MIMICKING MANTIS SHRIMP FINDING THE BALANCE RACING ACROSS AUSTRALIA SUPPORTING ENGINEERING STUDENTS PARTNERING WITH INDUSTRY LOOKING UP AND COLLECTING DATA FORGING YOUR PATH

RESONANCE

THE MAGAZINE OF ECE ILLINOIS

WINTER 2017/18

SEEING CANCER THROUGH NEW EYES

ILLINOIS
Electrical & Computer Engineering
COLLEGE OF ENGINEERING

TOP OF MIND

In this issue, you'll find two stories with a health care focus (pages 10 and 18). Both feature ECE ILLINOIS faculty members who are also part of the faculty at the Carle Illinois College of Medicine. Engineering is at the heart of the new college's research, and our faculty members continue to pursue impactful and exciting breakthroughs that promise to change the way we all experience medical care.

I'm also excited to share the college's progress toward the Engineering Visionary Scholarship Grainger Matching Challenge (page 25). These scholarships allow us to bring the best and brightest to Illinois by making college more affordable. Gifts to the EVS fund have a direct impact on these students' lives and on society. They enable future engineers to fuse their talent and passion with the world-class education and skills they need to solve the world's greatest challenges. Be sure to read the story of one of these students on the back cover of this magazine.

I will be travelling this summer to attend events for our alumni and friends across the country. Gatherings are planned for New York City, Washington DC, and the Bay Area in April with more to come. We send invitations by email. Please take a moment to update your information with us at » **go.ece.illinois.edu/stayconnected**. I look forward to seeing many of you later this year.

Sincerely,

William H. Sanders
ECE Department Head
Donald Biggar Willett Professor of Engineering

RESONANCE

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This publication is available in an accessible electronic format at **ece.illinois.edu/newsroom/resonance**.

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Jaushin Lee (PhD '92)
Zentera founder and CEO

OUR STUDENTS, FACULTY, AND ALUMNI MADE HEADLINES WITH THEIR WORLD-CHANGING ACCOMPLISHMENTS.

FOR OUR FULL LIST OF TOP STORIES OF LAST YEAR, VISIT » GO.ECE.ILLINOIS.EDU/TOPSTORIES

ILLINOIS CLAIMS VICTORY AT NVIDIA AI CITY CHALLENGE

The Illinois team of researchers placed first by a large margin in the premier IEEE Smart World NVIDIA AI City Challenge. For two months, they competed against academic labs from around the globe to make strides in the field of computer vision and engineer the most effective model for object detection in traffic video.

The team's work was supported in part by IBM-ILLINOIS C3SR, directed by Professor Wen-Mei Hwu and Dr. Jinjun Xiong from IBM Research.

Learn more about the challenge at » go.ece.illinois.edu/nvidia2017.

SANDERS EDUCATES CONGRESS ABOUT ELECTRIC GRID AND CYBER RESILIENCY

ECE ILLINOIS Department Head William H. Sanders, Donald Biggar Willett Professor of Engineering, testified before the 115th United States Congress as one of four witnesses in a hearing titled "Resiliency: The Electric Grid's Only Hope" held by the Committee on Science, Space, and Technology.

The purpose of the hearing was to help define resiliency, discuss recommendations from the report, and highlight the importance of research focused on grid resiliency, infrastructure, and operational strategy.

Learn more about the questions asked by Congress and see a video of the hearing at
» go.ece.illinois.edu/sanders-testimony.

Photo credit: Elizabeth Innes, I-STEM Education Initiative
Paula-Angela Mariano and Molly Pace, alumni and keynote speakers at this year's WIE orientation.

WOMEN IN ENGINEERING ORIENTATION WELCOMES LARGEST GROUP TO DATE

Recent ECE ILLINOIS graduates Paula-Angela Mariano (BSEE '16) and Molly Pace (BSEE '16) shared their knowledge and experiences as the keynote speakers for this year's Women in Engineering (WIE) Orientation. Both work at Texas Instruments (TI), who, along with Abbot, sponsored Orientation for the second year in a row.

Since the orientation's inception 15 years ago, 2,724 female freshman engineering students have participated, with 268 students from the fall 2017 freshman class attending. Another impressive number? The 268 women attending orientation were a just bit more than half of the total number of female engineering students in the fall 2017 class. This represents the largest number (496) and percentage (25%) of women ever in a freshman engineering class at Illinois—a milestone for Women in Engineering and a cause for celebration.

For the top five pieces of advice shared with incoming freshmen, visit » go.ece.illinois.edu/wie2017.

›PROFESSORS ›ALLEN ›BAYRAM ›BOPP CHOQUETTE ›CUNNINGHAM ›DALLESA ›GONG ›GRUEV ›HAKEN ›HANUMOLU ›A ›KREIN ›KUMAR ›LEBURTON ›LEE ›LI ›L ›CHOUDHURY ›SANDERS ›SAUER ›SING ›VARODAYAN ›VARSHNEY ›ZHAO ›ZHU

FACULTY AWARDS

JONT ALLEN
Keynote speaker and session speaker, 2017 Science, Technology and Engineering, Arts, Mathematics and Education Conference

CAN BAYRAM
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Senior Member, IEEE

STEPHEN ALLEN BOPPART
IEEE Technical Achievement Award - Engineering in Medicine and Biology Society

DEMING CHEN
2016 ACM Distinguished Service Award
First place, 2017 IEEE/ACM Design Automation Conference (DAC) International Hardware Design Contest
Invited keynote paper for *Integration*, the VLSI journal

XIAOGANG CHEN
Senior Member, IEEE

WENG CHO CHEW
IEEE Electromagnetics Award
President-Elect, IEEE Antennas and Propagation Society

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AAAS Fellow

JOHN MICHAEL DALLESASSE
$2.5 million grant from NSF and Semiconductor Research Corporation

MINH N. DO
Associate, Center for Advanced Study, 2017-18

IVAN DOKMANIĆ
Ecole Polytechnique Fédérale de Lausanne (EPFL) outstanding Doctoral Thesis Award
Google Faculty Award

LIANG GAO
NSF CAREER Award

LYNFORD L. GODDARD
2016 Leadership in Diversity Larine Y. Cowan "Make a Difference Award"

SONGBIN GONG
2017 NASA Early Career Faculty Award
Best Paper Award, 2017 International Frequency Control Symposium

VIKTOR GRUEV
Best Live Demo Award, IEEE Circuits and Systems Conference
Best Paper Award, IEEE Circuits and Systems Conference

LIPPOLD HAKEN
Invited keynote speaker, The Future Sound of Pop Music 2017 Research Symposium
Keynote speaker, ContinuuCon 2017

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Best Paper Award, 22nd ACM International Conference on ASPLOS
2017 Dean's Award for Excellence in Research, Engineering at Illinois

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2016 ACM Doctoral Dissertation Award
Best Paper Award, 2017 ACM MobiSys

THOMAS S. HUANG
2016-17 A.T. Yang Research Award

JIANMING JIN
2017 Harrington-Mittra Award in Computational Electromagnetics, IEEE Transactions on Antennas and Propagation
Adjunct Professorship, University of Technology Sydney, 2016-19
Best Student Paper Award (Tianjian Lu), IEEE Electrical Design of Advanced Packing and Systems (EDAPS)

NAM SUNG KIM
2017 ACM SIGARCH and IEEE-CS TCCA ISCA Influential Paper Award
MICRO Hall of Fame Inductee

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PHILIP T. KREIN
China 1000 Talents Program, Foreign Experts category

RAKESH KUMAR
Best Paper Award, 22nd ACM International Conference on Architectural Support for Programming Languages and Operating Systems
Engineering Council Outstanding Advising Award

JEAN-PIERRE LEBURTON
IEEE Life Membership
Illinois Proof-of-Concept program awardee

MINJOO LARRY LEE
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XIULING LI
Fellow, IEEE

ZHI-PEI LIANG
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Keynote speaker, 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society
Savio Woo Lecturer, The 8th World Congress on Bioengineering

JONATHAN J. MAKELA
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JANAK H. PATEL
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Author, "The power of imaging with phase, not power," *Physics Today*
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Distinguished Alumni Award, Department of Computer Science, University of Illinois at Urbana-Champaign
Runner Up Award, 2016 ACM MobiCom, Student Research Competition

WILLIAM H. SANDERS
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PETER SAUER
Honored for Continued and Dedicated Service Award as Chair of PES Scholarship Plus Initiative
Two awards for continued and dedicated service as the Vice President of Education and Chair of the IEEE Power and Energy Society Scholarship Plus Initiative

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Fellow, Technical University of Munich Institute for Advanced Study
Interim Director, Siebel Center for Design

PARIS SMARAGDIS
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R. SRIKANT
Plenary Speaker, 2017 Applied Probability Conference

DAVID VARODAYAN
2017 Engineering Council Outstanding Advisor

LAV R. VARSHNEY
Finalist, 2016 Bell Labs Prize
Illinois Proof-of-Concept program awardee
Siebel Energy Institutes seed grant awards

ZHIZHEN ZHAO
2nd Place, ACM TAU-2017 CAD Software Contest of Timing Analysis

ZHIZHEN ZHAO
NCSA Faculty Fellow

WENJUAN ZHU
2017 NSF CAREER Award

We publish the latest achievements of our faculty on our website and on social media. Visit » **ece.illinois.edu** for our most recent headlines.

THREE FACULTY MEMBERS HONORED WITH NAMED APPOINTMENTS

Three faculty members have been honored with new named appointments at ECE ILLINOIS. Made possible by the generosity of alumni and friends, these appointments allow the department to recruit and retain promising researchers and teachers, encouraging them to expand their work and careers at Illinois.

J. Gary Eden, Intel Alumni Endowed Chair in Electrical and Computer Engineering, is an international expert and leader in atomic, molecular, and ultrafast laser spectroscopy. His research contributions include the first violet and UV fiber laser, the demonstration of UV-assisted photochemical vapor deposition to semiconductors, and the invention of the plasma bipolar junction transistor. He holds 44 patents in the last five years and was elected into the National Academy of Inventors in 2014.

Douglas L. Jones, William L. Everitt Distinguished Professor in Electrical and Computer Engineering, is an expert in multiple fields and a global leader in the area of digital signal processing. As the principle investigator of the Integrative Graduate Education and Research Traineeship (IGERT), he has led significant advancements in intelligent hearing aids, biologically inspired sensory systems, and ultra-low-power electronic systems. He also serves as director of the Advanced Digital Sciences Centre (ADSC), Illinois at Singapore.

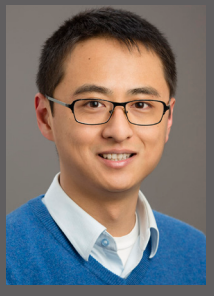
Farzad Kamalabadi, Kung Chie and Margaret Yeh Endowed Professor in Electrical and Computer Engineering, has made outstanding multi-disciplinary contributions, including solar rotational tomography, computationally efficient spatiotemporal imaging, and ionospheric sensing and imaging. His research highlights a precise understanding of our space environment, devising novel computational signal and image processing techniques for optimal estimation of multidimensional physical parameters from lower-dimensional observables which have also been used in application with magnetic resonance and ultrasonic imaging in medicine.

FIVE NEW FACULTY MEMBERS JOIN ECE ILLINOIS

The department welcomed five new tenure-track faculty members last spring. Along with the ten tenure-track faculty and one research professor who joined in fall 2016, this group represents the largest increase of new faculty in a single academic year in recent memory.







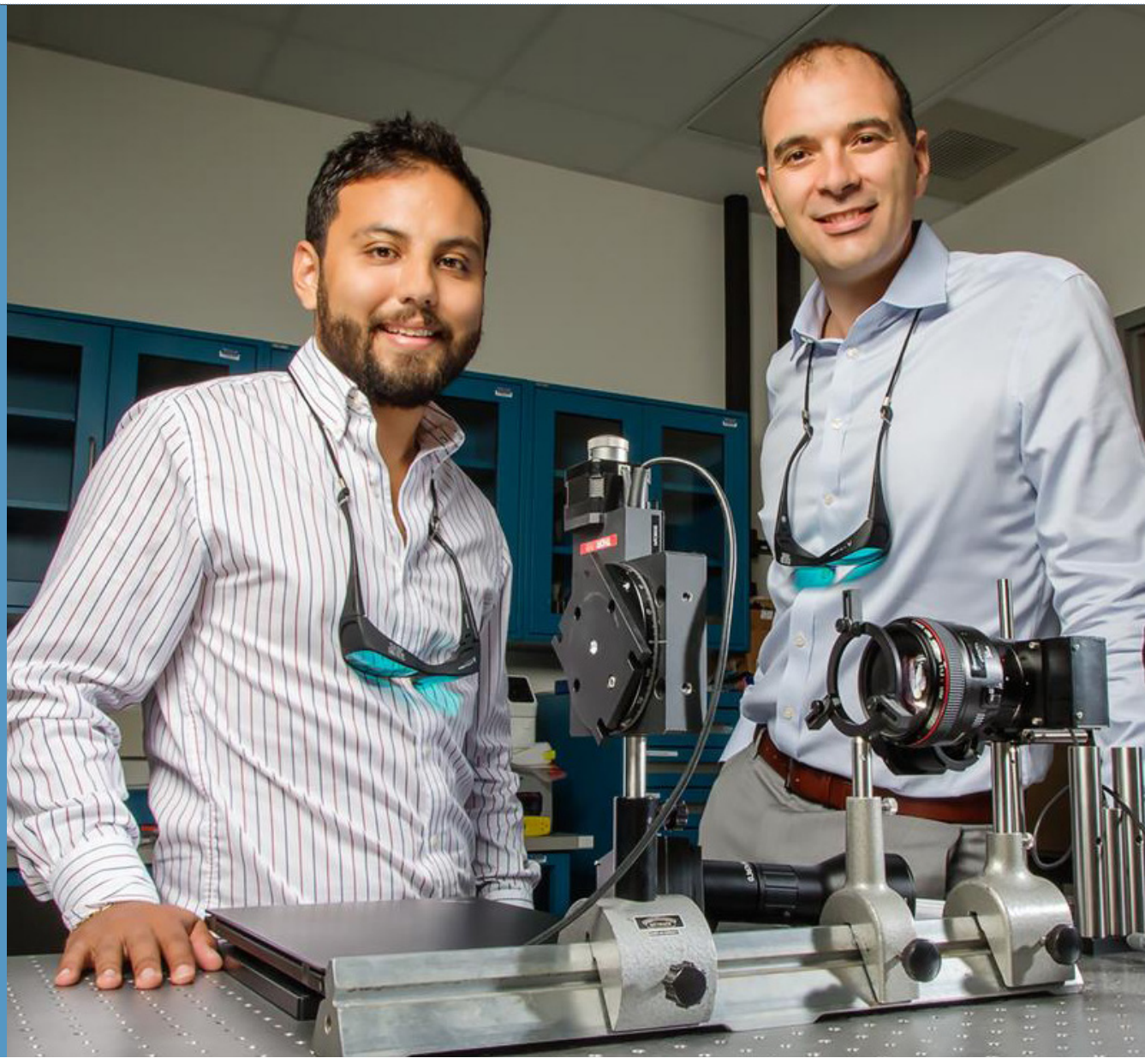
ASSISTANT PROFESSOR ARIJIT BANERJEE received his PhD in electrical engineering from the Massachusetts Institute of Technology. Prior, he worked at General Electric Global Research Center, India, and was a visiting researcher at the Institute for Power Electronics and Control of Drives, Technische Universität Darmstadt, Germany. His research mission is to create inexpensive, clean, and efficient energy conversion systems through the application of power electronics, electromagnetics, electromechanics, and control. He holds thirteen issued patents.

ASSISTANT PROFESSOR IVAN DOKMANIĆ received a doctorate in computer and communication science from Ecole Polytechnique Fédérale de Lausanne. Previously he was a teaching assistant at the University of Zagreb, a codec developer for MainConcept AG, and with Microsoft Research where he worked on ultrasonic depth sensing. He works on a medley of audio and acoustics, distance geometry, and inverse problems theory. He is a laureate of the EPFL Outstanding Doctoral Thesis Award. One of his ongoing projects on the use of echoes in auditory scene analysis is funded by a Google Faculty Research Award.

ASSISTANT PROFESSOR RALUCA ILIE focuses her research on the development and application of high-performance, first-principles computational models to describe and predict the conditions in the near-Earth space leading to geomagnetic storms. She served as a research scientist at the Center for Space Environment Modeling at the University of Michigan, where she was a core member of the software developing team for the Space Weather Modeling Framework. Prior to that, she has been an NSF Postdoctoral Fellow at Los Alamos National Laboratory, working on TWINS NASA space mission data.

ASSISTANT PROFESSOR IDOIA OCHOA received her master's and PhD in electrical engineering from Stanford University. Her research interests include data compression, bioinformatics, information theory and coding, machine learning, and signal processing. She holds two U.S. patents, conducted internships at Google and Genapsys, and served as technical consultant for the HBO show *Silicon Valley*. She is an organizer of the Stanford Compression Forum and an active participant of the initiative to define and establish a compression standard for genomic data as part of the International Organization for Standardization.

ASSISTANT PROFESSOR JIN ZHOU received his PhD from Columbia University. Originally from China, he spent one year as an RFIC design engineer in Singapore prior to his PhD. His research centers around integrated circuit design, with a current focus on circuits and systems for next-generation wireless communications. He demonstrated the world's first integrated full-duplex radio – a compact radio on a chip that can concurrently transmit and receive at the same frequency. In collaboration with wireless networking researchers, he contributed to the development of full-duplex wireless network through a cross-layer approach.

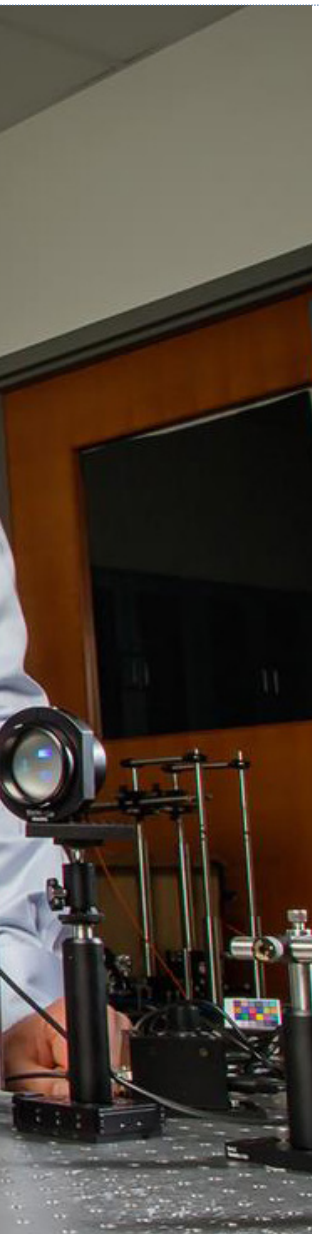


SEEING CANCER THROUGH NEW EYES

BY LOIS YOKSOULIAN, ILLINOIS NEWS BUREAU
PHOTO ABOVE BY L. BRIAN STAUFFER
FIELD PHOTOS PROVIDED BY VIKTOR GRUEV

By mimicking the eye of the mantis shrimp, Illinois researchers have developed an ultra-sensitive camera capable of sensing both color and polarization. The bioinspired imager can potentially improve early cancer detection and help provide a new understanding of underwater phenomena.

"The animal kingdom is full of creatures with much more sensitive and sophisticated eyes than our own," said Viktor Gruev, ECE ILLINOIS professor and co-author of the study. He is also a faculty member of the Carle Illinois College of Medicine, director of the Biosensors Lab at Illinois, and affiliated with the Beckman Institute for Advanced Science and Technology.



“THE ANIMAL KINGDOM IS FULL OF CREATURES WITH MUCH MORE SENSITIVE AND SOPHISTICATED EYES THAN OUR OWN.”

VIKTOR GRUEV

“These animals perceive natural phenomena that are invisible to humans. Polarization of light – that is, the direction of oscillation of light as it propagates in space – is one such example. While most of us are familiar with polarized sunglasses, which simply remove glare, many animals use polarized vision as a covert communication channel, to find food, or even to navigate by sensing polarization patterns in the sky.”

The mantis shrimp, considered one of the best hunters in shallow waters, possesses one of the most sophisticated eyes in nature. Compared with human vision, which has three different types of color receptors, the mantis shrimp has 16 different types of color receptors and six polarization channels, Gruev said.

“These organs not only surpass the sensitivity of our own visual systems, they also capture more visual information, using less power and space, than today’s most sophisticated, state-of-the-art cameras,” he said.

Graduate student Missael Garcia and Gruev (pictured above on the opposite page) led an effort to replicate the shrimp’s visual system using some basic physical concepts.

Continued »

IMPACT

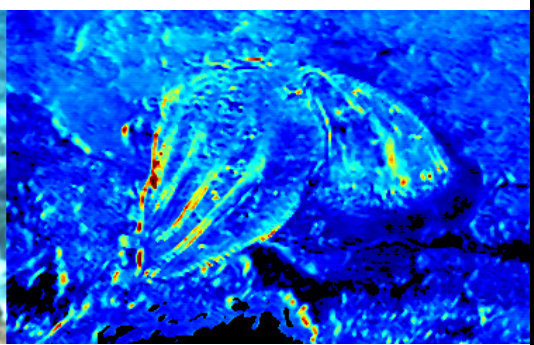
"THE SAME LAWS OF PHYSICS THAT APPLY TO THE MANTIS VISUAL SYSTEM ALSO APPLY TO SILICON MATERIALS, THE MATERIAL USED TO BUILD OUR DIGITAL CAMERAS"
MISSAEL GARCIA

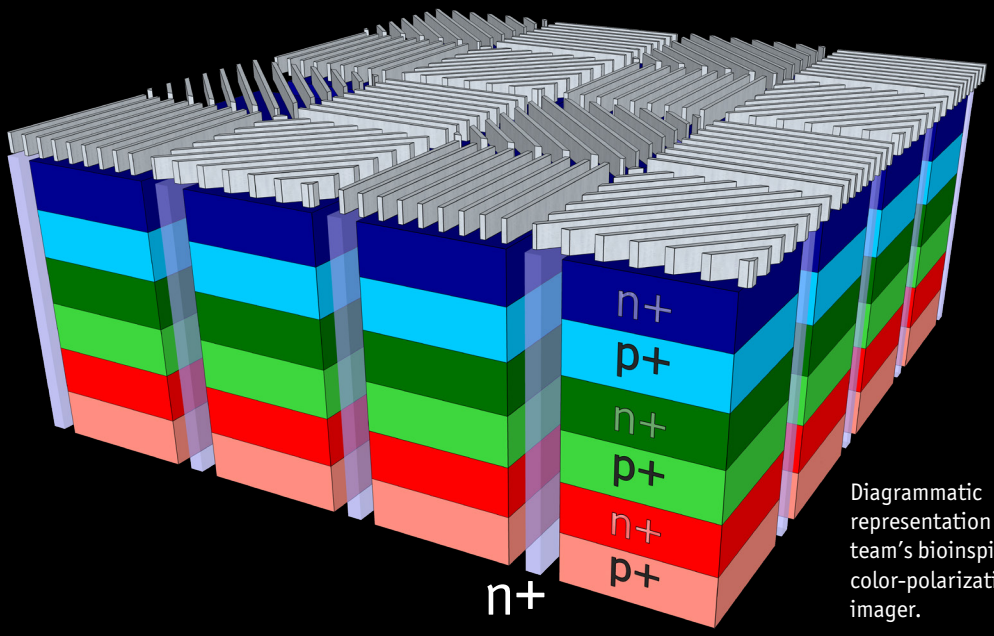
"Nature has devised materials such that different colors of light penetrate at different depths," said Gruev, who also directs the Biosensors Lab at Illinois. "If we shine a blue laser and a red laser on the tip of our finger, we can only observe the red light on the other side of the finger. This is because the red light can penetrate deeper in the tissue."

"Nature has constructed the mantis shrimp eye in such a way that photosensitive elements are vertically stacked on top of each other," Gruev said. This stacking allows for absorption of shorter wavelengths, such as blue light, in the shallow photoreceptors and red light in the deeper receptors. The photoreceptors are organized "in a periodic fashion at the nanoscale that allows them to also 'see' the polarized properties of light," he said.

"The same laws of physics that apply to the mantis visual system also apply to silicon materials, the material used to build our digital cameras" Garcia said. "By stacking multiple photodiodes on top of each other in silicon, we can see color without the use of special filters. And by combining this technology with metallic nanowires, we effectively have replicated the portion of the mantis shrimp visual system that allows it to sense both color and polarization."

These underwater images illustrate how polarized vision highlights certain regions of an object.





Diagrammatic representation of the team's bioinspired color-polarization imager.

This unique combination of silicon photodetectors and nanomaterials allowed the Illinois research team to create a point-and-shoot color-polarization camera. The applications for such cameras are wide-ranging, from early cancer detection to monitoring changes in the environment to decoding the covert communication channels that many underwater creatures appear to exploit, the researchers said.

In a previously published study by Gruev, a bioinspired polarization sensor fitted to a colonoscope could detect the disordered nature of cancerous cells in the human colon.

"By mimicking the mantis shrimp visual system, we have created a unique camera that can be used to improve the quality of our lives," Gruev said. "The notion that we can detect early formation of cancer is what is driving this research forward. The cost of this technology is less than $100, which will enable quality health care in resource-limited places around the world."

WATCH A VIDEO ABOUT THIS BIOINSPIRED RESEARCH AT
» GO.ECE.ILLINOIS.EDU/MANTIS-VIDEO

FOCAL POINT

» THREE ECE ILLINOIS STUDENTS WERE AMONG THE RESEARCHERS WHO SPENT LAST SUMMER AT THE ARECIBO OBSERVATORY IN PUERTO RICO. SENIOR KHUSHBOO JAIN AND GRADUATE STUDENTS GONZALO AUGUSTO CUCHO PADIN AND BILL WANG JOINED FACULTY AND STUDENTS FROM MIT, BOSTON UNIVERSITY, AND OTHER INSITUTIONS FOR THE "INCOHERENT SCATTER RADAR (ISR) SUMMER SCHOOL."

PHOTOS BY KHUSHBOO JAIN

SHARON HWANG:

FINDING THE BALANCE

Photo credit: Della Perrone

BY DEB ARONSON

Sharon Hwang (BSEE '90) came to the University of Illinois not knowing what, exactly, she wanted to do with her life.

Growing up in Naperville, Hwang never doubted she would go to Illinois. Being strong in the STEM fields — and with both parents working scientists and an older sister majoring in math/computer science at Illinois — her only question was what concentration within engineering she might choose. Her dad suggested electrical engineering, which he believed provided maximum flexibility in career choices.

And, except for a moment her junior year when she considered switching to broadcast journalism, Hwang has been happy she followed her father's advice, which has led to a fascinating and fulfilling career while balancing outside interests and a family.

"I've even given the same advice to my own kids," she says with a laugh.

One downside to being in electrical engineering, however, was that Hwang was one of only two or three women in every class, which was "definitely tough." She responded by joining Zeta Tau Alpha sorority.

"With so few women in my classes, it was a great way to meet more women," she said of the sorority. "I was looking for balance."

Hwang participated in numerous extracurricular activities, including intramural sports, with her sorority sisters.

"My favorite memory is playing powder-puff football," she says. "Just getting out and running around and doing it with a team was the best."

Fond memories of her undergraduate experience, as well as the desire to help others, meant that Hwang was thrilled when she was asked to join the ECE alumni board in 2015.

"I was so honored and excited to be invited to join the ECE alumni board," she says. "It gives me a wonderful opportunity to meet and mentor current ECE students and alumni, to help ECE maintain and enhance its reputation, and equally importantly, to encourage the recruitment and retention of female faculty and students in ECE."

As graduation approached, Hwang wondered if there was a way to use her engineering background in a non-traditional way. She even considered law school. After a year at Andersen Consulting in Chicago, Hwang decided to take the plunge and enrolled in Boston College Law School, where she learned about patent law.

"It's a perfect way of meshing the technical without being confined to a lab," she says. "And I liked writing, so it was a great match."

Hwang was hired by McAndrews, Held and Malloy, Ltd., then a small Chicago patent firm of 19, which has since grown to about 80 lawyers over the almost 25 years she's worked there. Hwang represents clients in high-stakes patent litigation over cutting-edge technology in federal district courts, the Federal Circuit Court of Appeals, and more recently, the United States Supreme Court. She has been named an Illinois Super Lawyer and IP Star every year since 2015 and included in "Best Lawyers Under 40" by the National Asian Pacific American Bar Association.

In the legal field, however, Hwang finds herself as a double-minority as an Asian-American woman.

Hwang has addressed her minority status the same way she did in college; she joins groups that help her create a better balance. For example, she is a past president of the Asian American Bar Association, immediate-past President of the Asian American Bar Association Law Foundation, and is a member of the executive board of the Chicago Committee on Minorities in Large Law Firms, which seeks racial and ethnic diversity in the legal profession. She also chairs her firm's Diversity Committee, where she spearheaded the launch of the firm's Diversity in Patent Law Fellowship, and she sits on her firm's Executive Management Committee.

"I love what I do," she says. "Patent law is a great option for people who are both technically proficient and skilled communicators. I am always telling other engineers to consider this path."

THE MOLECULES OF MEDICATIONS

GSK AND THE BIOPHOTONICS IMAGING LAB ARE USING ADVANCED OPTICAL IMAGING TO IMPROVE THE DEVELOPMENT OF TOPICAL MEDICATIONS

BY DORIS DAHL, BECKMAN INSTITUTE

GSK's global search for the right partner led them to the Biophotonics Imaging Lab at the Beckman Institute and the lab's director, ECE ILLINOIS Professor Stephen Allen Boppart. Boppart is also the Abel Bliss Professor of Engineering and a faculty member of the Carle Illinois College of Medicine.

"Steve proposed a structure where we have GSK working side-by-side in the lab with postdocs and grad students working on the same project," said Zane Arp, U.S. lead for imaging technologies at GSK and co-director of the center. "They're advancing the technology. We're advancing the applications. And the marriage of those two makes the sum greater than either part."

"Our advanced optical imaging techniques also enable new molecular, metabolic, structural, and functional imaging of cells and tissues, even in human subjects," said Boppart, who is co-chair of the Integrated Imaging theme and co-director of the GSK Center. "All of these aspects were directly relevant to what GSK was looking for in order to advance their drug discovery and development. There is a clear need to image drug distribution and efficacy at the molecular-cellular level in living tissues, and our techniques and technologies were a perfect fit."

IMPROVING EFFICACY

The techniques involve laser light that penetrates the skin to a depth of about 200 to 500 microns. (The width of a single human hair ranges from about 50 to 100 microns.) The light can actually penetrate completely through the skin—up to 10 centimeters—but it only provides valuable high-resolution imaging and feedback at about 200 microns in depth, according to Arp.

"Traditional imaging modalities such as MRI, x-ray, and CT typically measure morphological (or structural) changes," Arp said. "We're looking more for the small changes, the chemical-level changes that occur before you ever see that morphological change."

Detecting how medications work at the molecular-cellular level can save time and money.

The new optical imaging techniques allow researchers to see what targets the medication is hitting in a variety of different systems including cells, animals, and humans. This allows vertical translation of methods from these systems into clinical work, such as dermatology. In dermatology, the techniques can be used to determine how long the drug stays on the skin, the dosing regimen, and drug-target interaction. Skin is the body's natural protective layer so figuring out how much medication—if any—is penetrating the skin can be problematic.

Continued »

Co-directors for the GSK Center for Optical Molecular Imaging: Zane Arp, U.S. lead for imaging technologies at GSK, and Professor Stephen Boppart

Curious about how how light is being used to generate high-resolution, real-time, non-invasive images of biological tissue at the cellular and molecular level for diagnosing diseases such as cancer?

Professor Boppart explains in a video by the Beckman Institute at » **go.ece.illinois.edu/ boppart-molecular.**

"Most dermal drugs fail because they don't manage to get through the stratum corneum (the first layer of skin)," said Aneesh Alex, who is a GSK employee and a postdoctoral fellow in the center.

"As a drug development company, one of the critical aspects of our dermatologic drugs is how we defeat the barrier so that we're getting our medicine where it needs to go in the patient," Arp said.

"If you get too much penetration too quickly, you'll just wash it out into your bloodstream," he explained. "If you get too little penetration then you don't see any effect. We also have to prove that the drugs hit the primary target the hardest. That's where we get the most efficacy. It's an art actually."

"WE HAVE A VERY UNIQUE ACADEMIC-INDUSTRY PARTNERSHIP THAT IS DEMONSTRATING EARLY SUCCESS." STEPHEN BOPPART

Another benefit of the new platform of technologies is that they allow researchers to observe changes at the cellular level without tagging the medication applied with a dye, which can impact the test results.

The center has three to four projects in progress, and researchers have completed nearly half-a-dozen studies with several in publication. The noninvasive techniques also allow the center to do its dermatological research on healthy human subjects as well as animal models.

"The other beauty of this is that we can do what we call an optical biopsy because it eliminates the need for a true biopsy, where you need to extract a tissue sample," Arp said.

Alex said, "we are also planning to go beyond the optical capabilities so we want to make use of the MRI and PET capabilities that we have here. And I think that is something unique about Beckman. We have all the resources here under one roof. I think that is one of the main reasons GSK wanted to come here. Not a lot of places have these kinds of resources in one location."

And even though it's early, the center is seeing results and impacting decisions at GSK that will improve patient care.

"Being able to see our drugs have an action at the earliest possible time point improves safety, improves the efficacy, and improves our knowledge base," Arp said.

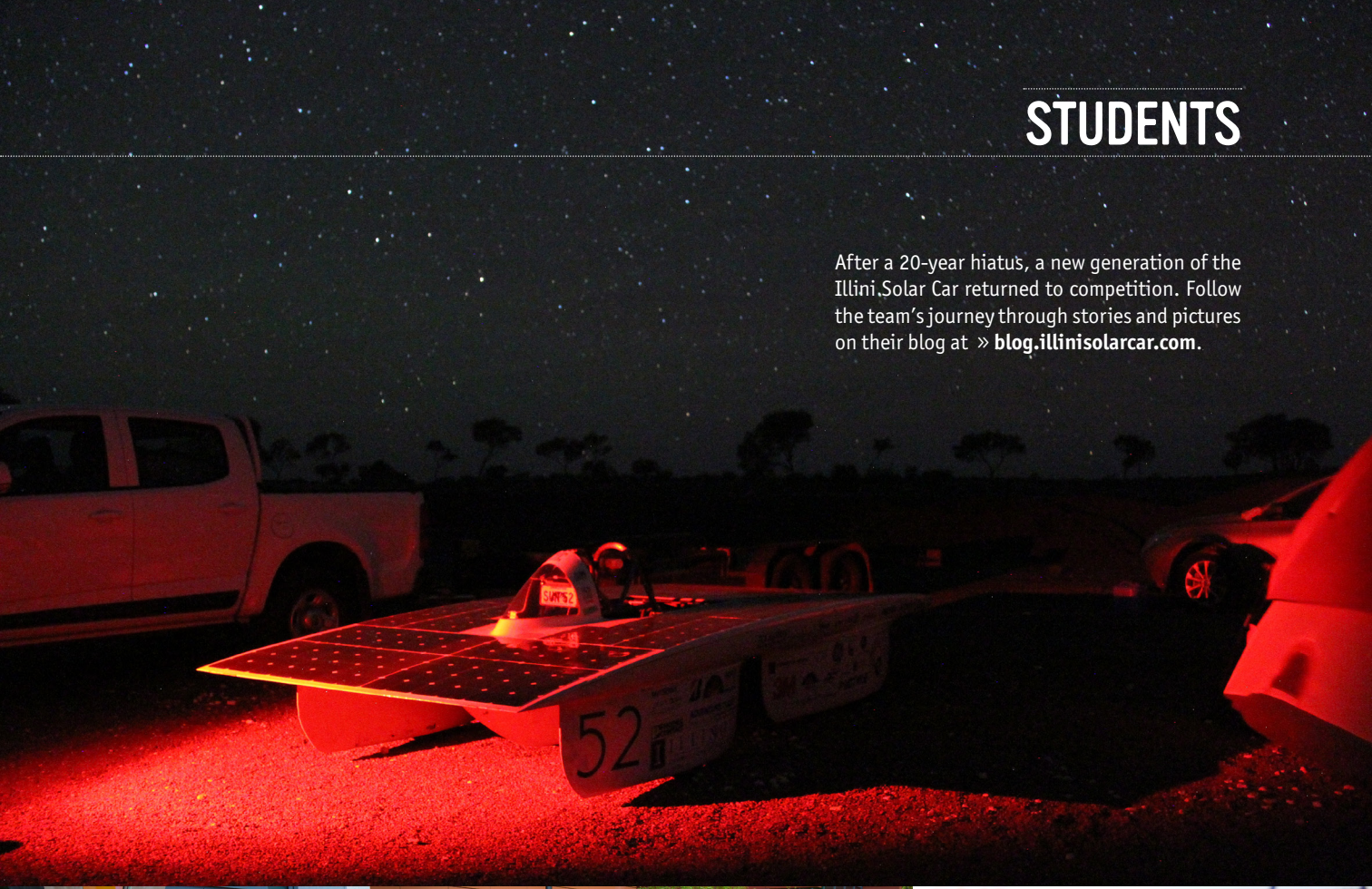
"We are confident that we are on the right track, and that we have a very unique academic-industry partnership that is demonstrating early success," Boppart said.

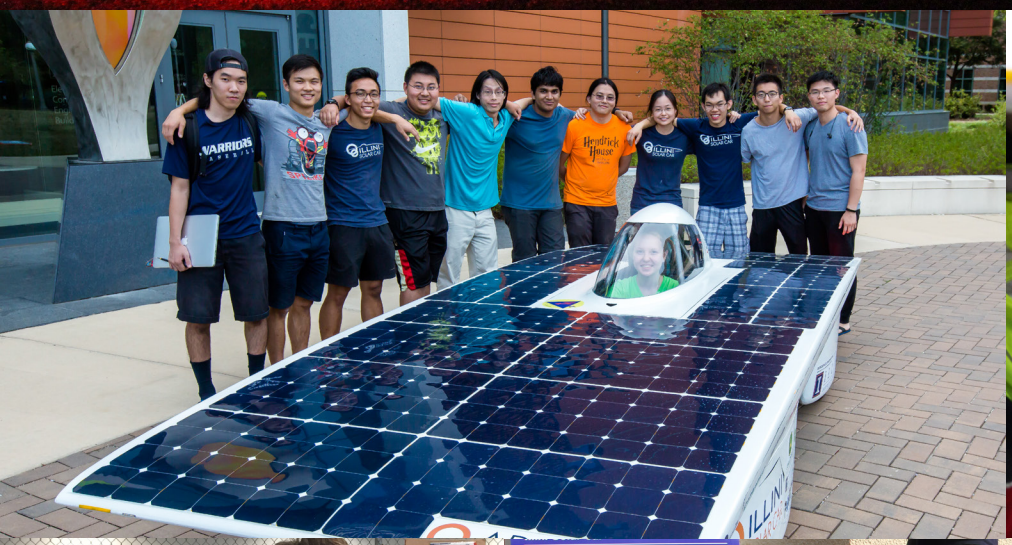
"We're very pleased with the progress being made," Arp said. "We have had senior managers come out here who are extremely pleased with the type of work we're doing, and the fact that we're getting value out of cutting-edge capabilities 5 to 10 years before the techniques are commercially available is a big deal."

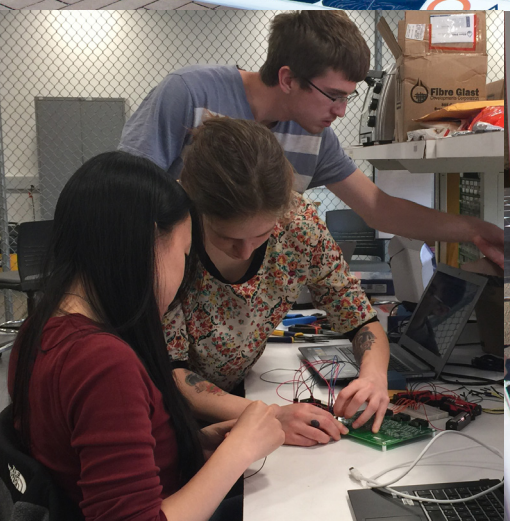
The center also is helping to drive the future of technology. For one, reducing the size of the equipment in order to help diagnose and treat individual patients is a possible long-range goal.

"We expect that we will start seeing biomarkers that are specific to individual patients or patient populations," Arp said. "But I would say that using these technologies to differentiate patient populations for personalized medicine is a larger goal for us at some point. That's something we see out in the future."

After a 20-year hiatus, a new generation of the Illini Solar Car returned to competition. Follow the team's journey through stories and pictures on their blog at » **blog.illinisolarcar.com**.







PHD GRADUATES

AUGUST 2016

STUDENT	ADVISER	THESIS
GINSBERG, MARK D	Hovakimyan, Naira	Marginal oscillator sensitivity enhancement using full-state nonlinear feedback
HUANG, JIA-BIN	Ahuja, Narendra	Visual analysis and synthesis with physically grounded constraints
JIANG, XICHEN	Dominguez-Garcia, Alejandro	Real-time power system topology change detection and identification
JOHNSON, ERIK C	Jones, Douglas	Minimum-error, energy-constrained source coding by sensory neurons
JUNG, KYOOHO	Li, Xiuling	Novel nanomanufacturing methods for bottom-up III-V nanowires and van der Waals epitaxy of monolayer MoS2
KAIROUZ, PETER	Viswanath, Pramod	The fundamental limits of statistical data privacy
KIM, IN YONG	Kim, Kyekyoon	Investigation of cell-based therapies employing microcapsules and microspheres: encapsulation and controlled release
LIU, MICHAEL ERNEST	Feng, Milton	Development of high speed vertical cavity surface-emitting semiconductor diode laser and transistor laser
MIRONOV, ANDREY	Eden, J. Gary	Laser physics and spectroscopy in alkali vapor-noble gas mixtures
SU, GUAN-LIN	Chuang, Shun; Dallesasse, John	Modeling of devices for gallium-nitride-based integrated photonics
WANG, HE	Roy Choudhury, Romit	Applying multimodal sensing to human location estimation
YAN, SU	Jin, Jianming	Computational modeling and simulation of nonlinear electromagnetic and multiphysics problems
ZHANG, JIANGMENG	Dominguez-Garcia, Alejandro	Impact evaluation of cyber-physical uncertainty on power systems

DECEMBER 2016

STUDENT	ADVISER	THESIS
AHMADYAN, SEYED NEMATOLLAH	Vasudevan, Shobha	Validation and optimization of analog circuits using randomized search algorithms
BOHANNON, NICOLE L	Bernhard, Jennifer	Synthesis process using characteristic modes for multiple in situ antennas for system radiation requirements
CHABAK, KELSON D	Li, Xiuling	Three-dimensional field-effect transistors with top-down and bottom-up nanowire-array channels

CHANG, SHIYU	Huang, Thomas	Similarity learning in the era of big data
CULLINA, DANIEL FRANCIS	Kiyavash, Negar	Combinatorial channels from partially ordered sets
DALY, ERICA LYNN	Bernhard, Jennifer	Wideband spectrum sensing using rapidly tuned antennas
ELKHOLY, AHMED MOSTAFA MOHAMED ATTIA	Hanumolu, Pavan Kumar	Digital enhancement techniques for fractional-N frequency synthesizers
ESTRADA, ZACHARY J	Iyer, Ravishankar	Dynamic reliability and security monitoring: a virtual machine approach
HUANG, ZHENQI	Mitra, Sayan	Computational analysis of networked cyber-physical systems: safety and privacy
KAZEROONI, MARYAM	Overbye, Thomas	Enhanced power system resiliency to high-impact, low-frequency events with emphasis on geomagnetic disturbances
KIM, SEONG JOONG	Hanumolu, Pavan Kumar	Time-based control techniques for integrated DC-DC conversion
LIU, RUNYU	Wasserman, Daniel	Leveraging free carriers effects for infrared photonic structures and devices
LIU, SIYING	Do, Minh	Physically based geometry and reflectance recovery from images
LIU, XIANMING	Huang, Thomas	Feedback convolutional neural network in applications of computer vision
LU, TIANJIAN	Jin, Jianming	Multiphysics modeling and simulation for large-scale integrated circuits
LUCHIES, ADAM C	Oelze, Michael	Using two-dimensional impedance maps to study acoustic properties of tissue microstructure
MEYER, GREGORY PAUL	Do, Minh	Real-time 3D face localization and verification
NGUYEN, TAN HUU	Popescu, Gabriel; Do, Minh	Computational phase imaging for biomedical applications
PHAM, CUONG MANH	Iyer, Ravishankar	Continuous monitoring methods to achieve resiliency for virtual machines
SHU, GUANGHUA	Hanumolu, Pavan Kumar	Energy-efficient wireline transceivers
SONG, YI	Li, Xiuling	Multigate MOSFETs for digital performance and high linearity, and their fabrication techniques
STREYER, WILLIAM H	Wasserman, Daniel	Reststrahlen band optics for the advancement of far-infrared optical architecture
TIAN, HAITONG	Wong, Martin	Layout decomposition for triple patterning lithography
TRAA, JOHANNES	Smaragdis, Paris	Phase difference and tensor factorization models for audio source separation
WANG, XINHAO	Liu, Gang	Portable electrochemical and plasmonic biosensors for biomedical application
WANG, ZHANGYANG	Huang, Thomas	Task-specific and interpretable feature learning
XIE, QIAOMIN	Lu, Yi	Scheduling and resource allocation for clouds: novel algorithms, state space collapse and decay of tails
XU, AOLIN	Raginsky, Maxim	Information-theoretic limitations of distributed information processing
YANG, HUIGUANG	Ahuja, Narendra	From image co-segmentation to discrete optimization in computer vision - the exploration on graphical model, statistical physics, energy minimization, and integer programming
YANG, JAMES YIFEI	Hajek, Bruce	Distributed content collection and rank aggregation
YANG, YINGZHEN	Huang, Thomas	Similarity modeling for machine learning
YU, LAN	Wasserman, Daniel	Semiconductor quantum dots for mid-IR light emission
ZHANG, SAI	Shanbhag, Naresh	Design of robust ultra-low power platform for in-silicon machine learning

MAY 2017 STUDENT	ADVISER	THESIS
BAHRAMIANPARCHEKOOHI, SARA	Insana, Michael	Improving ultrasound display by retrieving high-frequency sonographic information
CHEN, WEILI	Cunningham, Brian	Smartphone-based systems for mobile infectious disease detection and epidemiology
CHIDESTER, BENJAMIN WILSON	Do, Minh	Histopathological image analysis with connection to genomics
CHOI, WOOSEOK	Hanumolu, Pavan Kumar	Design of energy-efficient high-speed wireline transceiver
FRYSLIE, STEWART T	Choquette, Kent	Modulation of coherently coupled surface-emitting laser arrays: analysis and applications
FU, MAOJING	Liang, Zhi-Pei	High-resolution full-vocal-tract dynamic speech magnetic resonance imaging
GUO, SIMING	Overbye, Thomas	Improvements to power system dynamic load model parameter estimation
HARDING, BRIAN	Makela, Jonathan	Midlatitude thermospheric wind and temperature: Networked Fabry-Perot interferometer observations and radiative transfer modeling
HUANG, WEN	Li, Xiuling	Miniaturization of on-chip passive electronic devices by silicon nitride self-rolled-up membrane microtube nanotechnology
JANG, WONHYEOK	Overbye, Thomas	Line-limit-preserving power system equivalents
JIANG, JING	Liu, Gang	Portable EIS and SERS sensing with flexible sensors
JOHNSTONE, PATRICK ROYCE	Moulin, Pierre	Accelerated first-order optimization methods using inertia and error bounds
KESLER, BENJAMIN A	Chuang, Shun; Dallesasse, John	Mode control in VCSELs using patterned dielectric anti-phase filters
KHORRAMI, POOYA REZVANI	Huang, Thomas	How deep learning can help emotion recognition
KIM, MINJI	Milenkovic, Olgica; Song, Jun	Information theoretic and machine learning techniques for emerging genomic data analysis
KONIGSMARK, SVEN TENZING CHODEN	Chen, Deming; Wong, Martin	Hardware security design from circuits to systems
LE, LONG NGUYEN THANG	Jones, Douglas	Resource management in sensing services with audio applications
LEI, YUTIAN	Pilawa-Podgurski, Robert	High-performance power converters leveraging capacitor-based energy transfer
NANDWANA, ROMESH KUMAR	Hanumolu, Pavan Kumar	Clock multiplication techniques for high-speed I/Os
QIN, SHIBIN	Pilawa-Podgurski, Robert	Toward high-efficiency high power density single-phase DC-AC and AC-DC power conversion - architecture, topology and control
REINHARD, KARL EDWARD	Sauer, Peter	Power system dynamic modeling and synchrophasor measurements
SERWY, ROGER DAVID	Hasegawa-Johnson, Mark	Hilbert phase methods for glottal activity detection
THOMSON, NICHOLAS A	Rosenbaum, Elyse	Investigation of system-level ESD induced soft failures
WAYNE, MICHAEL ALAN	Kwiat, P.	Optical quantum random number generation: applications of single-photon event timing
YU, HOJEONG	Cunningham, Brian	Mobile platform based point-of-care diagnostics

DONATION ENRICHES LEARNING WITH WAVEFORM VISUALIZATION

Associate Professor Robert Pilawa-Podgurski, alumna Erica Messinger, Assistant Professor Arijit Banerjee, and Senior Instructional Lab Coordinator Casey Smith mark the addition of the new equipment from Keysight Technologies.

A generous donation of fourteen IntegraVision Power Analyzers from Keysight Technologies will shape the power electronics curriculum at ECE ILLINOIS. Alumna and Director of Keysight's Worldwide University Program Erica Messinger (BSEE '99) returned to campus to meet with faculty, see the lab, and speak to students as part of the ECE Explorations Seminar series.

"We are excited and grateful to have these power analyzers in our power lab both from an instructional and a research perspective," said Assistant Professor Arijit Banerjee. "While teaching the power electronics classes, we strongly emphasize that sketching expected waveforms of voltage, current, and power in time and frequency domain is vital to really understand the functionality and performance of a power-electronic circuit. This is the exact capability of these power analyzers. Visualization of waveforms brings much more clarity in fundamental understanding than looking at some numbers through alternative power meters. With these analyzers, students are often intrigued how theoretical expectations differ from practical observations."

GRAINGER MATCHING CHALLENGE SURPASSES 30%

A longtime supporter of the University of Illinois at Urbana-Champaign, The Grainger Foundation, has issued a generous Matching Challenge in support of Engineering at Illinois. Now through the end of 2019, The Grainger Foundation will match all donations made to the College's Engineering Visionary Scholarship Initiative, dollar-for-dollar up to $25 million. As of the end of 2017, more than $7 million in gifts had been matched.

Scholarships funded by the Engineering Visionary Scholarship Initiative support undergraduate students who enter as freshmen, as well as students who transfer to Illinois from community colleges. They are also used to support students in the summer scholars program and Academic Redshirt in Science and Engineering (ARISE) Scholars program, which provide access and assist low income and underrepresented students in making the transition to one of the top engineering programs in the world.

While the challenge reaches across the entire college, gifts can be designated to specific departments. Individual matched gifts have ranged from $2.00 to $1 million. With 22,000 living ECE alumni, gifts of all sizes quickly add up to make a big impact. Read the story of Anthony "TJ" Lambert, one ECE student impacted by an Engineering Visionary Scholarship , on the back cover of this issue.

TEN ANSWERS

Jaushin Lee (PhD '92) is Zentera's founder, CEO, and visionary architect, with 20 years of executive network and engineering experience. Before Zentera, he headed Imera Systems, which provided secure enterprise collaboration solutions, after managing Cisco's network search engine program. He has published widely, holds 20 U.S. patents, and was named Entrepreneur of the Year by CIE/USA in Silicon Valley.

JAUSHIN LEE (PHD '92)

ECE ILLINOIS ALUMS ARE SOME OF THE MOST INTERESTING PEOPLE WE KNOW. TO CELEBRATE THEM, WE'VE DECIDED TO ASK THEM QUESTIONS BOTH SERIOUS AND FUN. HERE, YOU'LL FIND THEIR TEN ANSWERS.

WHAT WAS YOUR FAVORITE ECE CLASS?

I think the class was called Design for Test, offered by Professor Janak Patel. The class was about silicon design for testability and test vector generation, and it provided the most thorough but high-level overview of the technology landscape.

WHEN YOU HAVE 30 MINUTES OF FREE TIME, HOW DO YOU SPEND IT?

I'd spend time with my family. I love any moment where I get to talk about casual topics like sports, culture, food or entertainment. These conversations tend to go past 30 minutes, though.

IF YOU COULD ONLY WORK ON ONE PROJECT FOR THE NEXT YEAR, WHAT WOULD IT BE?

At work, my one project would be to turn on the security service business for a global leading telecom company. My personal project would be to go traveling with my wife.

WHAT'S YOUR PERSONAL PHILOSOPHY?

My philosophy is "pursue excellence." You don't have to be the smartest person in the world with the highest IQ and the best test scores. Have the right attitude and the drive to keep pushing forward and you will win. I also have a "yin-yang" philosophy: there is always a pro and a con to something.

WHAT MAKES YOU FEEL ENERGIZED?

I always become energized and productive after having my morning house blend coffee. The smell of the coffee wakes up my brain so my thoughts can get going.

IF YOU COULD CHOOSE A SUPERPOWER, WHAT WOULD IT BE?

I would want the ability to time travel. I'm so busy that I've had too many moments where time just slipped by me. I think most everybody would love to have all the time in the world. And there are some things in my past that I wouldn't mind doing over.

WHAT ARE YOU PASSIONATE ABOUT?

I'm passionate about new inventions that improve people's lives. Back in 1989, I was using a Unix talk function at CSL (Coordinated Science Lab) to "chat" with my brother on the east coast. Today, we not only chat, but see each other on live video on this small device called a smartphone.

WHAT DO YOU THINK IS THE NEXT BIG IDEA THAT'S GOING TO CHANGE THE WAY WE LIVE?

My guess is AI and IoT. Artificial intelligence is certainly going to lead to more and more products being autonomous—we're already seeing automated cars. IoT, on the other hand, will connect all devices together and present new business opportunities.

DO YOU HAVE A SECRET TALENT, AND IF SO, WHAT IS IT?

I do business like a professor. As for talents from a hobby perspective, I am a pretty good golf and badminton player.

WHAT ADVICE WOULD YOU GIVE TO YOURSELF ON GRADUATION DAY?

Always keep an open mind on any incoming opportunity. Remember that you don't know what you don't know.

CHANCELLOR SELECTS CANGELLARIS AS NEXT VICE CHANCELLOR FOR ACADEMIC AFFAIRS

Andreas C. Cangellaris, the dean of the College of Engineering at the University of Illinois at Urbana-Champaign and M.E. Van Valkenburg Professor in Electrical and Computer Engineering, has been selected by Chancellor Robert Jones to be the campus's next vice chancellor for academic affairs and provost. "I am honored and humbled to be entrusted by Chancellor Jones and our university community with this responsibility," Cangellaris said about his new role, which began January 16. "The challenges are many, both local and global. But we have the will to engage with them, and the passion and talent to overcome them. When Illinois rises, the world advances."

"WITH ILLINOIS" CAMPAIGN KICKS OFF

Our most ambitious, campus-wide, philanthropic campaign kicked off in October with a QuadFest Celebration and a signature event at State Farm Center. Watch the campaign launch event, read stories of the impact of gifts, and learn more about the campaign goals at » with.illinois.edu.

Read this issue and archived copies of Resonance online at » **ece.illinois.edu/newsroom/resonance**.

PRESIDENT KILLEEN JOINS ILLINOIS GOVERNOR TO ANNOUNCE CHICAGO-BASED INSTITUTE

The University of Illinois System will lead a new research institute that will be developed on a donated site in downtown Chicago where world-class researchers will work side-by-side with students and businesses to foster next-generation innovation and workforce development.

Plans for the Discovery Partners Institute (DPI) were outlined by Illinois Gov. Rauner and U of I President Tim Killeen during an October event at the site donated by Chicago-based Related Midwest. The institute is the inaugural step in the development of the Illinois Innovation Network (IIN), an initiative to spread DPI's impact across the state that also was announced by the governor.

LEARN MORE AT » INNOVATION.UILLINOIS.EDU.

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THE CONFIDENCE TO PURSUE YOUR DREAMS

Robots have always fascinated Anthony "TJ" Lambert. “When I was a little kid, I dreamed of living in a house full of robots that I designed and built," he said. Now, with a more sophisticated idea of robotics and support from an Engineering Visionary Scholarship, he is pursuing his goals. "I want to build robots that help people, especially people in poverty.”

TJ received several competing offers from engineering programs across the country. Growing up in a small town near St. Louis, he wasn't sure if he could succeed on a campus twice the size of his hometown. Nearly half way through his undergraduate career, he's confident he made the right choice.

“Receiving a scholarship helped give me the confidence that I am smart enough to attend one of the best engineering universities in the world.”

READ MORE STORIES AT ECE.ILLINOIS.EDU/GIVE

ILLINOIS