and sophomore years, as students build their skills to pursue future internships and co-ops. We are proud of the generous support ECE alumni have provided to our undergraduate students and hope to build upon this success to further reduce college costs for deserving students in our programs.

MODERN LEARNING ENVIRONMENTS:

ECE facilities are meeting the needs of our student body, but face challenges moving forward. The replacement of Caldwell Laboratory is a long-term goal; more immediate needs include smaller renovations of the Control Systems Laboratory, relocation of the electronics group, improvements in equipment for the sophomore teaching laboratories, enhancements to the laboratory space for our project-based master's program, and the creation of a "maker" space for our undergraduate students to pursue their innovative ideas. Alumni support helps us meet our facility needs going forward.

OTHER OPPORTUNITIES:

Many opportunities exist for our alumni to make significant impacts. Thes include endowments to support annual awards recognizing outstanding performance by our graduate or undergraduate students, support for expansion of the ECE-led Humanitarian Engineering program (including support for students to participate in humanitarian projects) and support for the ECE K-12 Engineering Outreach Program that has already taught more than 13,500 young students across Ohio about STEM topics applicable to society.

SUPPORT

WAYS TO GIVE

There are many ways to give to the Department of Electrical and Computer Engineering, including establishing an endowed or support fund, or contributing to the ECE fund of your choice.

You can contribute directly to an ECE fund through The Ohio State University Online Giving secure website giveto.osu.edu. Visit our list of ECE department program support and scholarship funds to find out more: ece.osu.edu/alumni/support

CONTACT US

Please contact **Katie Coen,** ECE Director of Development, at coen.40@osu.edu or (614) 688-2212, with any questions or to discuss giving opportunities.

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