2014 | Electrical & Computer Engineering *CURRENTS*
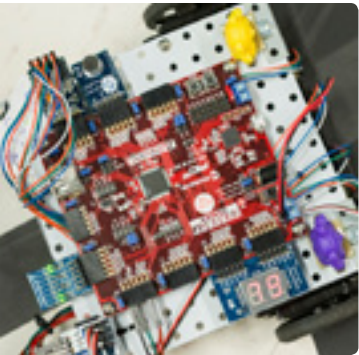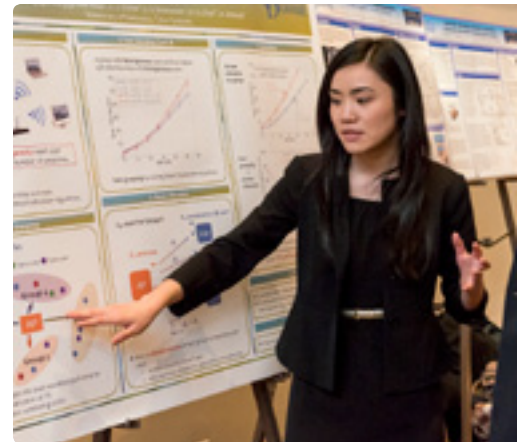
INSIDE: *Read how students, faculty and alumni are driving dynamic changes and innovations.*

www.ece.udel.edu

UNIVERSITY OF DELAWARE | College of Engineering
DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

MESSAGE FROM THE CHAIR

KENNETH E. BARNER

I am pleased to share the latest *Currents,* highlighting news and achievements from UD's Department of Electrical and Computer Engineering (ECE). Inside you will see how our students, faculty and alumni are driving dynamic changes and innovations in our field.

UD ECE has improved 24 places in the *U.S. News & World Report* departmental rankings over the past five years, and is now ranked 55. Undergraduate enrollment increased more than 60 percent over that same timeframe—90 freshman ECE students were welcomed to campus this September—and graduate enrollment increased by 33 percent.

The gains in recognition and enrollment are a reflection of UD ECE dynamism manifested in program innovations, faculty research and student achievements. Cybersecurity is just one area of broad innovation. A cybersecurity minor is now a popular option for students, and three new faculty members joined ECE to advance the cybersecurity research and curriculum efforts: **PROF. STARNES WALKER** is the founding director of UD's Cyber Security Initiative (CSI); **PROF. HAINING WANG,** formally at William & Mary, brings a well-established group focused on attacks and countermeasures inside data centers to UD; and **PROF. CHASE COTTON** brings 30 years of industry security expertise to UD as the department's first Professor of Practice. The cybersecurity research portfolio continues to grow and a new cybersecurity MS program is anticipated to accept its first cohort in September 2015.

ECE Research Day celebrated scholarship, innovation and accomplishments by students, faculty and alumni. Highlights included student capstone project and research posters, and a Distinguished Lecture by **DAVID WELCH (EE '81),** co-founder and president of Infinera Corp. Dr. Welch was also honored with the ECE Distinguish Achievement Award.

Fellow alumni **MARK MELILLO (EE '82),** Entrepreneurial Innovation Award, **KRISTOFER ROE (EE '95, M '97, PH.D. '01),** Outstanding Service Award, and **JAMES ORR (B '01, M '04),** Young Alumni Achievement Award, were also recognized for their accomplishments. Mark your calendar now for the 2015 Research Day on March 11, which features a Distinguish Lecture by **JAN ALLEBACH (EE '72),** Hewlett-Packard Distinguished Professor of ECE, Purdue University.

Students continue to excel individually and collectively. **KEVIN LANE, SAGAR PATEL, THOMAS PIACENTINO, DYLAN ROSS** and **NAVDEEP SEKHON** received the Outstanding Capstone Senior Design Project Award for their project "Dead Reckoning Tracking System for Application in GPS Degraded Environments." And the UD Epsilon Omicron student chapter of the IEEE-Eta Kappa Nu was honored with the Outstanding Chapter Award—one of 23 student organizations recognized for excellence in chapter activities.

I am extremely proud of the accomplishments showcased in the following pages, and am confident that as UD ECE continues on its strategic path as a field leader, even greater achievements will be realized. I thank our many alumni, friends and industry partners who provide the support that is integral to our efforts for excellence in education and research.

As always, feel free to contact me at **barner@ udel.edu** with your ideas and feedback.

Kenneth E. Barner, PhD
Professor and Chair
Electrical and Computer Engineering

Be sure to *like* the *University of Delaware Electrical and Computer Engineering Department* Facebook page!

WE'RE ON facebook

In this issue...

- Content Direction: Kenneth Barner
- Design, Photography & Writing: Office of Communications & Marketing
- Printing: University Printing

UNIVERSITY OF DELAWARE
Electrical & Computer Engineering
2014-15 DISTINGUISHED LECTURE SERIES

SEPTEMBER 24, 2014

AYDOGAN OZCAN
UNIV. OF CALIFORNIA LOS ANGELES

"Democratization of Next-Generation Imaging, Diagnostics and Measurement Tools Through Computational Photonics"

NOVEMBER 12, 2014

REINALDO VALENZUELA
ALCATEL-LUCENT BELL LABORATORIES

"5G: Technology Opportunities and Challenges"

MARCH 11, 2015

JAN ALLEBACH
PURDUE UNIVERSITY

"Digital Printing: The Transformation of a 2,000-Year Old Technology and What It Means to You"

APRIL 22, 2015

NAOMI HALAS
RICE UNIVERSITY

"Plasmonics: a Nanoscale Focus on Cross-cutting Science and Technologies"

Co-Sponsored by the Delaware Bay IEEE

3

Understanding HIV: *Nature Medicine* paper explores role of T-cells in HIV

RYAN ZURAKOWSKI'S co-authored paper "HIV-1 Persistence in CD4+ T-Cells with Stem Cell-Like Properties," published January 12 in *Nature Medicine*, provides evidence that a particular T-cell type may help researchers better understand why HIV can persist despite treatment.

According to Zurakowski, associate professor, HIV treatments do not kill infected cells. Instead, they stop the infection of new cells, and rely on the virus itself to kill the infected cells. Unfortunately, some cells infected by the virus—memory T-cells—are not killed by the virus.

T-cells are a type of lymphocyte, or white blood cell, produced by the thymus gland that actively participates in the body's immune response. "Memory" T-cells can live for years, or even decades, providing life-long immunity to previously encountered diseases. They can form "quiescent" infections, which last for years, and cause HIV to rebound whenever a patient stops treatment.

During the 10-year study, the researchers discovered that not all memory T-cells are alike. A sub-group, Stem Memory T-Cells (Tscm), are different, particularly in their ability to produce daughter cells.

The researchers were able to show that the HIV-infected Tscm cells in patients on HIV therapy decayed more slowly than any other type of T-cell. As a result, after 10 years of therapy, the Tscm cells represented 24 percent of the total HIV-infected cell population, despite being only 1 percent of the total T-cell population.

This finding is significant, Zurakowski said, because it demonstrates that Tscm cells are the slowest-decaying portion of the HIV reservoir.

"Over time, this particular cell type plays an increasingly significant role in sustaining HIV infection in patients who have remained on therapy," he said.

Zurakowski's co-authors include lead author Mathias Lichterfeld from Harvard University Center for AIDS Research, and researchers from Massachusetts General Hospital; Ragon Institute of MGH, the Massachusetts Institute of Technology and Harvard University; the First Affiliated Hospital of China Medical University; Brigham and Women's Hospital; and Howard Hughes Medical Institute.

Zurakowski credits the finding to the diligence of Lichterfeld and the researchers at the Ragon Institute in carefully following the same HIV patients for a decade.

Ryan Zurakowski

> **"If we can find a way to selectively eliminate the HIV-infected Tscm cells, it will be a major step in developing a true 'cure' for HIV infection."** —Ryan Zurakowski

"Because the researchers have followed the same patients over a decade, we have created a high-fidelity data set that would not otherwise have been possible," he said.

Drugs currently being developed for cancer therapy that target stem-cell metabolic pathways may be able to target this cell type, as well, due to the "stem-cell like" nature of the Tscm cells, he said.

A better understanding of how the HIV virus leverages a cell's stem cell-like properties of cellular immune memory to stay alive could lead to improved clinical strategies for HIV treatment.

The research reported in this paper was funded, in part, by the American Foundation for AIDS Research, the U.S. National Institutes of Health, the Mark and Lisa Schwartz Foundation and the Bill and Melinda Gates Foundation.

Article by Karen B. Roberts | Photo by Ambre Alexander Payne

BIG DATA ANALYSIS: Researchers mine data to analyze political behavior on mobile devices
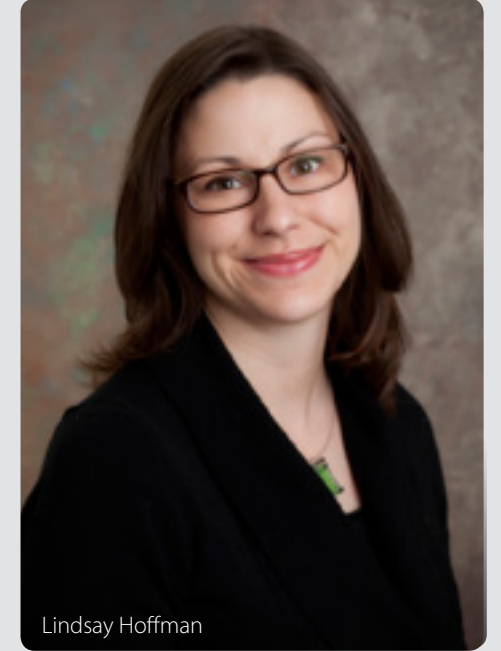

Hui Fang

Lindsay Hoffman

As tablets and other mobile devices become an increasingly common part of everyday life, researchers in political communication are focusing more of their attention on how people use that technology to access news and other information.

A study published in the *Journal of Information Technology and Politics* by assistant professor **HUI FANG** and **LINDSAY HOFFMAN,** associate professor of communication, revealed that users:

• Spent more time with online aggregators (such as Google), recreational sites (playing games, for example) and social networking sites than with news or political sites;

• Tended to overestimate the time they spent with online news, but when they were on news sites, they spent an average of 10 minutes on each page, with national and regional news the most popular; and

• Showed what Hoffman called "selective exposure," meaning that they were much more likely to visit sites that shared their liberal or conservative point of view rather than seeking out opposing ideologies.

"The data analysis in this project is a perfect example of 'big data' analysis," said Fang. "The main goal is to understand user behaviors based on the traces they left when surfing on the Internet," a challenge that she called "not a trivial task."

The limitation of previous similar studies, said Hoffmnan, is that they relied on the users' reports about their own behavior. "Scholars have surveyed people about how and why they use media, but that use is very fluid. It's so interspersed with other daily activities that most

> **"The main goal is to understand user behaviors based on the traces they left when surfing on the Internet."** —Hui Fang

people would find it difficult to say exactly how many minutes they spend on particular kinds of website," said Hoffman.

Hoffman and Fang's study tracked the websites visited and time spent on each by 20 carefully selected participants over four months during the 2012 presidential campaign season. Each website was then categorized by type and political leaning, from conservative to liberal, and the results were coded for computer analysis by nine students over the past three years.

Because only 20 people were tracked, Hoffman notes the study has limited use in generalizing about user behavior. Instead, she said, the significance is in demonstrating that this type of tracking method can be used for further research.

"To say that the Internet has radically changed the way people get their news in the new digital era is an understatement," she said. "As technology use changes, so must our methodologies to advance research and theory in information technology and politics."

Article by Ann Manser

Cybersecurity

Starnes Walker

National defense expert leads UD cybersecurity initiative

Leading national cybersecurity expert **STARNES WALKER** has joined UD as founding director of the new University of Delaware Cybersecurity Initiative (UDCSI).

"With Dr. Walker's appointment, the University of Delaware gains exceptional expertise in an area of urgent concern," said University Provost Domenico Grasso. "Under his leadership, UD will develop new partnerships to advance cybersecurity education and research and will create prominent academic programs at the undergraduate and graduate levels, as well as certificate programs for corporate and government professionals."

Walker has held senior management positions in the U.S. Departments of Defense, Energy and Homeland Security, as well as in industry.

Defending the United States from cyber attacks requires highly trained specialists who can design secure computing systems, write secure computer code and create tools to protect, detect and recover from malicious acts, Walker said. The need is immediate, and the stakes are high.

Walker's top goals for the initiative include developing problem-based and experiential learning programs—areas in which UD has been a pioneer— and developing cybersecurity activities in partnership with colleges and departments across campus and with corporations and government entities.

Adapted from an article by Tracey Bryant

"Starnes Walker understands what it takes to defend a nation against cyber threats. Cyber attackers are growing increasingly more sophisticated, now becoming more interested in taking out entire systems instead of just compromising data.

"Academia will play an important role in developing solutions for shoring up the nation's cyber-defense."

— Michael Hayden, retired U.S. Air Force four-star general and former director of the National Security Agency and of the Central Intelligence Agency

Elite cyber talent: training camp draws students from around the state

As cyber attacks increase in frequency and scope, identifying and training people to thwart these attacks is an increasingly urgent need.

"One person with a laptop can have just as much effect as an entire army," said **JAMES LUCK,** now a senior Honors Program student studying computer science.

Luck was one of 62 students from UD, Wilmington University, Delaware Technical Community College, Delaware State University and several local high schools, who along with local security professionals, participated in the United States Cyber Challenge (USCC) camp hosted this summer at UD.

USCC is a national program that works with states to connect cyber talent to the industry. Camp participants attended in-depth classes on digital forensics, web penetration testing and packet crafting taught by cybersecurity experts, in addition to a career fair that could potentially help them land jobs.

A capture the flag attack and defense competition rounded out the week, with campers testing their new skills by completing tasks to either hack, or protect, a server.

Professor **CHASE COTTON, PH.D. 1985**, said that the camp prepares participants for careers by exposing them to both the offensive and defensive aspects of the work.

"The defensive nature of this field requires students to understand the defects in a system and how to bypass them so that they can create preventive measures to protect information, or know how a hacker may have already entered the system," he said.

This year's event was supported, in part, through sponsorships by the State of Delaware, SANS Institute, CyberAces, Association for Federal Information Resources Management, Department of Homeland Security, Microsoft and Lockheed Martin. Local sponsors include Wilmington University, Delaware State University, UD and PJM.

ECE Department Chair **KENNETH BARNER** was joined at the awards ceremony in commending camp participants by U.S. Sen. Tom Carper (Del), chair of the Senate Committee on Homeland Security and Governmental Affairs, Delaware Gov. Jack Markell, Delaware Chief Security Officer Elayne Starkey and Delaware Secretary of Education Mark Murphy.

Article by Collette O'Neal | Photos by Evan Krape

New cybersecurity minor offered

This fall, the electrical and computer engineering department began offering a new 18-credit cybersecurity minor allowing students to infuse computer and network security fundamentals into their current degree program. A master's degree program in cybersecurity is also under development.

Science Coalition report highlights ECE spin-off

A University of Delaware spin-off company, which grew out of federally funded research by ECE Endowed Distinguished Professor **GUANG GAO,** is highlighted in a new national report by The Science Coalition.

The report, "Sparking Economic Growth 2.0: Companies Created from Federally Funded Research, Fueling American Innovation and Economic Growth," identifies 100 companies that trace their roots to federally funded university research. These companies — while only a tiny fraction of the new companies formed each year — are contributing to the U.S. economy in a significant way.

Gao's E.T. International Inc. (ETI), located in Newark, Del., provides advanced computing systems and software based on new multi-core chip technology to analyze "big data" — large, complex data sets that are critical to a wide array of global businesses.

"From Dick Heck's Nobel Prize-winning chemistry research that today finds use in pharmaceuticals, to electronics, to the touch screen technology of John Elias and Wayne Westerman that laid the foundation for smart phones and tablets, UD's federally funded research has been impacting the world," said Charlie Riordan, vice provost for research.

"It's gratifying to see Professor Guang Gao take his computing solutions seeded by the departments of Defense and Energy to market by founding ET International, a company here in Delaware that employs more than 20 people and provides software solutions to some of the world's biggest companies," Riordan added.

The basic scientific research that gives rise to companies like ETI, and spurs the economy in many other ways, is jeopardized by the current funding environment. Federal funding for research and development has been on

Guang Gao

a downward trend for the past decade, with funding levels in 2013 at historic lows.

"The federal funding I received in the late 1990s and early 2000s was instrumental in my research group's fundamental and long-term research on a dataflow model of computation — the very research on which ETI was founded," Gao said. "Dataflow modeling is critically important to big data technology, and today provides ETI technology a competitive edge."

As the report points out, university research and the companies born from such research are a driving force behind much of the innovation in the United States. They are bringing forward innovations with the potential to transform industries and solve some of the world's greatest problems.

The Science Coalition is a nonprofit, nonpartisan organization of more than 50 of the nation's leading public and private research universities, including the University of Delaware. It is dedicated to sustaining the federal government's investment in basic scientific research as a means to stimulate the economy, spur innovation and drive America's global competitiveness.

*Adapted from an article by Karen B. Roberts
Photo by Ambre Alexander*

Alumnus David Welch delivers keynote at 2014 ECE Research Day

DAVID WELCH, EE1981, co-founder and president of global optical telecommunications company Infinera Corp, delivered the keynote address at the Department of Electrical and Computer Engineering Research Day last March, and was also honored with a distinguished achievement award.

Welch's talk titled "Disruptive Innovation in the Telecommunications Market," covered the evolution of the telecommunications market, including how optics have displaced traditional telecommunications technologies. The lecture, which was part of ECE's 2013-14 Distinguished Lecture Series, detailed the story of photonic integration and Infinera.

Widely regarded in the optical communications field, Welch is a fellow of the Optical Society and the Institute of Electrical and Electronics Engineers (IEEE). He is a recipient of the Adolph Lomb Medal, the Joseph Fraunhofer Award and the John Tyndall Award. He holds more than 130 patents.

Other outstanding department alumni honored along with Welch during 2014 Research Day festivities were:

· **MARK MELILLO, B1982** – Entrepreneurial Innovation Award; CEO, Melillo Consulting

· **KRISTOFER J. ROE, B1995, M1997, PH.D.2001** – Outstanding Service Award; director of R&D Imaging, Smiths Detection

· **JAMES E. ORR IV, B2001, M2004** – Young Alumni Achievement Award; Apple

Mark your calendar now for the next ECE Research Day, scheduled for March 11, 2015.

David Welch

ECE RESEARCH DAY

annually recognizes alumni achievements, undergraduate and graduate research excellence and outstanding Senior Capstone Projects. Special thanks to event sponsors DuPont, DTS, ETI, FiBest, IEEE, JPMorgan Chase and Mentor Graphics.

Outstanding students

The following doctoral students were recognized during ECE Research Day for outstanding research:

BROCK OVERMILLER – Ultrabroadband phased-array radio frequency (RF) receivers based on optical techniques

JAIME ARTEAGA – Locality-driven scheduling of tasks for data-dependent multithreading

YIN ZHOU – Stacked predictive sparse coding for tissue classification

The following students were also recognized:

DYLAN ROSS – Undergraduate Research Award: TiO2 slot like electro-optic polymer phase modulator

HODA AGHAEIKHOUZANI – IEEE Women in Engineering award

Capstone Senior Design Project winners

Team INERTIA: **KEVIN LANE, SAGAR PATEL, THOMAS PIACENTINO, DYLAN ROSS, NAVDEEP SEKHON** – Dead Reckoning Tracking System for Application in GPS Degraded Environments

Tech pioneers: Inventors of touch imaging interface technology inducted as NAI Fellows

ECE alumnus **WAYNE WESTERMAN, PHD EE99,** and **JOHN ELIAS,** adjunct professor, have been named fellows of the National Academy of Inventors (NAI).

Election to NAI fellow status is a professional distinction accorded to current and former academic inventors. Westerman and Elias pioneered the algorithms and touch imaging interface architecture used in many touch screen devices.

The touch imaging interface they created changed the way people interact with computers by incorporating scrolling, finger tracking and gesture recognition, features found in electronic devices worldwide, including the iPod, iPhone and iPad.

"Wayne and John's success story is a shining example of the entrepreneurial ecosystem that is being nurtured at UD," said Brad Yops, director of UD's Technology Transfer Center, who nominated Westerman and Elias for the award.

It illustrates what can happen when an innovation in academic research is matched with a market need and translated into real-world products.

Westerman recently shared the original motivation behind the touch imaging invention and the importance of instilling an entrepreneurial mindset in today's students.

Q: What was the original motivation behind your touch imaging invention?

WESTERMAN: I joined Dr. Elias' lab in 1995 to study neural computation by building and experimenting with silicon dendrites – one of the main computational elements in the brain. I had tendonitis and this motivated me to tinker with different types of input technology. I noticed my hands had much more endurance with zero-force input like optical buttons and capacitive touch pads

than force-actuating keys and buttons (that were stiffer twenty years ago than today).

Q: Was there a Eureka moment in your research?

WESTERMAN: Trying to pick a dissertation topic, I considered training our neuromorphic silicon circuits to recognize handwriting patterns – hundreds of researchers had already tackled handwriting with simpler methods.

The Eureka moment was when I imagined training the neural simulator with multi-finger patterns from a zero-force tablet. We began looking for one but there were no such tablets on the market. The touch pad manufacturers of the day told Dr. Elias that their products could not process multi-finger input. Since I played piano, using all 10 fingers seemed fun and natural and inspired me to create interactions that flowed more like playing a musical instrument.

Q: What contributed to your success?

WESTERMAN: Dr. Elias' expertise building custom circuits and computers was uncommon amongst professors, but luckily was just the expertise needed to prototype (and eventually manufacture) advanced input devices. Our early experiments with surface typing for desktop computers were met with skepticism, but the algorithms we invented helped surface typing feel crisp, airy and reasonably accurate despite the lack of tactile feedback. Hundreds of millions of people now utilize surface typing on mobile devices.

Q: What elements of an entrepreneurial mindset are key for today's engineers?

WESTERMAN: Whether you're an engineer with an independent streak who wants to found your own startup, or you're more comfortable within a stable corporation, shipping any new idea requires enormous determination, creativity and coordination.

Serial entrepreneurs bring a relentless, unstoppable attitude to problem solving; they share a mindset that embraces each obstacle—be it excessive product complexity, manufacturing cost, organizational or marketing weakness—as solvable through creative exploration, even if that exploration ultimately sets them upon a totally unexpected path.

Q: What lessons have you learned that might help future innovators?

WESTERMAN: Entrepreneurs must be practical enough to recognize the flaws in their product vision and iterate, often for years, until enough flaws are resolved for market success. To introduce something truly new, it also helps to have a contrarian streak that leads away from the crowd towards fertile areas that others haven't yet pursued. If your ideas are truly new (or also if they're "batty"), the crowd will be skeptical initially. You must decide whether you're on the right path and, if so, keep pushing.

Q: What influence has University of Delaware had on your career success?

WESTERMAN: The diverse courses and environment at UD go a long way to prepare students for joining a startup or corporation where working in cross-disciplinary teams is standard. I garnered lots of insights into input device ergonomics by sitting in on a biomechanics class in UD's physical therapy department, taking product design inspiration from facts that were intended as therapy training for the other students. Working within UD electrical and computer engineering's friendly department atmosphere gave me the support and freedom to wander through several zany research topics until I found a new cross-disciplinary niche.

Adjunct professor John G. Elias (standing) and ECE alumnus Wayne Westerman (seated) show off their invention, the fingerworks keyboard/mouse combination.

About Westerman and Elias

The touch-sensitive imaging technology grew out of Wayne Westerman's UD doctoral thesis. He developed the revolutionary computer interface technology with John Elias, who began developing multitouch user interfaces for portable and desktop computer systems in 1995.

Westerman and Elias co-founded FingerWorks Inc. in 1998. It was the first company to commercialize touch-sensitive imaging technology with a line of 10-finger touch pads and keyboards that seamlessly combined typing, pointing, scrolling and editing gestures within the same surface area. Their early work at UD was supported, in part, by the National Science Foundation. Apple acquired the company in 2005.

Article by Karen B. Roberts
Photo Eric Crossan

Alumni support instrumental in helping ECE grow and excel

In 2005, **WAYNE WESTERMAN, PHD EE1999,** established a scholarship fund for undergraduate ECE students who demonstrated invention, innovation and/or entrepreneurial vision. The 2014 recipients were **JUSTIN PHILLIPS** and **DANIELLE DUVALSAINT**.

If you'd like to make a gift to support ECE students, faculty and programs, please contact Ken Barner, department chair, at 302-831- 2405 or barner@udel.edu; or Barbara Maylath, director of development, College of Engineering, at 302-831-7273 or bmaylath@udel.edu.

You may also visit www.udel.edu/makeagift to use our online giving form and specify ECE in the Other box of "Give to" options. Support from alumni and friends is instrumental in helping our department grow and excel. Thank you!

Robotics World Cup

## Students design robots to "walk the line"

More than 40 ECE students participated in the second annual Robotics World Cup competition on Friday, May 16.

The event was organized by **CHENGMO YANG,** assistant professor, as a culminating hands-on opportunity for students to demonstrate design and decision-making skills they learned during their Microprocessor Systems (CPEG222) class.

For the competition, students designed line-following robots using 32-bit micro controllers and robot kits. The robots used light sensors to detect tracks as the students controlled the robot's speed and direction.

TYLER BROWNING, a sophomore computer engineering major at the time of the competition, said of the design process, "You have to be willing to dig deep to solve the problems at hand. When something was not working correctly, my partner and I were able to isolate the problem, develop a solution and implement it into our code in order to get our robot
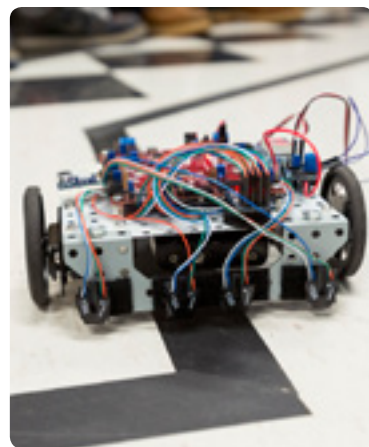
functioning correctly. In real-world engineering, that is what it takes to get the job done."

During the first stage of the competition, teams of two competed side-by-side, racing their robots on identical, parallel tracks. The first robot to conquer the track and stop correctly in the finish zone was deemed the winner.

Teams continued to compete against each other in a round-robin format, with teams winning two or more races advancing to the elimination stage.

"The event was filled with suspense and unpredictability," said Browning. "We had no clue how our robot would react and match up to everyone else's, so it was always exciting to see our robot cross the finish line."

The winners of the competition, all sophomores save one now graduated senior, were as follows:

- **FIRST PLACE: BEN SAMPSON** and **CONNOR ZANI**
- **SECOND PLACE: DEREK ALLEYNE, B2014,** and **TYLER BROWNING**
- **THIRD PLACE: ALEKS AZEN** and **JUSTIN PHILLIPS**

Article by Jessica Zoch | Photos by Evan Krape

CAPSTONE DESIGN EVENT
highlights seniors' preparation for workforce

Students, their families, project sponsors, mentors and faculty members gathered in May for the annual senior capstone celebration breakfast and poster session. Department Chair **KENNETH E. BARNER** offered opening remarks, followed by **TERRANCE BOWMAN, 1995,** who works for project sponsor JPMorgan Chase, and discussed the students' contributions toward the industry-based design team assignments. **MARK J. MELILLO, B1982,** CEO of Melillo Consulting in Somerset, N.J., and the 2014 UD ECE Entrepreneurial Innovation Award recipient, was the featured speaker.

Instructed by Professor **CHASE COTTON, PH.D. 1985,** Senior Capstone Design is a six-credit, year-long capstone course structured to imitate the scenario a young engineer will experience in the workforce. Teams select a project, discover customer wants, benchmark the best practices for each desired function, generate design concepts, build and test a prototype and make improvements,
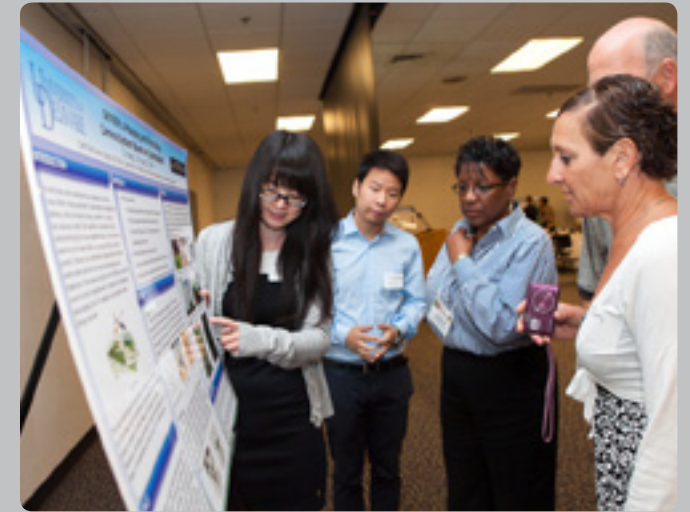
as necessary. The course provides a realistic industrial management structure and professional background for the design project activities.

2013-2014 TEAMS:

TEAM ARES (Advanced Room Entry System): Biometric Authentication system

Junaid Aamer
Allyssa Batten
Jerry Darko
Logan Kreal
Conor Truszkowski

TEAM CREEPER: Coordinated Airborne (quadcopter) and Ground-based Robots

Brett Bugglin-Borer
Anna Chumakovskaya
Michael Haney
Krissy Miller
Cong Wang

TEAM INERTIA: Dead Reckoning system with Stride Estimation

Kevin Lane
Sagar Patel
Tom Piacentino
Dylan Ross
Navdeep Sekhon

TEAM LASER: Laser Tag Android Application with Corresponding Game Hardware

Theo Dorotheos
Michael Fischetti
Angelo Luppino
Alyssa McHale
Matthew O'Donnell
Eric Schaffling

TEAM NOISE: Canceling Headphones using Adaptive Filters

Jianwei Ke
Jiefu Li
Brad Sheets
Joseph Zimmerman

TEAM OCULUS: Extended Senses using the Oculus Rift for Remote 3-D Viewing

Mike Raia
Melanie Terry
Shawn Trainor
Kevin Zheng

TEAM SCOOTNSHOOT: Continuous Wifi Surfing and Multihoming with MPTCP

Zachary Hanley
Brian Levine
Benjamin Llewelyn
John Tapp

TEAM SEGWAY: Mobile Self-Balancing Robot

Billy Bednar
Brian Gonzalez
Zachary Lowe
Adam Stein
Ye Xin

TEAM SKYRIM: Mapping and Recording Quadcopter Camera System

Ge Wang
Xiaoyu Ye
Jie Zhou

TEAM SNIFFER: Outdoor Roaming Robot with Detachable Chemical Sensor and Metal detector

Derek Alleyne
Cody Barnes
Victoria Carey
Veronica Mest
Matt Mills
Iuliana Murgescu

TEAM TARGETER: Distributed Sensors Array to Distinguish Gunfire from Other Noises and Pinpoint the Gunshot Location

Chris Falco
Chris Lefever
Jiabin Liu
Chris Prust

TEAM TIGR: Tactical Ground Reporting System

Rich Barton
Lawrence Kinsella
Ryan McDonough
Brian Weyl

TEAM WATCH: Smartwatch Wearable Technology

Hamzah Ahmed
Celia Davis
Miguel Hernandez
Fred Nedjoh
Christopher Stowers

Honors & Awards

IEEE-ETA KAPPA NU HAILS "OUTSTANDING STUDENT CHAPTER"

The University of Delaware Epsilon Omicron student chapter of IEEE-Eta Kappa Nu was honored this spring with a 2012-13 Outstanding Chapter Award at the 2014 Electrical and Computer Engineering Department Heads Association national conference in Nappa Valley, Calif. UD was one of 23 student organizations recognized for excellence in chapter activities.

University Graduate Awards

Three ECE graduate students were recognized by the Office of Graduate and Professional Education.

KASSEM NABHA, a doctoral student under the direction of Professor **FOUAD KIAMILEV,** received the Graduate Scholars Award. Nabha is working to create unique and singularly successful LED infrared scene projector systems that make civilian and military airplanes safer to fly. His research focuses on developing algorithms and processes for controlled light emission from LED infrared scene projectors.

XITONG LIU, a doctoral student studying under Assistant Professor **HUI FANG,** received the University Dissertations Fellow Award. Liu is finishing two potentially ground-breaking studies. He is studying how to leverage the temporal changes of entities to better capture the entity profiles, useful to improving search engine accuracy and to creating a more complete knowledge base. He also is focusing on separating rumors from truth, an important yet challenging task, given the exponential amount of user-posted information on social media. The study results could have major impact on various domains, including education and mental health.

HAO WU, a doctoral student studying under Assistant Professor **HUI FANG,** received the University Graduate Fellow Award. Wu has made excellent research contributions in information retrieval (IR), is involved in exploiting social media to discover unknown drug side effects, and is interested in developing fast and efficient IR systems.

Dissertation/ Thesis Titles *Fall 2013 – Summer 2014*

Ph.D. Dissertation

Non-Intrusive Monitoring of Electrical Loads Based on Switching Transient Voltage Analysis: Signal Acquisition and Features Extraction
CESAR DUARTE
Advisor – Keith Goossen

Energy-Efficient Wireless Communications
GUBONG LIM
Advisor – Leonard Cimini

Special Compressive Imaging: Classification and Unmixing Applications
ANA RAMIREZ
Advisor – Gonzalo Arce

Optimal Embedding of QR Codes into Color, Gray Scale and Binary Images
GONZALO GARATEGUY
Advisor – Gonzalo Arce

Cross-Layer Design for Wireless Cooperative Networks
YAO XIAO
Advisor – Leonard Cimini

Multi-Compartmental Modeling of HIV-1 Cryptic Viremia
ERWING FABIAN CARDOZO
Advisor – Ryan Zurakowski

Hybrid Light Emitting Diodes Based on Solution Processed Polymers, Colloidal Quantum Dots and Colloidal Metal Nanoparticles
XIN MA
Advisor – Sylvain Cloutier

The Tobit Kalman Filter: An Estimator for Censored Data
BETHANY ALLIK
Advisor – Ryan Zurakowski

Optically Addressed Ultra-Wideband Phased Antenna Array
JIAN BAI
Advisor – Dennis Prather

Toward High Performance and Energy Efficiency on Many-Core Architectures
ELKIN GARCIA
Advisor – Guang Gao

Narrow Linewidth Ultra-Wideband Tunable Optical RF Synthesizer
DAVID GRUND
Advisor – Dennis Prather

Master's Thesis

Exploring Story Similarities Using Graph Edit Distance Algorithms
SRITAMA PAUL
Advisor – Kristina Winbladh

A Computational Approach to Eliciting and Modeling Stories With Social Interactions
SERGIO PINO GALLARDO
Advisor – Kristina Winbladh

Data Warehouse Usage Analysis for JP Morgan Project
FANG LIU
Advisor – Stephan Bohacek

Optimized Design of Photonic Crystal-Based Infrared Obscurants
WILLIAM MASLIN
Advisor – Mark Mirotznik

Analog Joint Source Channel Coding for Optical Communications and Image Transmission
SERGIO MATIZ ROMERO
Advisor – Gonzalo Arce

Additive Manufacturing of Graded Dielectrics
DAVID A ROPER JR.
Advisor – Mark Mirotznik

Darts: A Runtime Based on the Codelet Execution Model
JOSHUA DANIEL SUETTERLEIN
Advisor – Guang Gao

Memory Optimation in Codelet Execution Model on Many-Core Architectures
YAO WU
Advisor – Guang Gao

Hybrid Micro-Scale Photovoltaics for Enhanced Energy Conversion Across All Irradiation Conditions
GAUTAM AGRAWAL
Advisor – Michael Haney

Low Complexity Extensions of Non-Linear Mappings
INAKI IGLESIAS
Advisor – Javier Garcia-Frias

100 Hz 512x512 Sleds System Design
KASSEM NABHA
Advisor – Fouad Kiamilev

Improving the Aesthetic Appearance of QR Codes
OFELIA VILLARREAL
Advisor – Gonzalo Arce

Photovoltaic System Deployment Optimization
FAN WANG
Advisor – Keith Goossen

Game Theory Manet Routing for Jamming Environment
YI ZHU
Advisor – Stephan Bohacek

MS with Non-Thesis Graduates

SUMAN ADDYA
LAWRENCE AIELLO
ROY T COLLINS
KEITH W ELLIOTT
KYLE M LEFLER
STEPHANIE M MCMONIGLE
CLIFTON J SIENKIEWICZ
JAMES YOCKEY
BRIAN HAMILTON
CHENGHAN JIA
XIAOYUE LIU
XUAN LONG
MATTHEW PUTERIO
HANXIAO QI
STEVEN E SPARKS
STEVEN TROMBETTA

On the Move
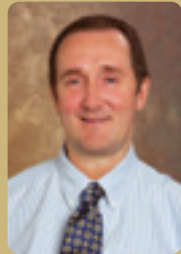
Professor **KENNETH E. BARNER** was appointed to a second five-year term as chair.

**MARK MIROTZNIK** was promoted to professor.

RYAN ZURAKOWSKI was promoted to associate professor with tenure.

ECE welcomes three to new cybersecurity group

STARNES WALKER is a professor of ECE and founding director of the new UD Cybersecurity Initiative. Walker previously served as the chief technology officer and technical director for the U.S. Fleet Cyber Command & U.S. 10th Fleet, U.S. Navy. Before that, he served in several senior executive positions in the government in which he developed critical programs and aligned strategic defense, homeland security and intelligence organizations across the U.S. and around the globe while forging key partnerships with other countries. He has also held several industry posts. Widely published in the fields of physics, chemistry, optics and signal processing, Walker holds numerous patents and has been honored with both the distinguished Office of the Secretary of Defense Exceptional Civilian Service Medal and an R&D 100 Award. He earned bachelor's, master's and doctoral degrees in physics from the University of California and an honorary degree in nuclear engineering from the University of Missouri, Rolla.
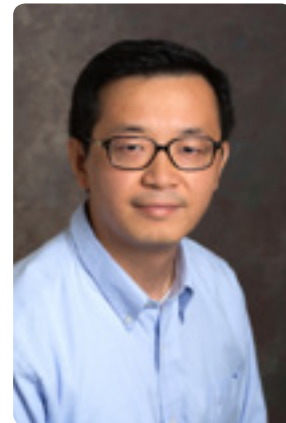
HAINING WANG joined the department this fall as professor of ECE and part of the new cybersecurity research group. Prior to joining UD, Wang spent 11 years as a faculty member in computer science at the College of William & Mary. His research interests lie in security, networking systems and cloud computing. The main thrusts of his current and past research include energy/power attacks and countermeasures inside data centers, covert channel attacks and countermeasures in the cloud, behavioral biometric-based user authentication, automatic online bot detection, transparent anti-phishing and countering distributed denial-of-service attacks. Now a senior member of IEEE, Wang received his doctoral degree in computer science and engineering from the University of Michigan at Ann Arbor.

CHASE COTTON who earned his Ph.D. from UD in 1985, returned to the university as a visiting scholar in 2008 and later as a senior scientist, professor and director of Delaware's Center for Information and Communications Sciences. He now joins ECE as professor of practice in cybersecurity. He is currently involved in the educational launch of a multi-faceted cybersecurity initiative at UD where he is developing new security courses and degree programs. His research interests include high-availability software systems and cybersecurity, with funding drawn from the National Science Foundation, Army Research Laboratory, CERDEC and JPMorgan Chase. For more than 30 years, Cotton has been a successful researcher, executive and consultant for the technologies used in internet and data services in the carrier environment. Today, he consults on communications and internet architectures for worldwide carriers and equipment vendors. He earned his bachelor's degree in mechanical engineering at University of Texas at Austin and his doctoral degree in applied sciences from University of Delaware.

ECE Advisory Council

Distinguished alumni and friends representing a cross-section of the electrical and computer engineering industry generously lend their expertise and provide valuable guidance to department leaders through their service on the ECE Advisory Council. Council members convene annually on campus to learn more about UD's program and offer counsel on proposed initiatives. This year, their meeting coincided with ECE Research Day in March, where the council welcomed two new members, **CHARLES JOHNSON-BEY, M1993, PH.D., 1994** of Lockheed Martin Corporation, and **RICK TAYLOR** who chairs the IEEE Delaware Bay Section.

MARK YOUR CALENDAR FOR 2015
ECE Research Day

March 11, 2015
Keynote address by **JAN ALLEBACH, EE1972**
Hewlett-Packard Distinguished Professor of Electrical and Computer Engineering,
Purdue University

2013-2014 ECE ADVISORY COUNCIL MEMBERS

Kristofer Roe, B1995, M1997, Ph.D.2001 – Advisory Council Chair
Director, R&D Imaging
Smiths Detection

Janine Barbacane, B2001
Account Executive
Oracle

Fil Bartoli
Professor and Chair, Electrical & Computer Engineering
Lehigh University

Tyler Barton, B2006
Computer Engineer
U.S. Army CERDEC

Charles Johnson-Bey, M1993, Ph.D., 1994
Open Innovation Project Manager
Lockheed Martin Corporation

Karen Bloch, B1985, M1997, Ph.D.2004
Engineering Manager
DuPont Company

Edward Coyle, B1978
Electrical & Computer Engineering
Georgia Institute of Technology

John Ferriter
SVP, Strategic Program Development
SAIC

William Gardner, B1989
Technical/Patent Consultant

Daniel Grim, B1970, M1972, Ph.D.1976
Chief Technology Officer IT
University of Delaware

Frederick Kitson, B1974
EVP & Chief Technology Officer
DTS, Inc.

Michael Lombardi
Deputy Director
Intelligence & Information Warfare Directorate
U.S. Army CERDEC

Ray Sokola, B1976
President
Cellport Systems

Edward Szurkowski, B1976, M1978, Ph.D. 1982
Founder/Managing Partner
Blue Mill Group

Rick Taylor
Chair
IEEE Delaware Bay Section

Douglas Tipton
Chair, IEEE Delaware Bay Section
IEEE MidAtlantic

Sean Wang, Ph.D.1992
Founder & Managing Director
B&W Tek, Inc.

Wayne Westerman, Ph.D.1999
Senior Engineer
Apple

UD ECE Advances in Rankings

The University of Delaware Electrical & Computer Engineering department's strong performance has yielded an 18-place improvement in the latest *US News & World Report* departmental rankings, which caps a 22-place improvement in just the past three years.

Looking for an old friend? Want to share your latest news? Searching for information on upcoming alumni events such as Homecoming? Now you can do it all in one place, **UDconnection.com**. UD and the UD Alumni Association (UDAA) have collaborated to bring alumni a vibrant online community—so register and get active! The online community allows you to search the alumni directory, post class notes, update your contact information and see if there are any upcoming alumni events in your area. You can also take advantage of networking opportunities and volunteer opportunities to get involved with your alma mater! Visit **www.UDconnection.com** today!