

NC STATE Engineering

# CSC NEWS

DEPARTMENT OF COMPUTER SCIENCE | FALL 2019



## DEPARTMENT RANKS FIRST NATIONALLY IN WOMEN FACULTY NUMBERS

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NC State researchers will lead an effort to create a 5G wireless testbed in the Research Triangle, thanks to funding from the National Science Foundation.



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The department continues to be a national leader in hiring women faculty members and placing them in prominent leadership positions. The American Society for Engineering Education has again ranked the department first in the country in the number of women tenured/tenure-track faculty members among departments of computer science within colleges of engineering.



#### WHAT'S NEW IN CSC PAGE 02

The department is using virtual reality to help save lives, giving undergraduates more options and receiving attention in national rankings.



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The department's alumni are helping improve some of the country's most important companies and starting their own and have been recognized with membership in the departmental hall of fame.



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Computer science faculty members are being recognized on campus and around the world for their impactful research and staff members are receiving accolades for increasing diversity and working with students.

## LETTER FROM THE DEPARTMENT HEAD GREGG ROTHERMEL



Dr. Gregg Rothermel

### Dear alumni and friends of the Department of Computer Science:

I'm excited to be wrapping up my first year as department head and glad to have a chance to share with you some of the transformative work our students and faculty members are undertaking. Fresh off its 50-year anniversary, the department is stronger than ever and is a national and global leader in computer science education, research and extension. I can't wait to see what the next decade brings to the department.

I'm very happy to share with you that the department has once again been ranked first in the nation in the number of women tenured/tenure-track faculty members among departments of computer science in colleges of engineering by the American Society for Engineering Education. This has been the case for several years and is indicative of the commitment this department, our College of Engineering and NC State have made to building a diverse, inclusive academic community.

Here are some other recent highlights for the department, which you can read more about in these pages:

- Our research leadership in wireless technology helped lead to the National Science Foundation awarding its third national 5G wireless testing platform to a coalition in North Carolina's Research Triangle region led by NC State. Dr. Rudra Dutta, a professor in our department, is a co-PI on the project.
- The department has created new undergraduate tracks in security and entrepreneurship. A degree in computer science is a terrific platform for a variety of careers, and it's important that we constantly update our offerings to give our graduates the best career opportunities available and to ensure that we are competitive with peer institutions in attracting the best potential undergraduate students.
- Dr. Chris Martens, assistant professor, has received a Faculty Early Career Development award, also known as the CAREER Award, from the National Science Foundation (NSF). The award is one of the highest honors NSF gives to young science and engineering faculty members. Martens is the department's 30th CAREER Award winner.
- Research in the Center for Educational Informatics in the department is using virtual reality to improve training for first responders and members of the United States military. It's work that can literally save lives.
- We are continuing to grow. The department welcomed five outstanding new faculty members this year who strengthen our research program in areas including robotics, software engineering, networks and network performance, theoretical computer science, and more.
- Dr. Frank Mueller has been named a Fellow of the Association for Computing Machinery for his contributions to the predictability of real-time systems, resilience in high-performance computing and multi-threading techniques. Mueller is the first faculty member in the department to be recognized with this distinguished honor.
- Dr. Tim Menzies has been named a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for his contributions to software engineering for artificial intelligence. The department can now boast of having 10 IEEE fellows.
- Dr. Donald Bitzer, Distinguished University Professor in the department, has received the Alexander Quarles Holladay Medal for Excellence. Named for NC State's first professor of history and its first president, the medal is the highest honor bestowed by NC State and the university's Board of Trustees. I trust that he will display the award proudly next to the National Academy of Television Arts and Sciences Emmy he received for inventing plasma panel displays used for flat panel televisions.

In closing, let me thank you for your continued support of the department. I hope that you will stay in touch with us.

Sincerely,

**Dr. Gregg Rothermel**

Department Head

## NSF announces Raleigh and Cary as testbed sites for advanced wireless

Fifth generation (5G) wireless networks hold promise to be as much as 10 times more efficient than current 4G networks, with faster speeds and higher capacity to support many more data connections than previously possible.

To ensure the nation's leadership in 5G, the National Science Foundation (NSF) and an industry consortium have invested \$100 million over the next seven years to build specialized wireless networks for U.S. researchers to test new ways of increasing wireless speed and capacity.

North Carolina's Research Triangle region has been selected to host the third wireless platform. NC State will lead the effort, with a computer science faculty member playing a major role.

"The platform will enable significant research into the wireless communications capabilities necessary for autonomous drone and mobility systems," says Dr. Erwin Gianchandani, NSF acting assistant director for computer and information science and engineering. "By enabling experiments that consider three-dimensional, highly mobile and diverse scenarios, AERPAW will be critically important for enhancing wireless networking capabilities in our communities, and for furthering the development of innovative new applications that will improve civic services and citizen safety."

Last year, New York City and Salt Lake City were the first cities to receive funding under the NSF Platforms for Advanced Wireless Research (PAWR) initiative. The \$24 million grant over five years is called Aerial Experimentation Research Platform for Advanced Wireless, or AERPAW.

Dr. Ismail Guvenc, associate professor of electrical and computer engineering, is the primary investigator (PI) on the project. Co-PIs on the project are: Dr. Rudra Dutta, professor and interim associate head of computer science; Dr. Brian Floyd, professor of electrical and computer engineering; Dr. Mihail Sichitiu, professor of electrical and computer engineering; and Thomas Zajkowski, flight operations manager, Institute for Transportation and Research Education.

NC State will work closely with the Wireless Research Center and researchers at Mississippi State University, Renaissance Computing Institute (RENCI) at the University of North Carolina at Chapel Hill, Purdue University and the University of South Carolina, as well as local partners including the Town of Cary, City of Raleigh and N.C. Department of Transportation to deploy the technology.

"NC State is committed to groundbreaking research that benefits our communities," says Chancellor Randy Woodson. "We're excited to work with our public and private partners to advance wireless communications and drone interaction."

The platforms are designed to accelerate the development and commercialization of promising technologies, ensuring continued U.S. leadership in wireless communications, while also preparing the next-generation workforce for new job opportunities.

"On the AERPAW platform, drones and 5G are integrated to be mutually beneficial," says NC State Vice Chancellor for Information Technology Marc Hoyt. "Drones are supporting 5G by providing increased coverage and connectivity; and 5G is supporting drones by providing improved signals and location data."

On today's networks, fixed nodes enable 4G signals to connect to wireless devices. On the AERPAW platform, nodes will be mobile, with the ability to transmit and receive radio waves from user devices while moving on demand. For example, in the aftermath of a natural disaster such as a hurricane, existing cellular networks may be damaged. As a result, aerial base stations can position themselves to provide the best wireless coverage to victims and first responders who would otherwise have no cellular connectivity.

"Drones are not the only mobile nodes," adds Guvenc, "NC State researchers will also be putting 5G equipment on cars, buses, golf carts and rovers for vehicle-to-vehicle communications, which will support autonomous driving and accident reduction."

The platform also has the potential to help pilots fly drones beyond line of sight, allowing for improved air traffic control under FAA regulations. ■



## Using WiFi like sonar to measure speed and distance of indoor movement

NC State computer science researchers have developed a technique for measuring speed and distance in indoor environments, which could be used to improve navigation technologies for robots, drones — or pedestrians trying to find their way around an airport. The technique uses a novel combination of WiFi signals and accelerometer technology to track devices in near-real time.

"We call our approach WiFi-assisted Inertial Odometry (WIO)," says Raghav Venkatnarayan, co-corresponding author of a paper on the work and a Ph.D. student at NC State. "WIO uses WiFi as a velocity sensor to accurately track how far something has moved. Think of it as sonar, but using radio waves, rather than sound waves."

Many devices, such as smartphones, incorporate technology called inertial measurement units (IMUs) to calculate how far a device has moved. However, IMUs suffer from large drift errors, meaning that even minor inaccuracies can quickly become exaggerated.

In outdoor environments, many devices use GPS to correct their IMUs. But this doesn't work in indoor areas, where GPS signals are unreliable or nonexistent.

"We created WIO to work in conjunction with a device's IMU, correcting any errors and improving the accuracy of speed and distance calculations," says Dr. Muhammad Shahzad, co-

corresponding author of the paper and an assistant professor of computer science. "This improvement in accuracy should also improve the calculations regarding a device's precise location in any indoor environment where there is a WiFi signal."

The researchers wanted to test the WIO software but ran into a problem: They could not access the WiFi network interface cards in off-the-shelf devices such as smartphones or drones. To address the problem, the researchers created a prototype device that could be used in conjunction with other devices.

The researchers found that using WIO improved a device's speed and distance calculations dramatically. For example, devices using WIO calculated distance with a margin of error ranging from 5.9 percent to 10.5 percent. Without WIO, the devices calculated distance with a margin of error from 40 percent to 49 percent.

"We envision WIO as having applications in everything from indoor navigational tools to fitness tracking to interactive gaming," Venkatnarayan says.

"We are currently working with Sony to further improve WIO's accuracy, with an eye toward incorporating the software into off-the-shelf technologies," says Shahzad.

In October, Venkatnarayan received the Best Demo Award at the IEEE ICNP conference in Chicago for the research.

The work was done with support from the National Science Foundation. ■

## New technique cuts AI training time by more than 60 percent

NC State computer science researchers have developed a technique that reduces training time for deep learning networks by more than 60 percent without sacrificing accuracy, accelerating the development of new artificial intelligence (AI) applications.

“Deep learning networks are at the heart of AI applications used in everything from self-driving cars to computer vision technologies,” says Dr. Xipeng Shen, a professor of computer science and co-author of a paper on the work.

“One of the biggest challenges facing the development of new AI tools is the amount of time and computing power it takes to train deep learning networks to identify and respond to the data patterns that are relevant to their applications. We’ve come up with a way to expedite that process, which we call Adaptive Deep Reuse. We have demonstrated that it can reduce training times by up to 69 percent without accuracy loss.”

Training a deep learning network involves breaking a data sample into chunks of consecutive data points. Think of a network designed to determine whether there is a pedestrian in a given image. The process starts by dividing a digital image into blocks of pixels that are adjacent to each other. Each chunk of data is run through a set of computational filters. The results are then run through a second set of filters. This continues iteratively until all of the data have been run through all of the filters, allowing the network to reach a conclusion about the data sample.

When this process has been done for every data sample in a data set, that is called an epoch. In order to fine-tune a deep learning network, the network will likely run through the same data set for hundreds of epochs. And many data sets consist of between tens of thousands and millions of data samples. Lots of iterations of lots of filters being applied to lots of data means that training a deep learning network takes a lot of computing power.

The breakthrough moment for Shen’s research team came when it realized that many of the data chunks in a data set are similar to each other. For example, a patch of blue sky in one image may be similar to a patch of blue sky elsewhere in the same image or to a patch of sky in another image in the same data set.

By recognizing these similar data chunks, a deep learning network could apply filters to one chunk of data and apply the results to all of the similar chunks of data in the same set, saving a lot of computing power.

“We were not only able to demonstrate that these similarities exist, but that we can find these similarities for intermediate results at every step of the process,” says Lin Ning, a Ph.D. student at NC State and lead author of the paper. “And we were able to maximize this efficiency by applying a method called locality sensitive hashing.”

But this raises two additional questions. How large should each chunk of data be? And what threshold do data chunks need to meet in order to be deemed “similar”?

The researchers found that the most efficient approach was to begin by looking at relatively large chunks of data using a relatively low threshold for determining similarity. In subsequent epochs, the data chunks get smaller and the similarity threshold more stringent, improving the deep learning network’s accuracy. The researchers designed an adaptive algorithm that automatically implements these incremental changes during the training process.

To evaluate their new technique, the researchers tested it using three deep learning networks and data sets that are widely used as testbeds by deep learning researchers: CifarNet using Cifar10; AlexNet using ImageNet; and VGG-19 using ImageNet.

Adaptive Deep Reuse cut training time for AlexNet by 69 percent; for VGG-19 by 68 percent; and for CifarNet by 63 percent — all without accuracy loss.

“This demonstrates that the technique drastically reduces training times,” says Hui Guan, a Ph.D. student at NC State and co-author of the paper. “It also indicates that the larger the network, the more Adaptive Deep Reuse is able to reduce training times — since AlexNet and VGG-19 are both substantially larger than CifarNet.”

“We think Adaptive Deep Reuse is a valuable tool, and look forward to working with industry and research partners to demonstrate how it can be used to advance AI,” Shen says.

The work was done with support from the National Science Foundation. ■



## Using virtual reality to create new tech for first responders

Emerging technologies could allow first responders to call up all sorts of information when responding to an emergency, but there is some uncertainty about what information is useful, how it should be displayed, and how emergency personnel could control which information to access and when. NC State is working with first responders to address these questions.

“We are working with first responders and the Washington Metropolitan Area Transit Authority (DC Metro), and have already developed three virtual reality (VR) scenarios that allow researchers to test new user interfaces for use by emergency responders,” says Dr. James Lester, the principal investigator (PI) on the project. Lester is also the director of NC State’s Center for Educational Informatics (CEI) and a Distinguished University Professor of Computer Science.

The work is made possible by a two-year, \$1.1 million grant from the National Institute of Standards and Technology (NIST). The project, called IntelliVisor, is focused on developing VR software that can help law enforcement, firefighters and emergency medical technicians respond to crises more rapidly and efficiently. RTI International is collaborating with NC State on the project.

“We’re currently working with first responders to validate the three scenarios we’ve developed, making sure they are sufficiently realistic to be useful,” says Dr. Randall Spain, co-PI on the project and a research psychologist in NC State’s Center for Educational Informatics.

That authenticity is important, because the VR scenario software will be used to test two things. First, it will help to determine what sorts of information would be useful to emergency responders in a visual display. For example, which forms of navigation guides are helpful? Or how much visual information is too much, and may distract an emergency responder?

“Second, the software will enable researchers to test various interfaces responders can use to call up or dismiss visual information,” Spain says. “For example, we’re planning to explore the utility of a spoken natural language interface, which would allow users to control visual displays using spoken commands. This may be important, given that first responders often have their hands full, which could make gesture-based controls problematic.”

The research team is working closely with emergency responders and DC Metro personnel to both develop the scenario software, based on real-world situations, and to test different visual display interface prototypes, in order to ensure the software is user-friendly.

“We will likely also be working with them to collect physiological responses to the system as part of its formal evaluation,” Spain says. “This can help us establish which combination of visual display formats and control interfaces is most intuitive and least demanding for responders.”

But the scenario software is likely to have utility beyond simply testing new display technologies.

“This project is also valuable because the VR-based scenario could be used to supplement training by emergency responders both in responding to real-world crises and in familiarizing themselves with emerging technologies before they are deployed in the field,” Lester says.

The research team includes co-PI Dr. Bradford Mott, a senior research scientist in NC State’s Center for Educational Informatics; and RTI team leads Donia Slack, Edward Hill and John Holloway.

The team is working with the Metro Transit Police Department of the Washington Metropolitan Area Transit Authority, the Fire Chiefs Committee of the Metropolitan Washington Council of Governments, and tri-jurisdictional first responder personnel in the DC area. ■



## Martens receives NSF CAREER Award

Dr. Chris Martens, assistant professor in the department, has received a Faculty Early Career Development award, also known as the CAREER Award, from the National Science Foundation (NSF).

This award is one of the highest honors NSF gives to young science and engineering faculty members. NSF will provide \$500,000 in funding over five years to support Martens' project, "Explorable Formal Models of Privacy Policies and Regulations."

The goal of the project is to enable automated reasoning over privacy policies and regulations that can assist users, policy developers and regulators in understanding consequences of data practices and policies. Data collection and analysis have become a major part of advancements in digital technology, but user expectations for what happens to their data often does not match software companies' privacy policies and practices. Martens' research team will be developing techniques to represent policies and regulations that formally model the

logical semantics of regulations and support mechanized correctness proofs while also providing more transparency to users through the use of natural language and visualization.

Using a relational programming model known as Answer Set Programming (ASP), the project will formalize privacy policies specific to software companies as well as privacy regulations like the European Union's General Data Privacy Regulation. New techniques for interoperating with ASP as a lightweight semantic modeling framework are also expected to be results of the research. These include support for answering queries, generating scenarios that reveal privacy loopholes, suggesting repairs for broken policies and allowing policy developers and users to explore hypothetical scenarios.

Martens received their B.S. in 2008 and Ph.D. in 2015, both in computer science from Carnegie Mellon University. Martens' research interests include human-computer interaction and programming languages. ■

## Code of ethics doesn't influence decisions of software developers

The world's largest computing society, the Association for Computing Machinery (ACM), updated its code of ethics in July 2018 — but new research from the department shows that the code of ethics does not appear to affect the decisions made by software developers.

"We applauded the decision to update the ACM code of ethics, but wanted to know whether it would actually make a difference," says Dr. Emerson Murphy-Hill, co-author of a paper on the work and an adjunct associate professor of computer science.

"This issue is timely, given the tech-related ethics scandals in the news in recent years, such as when Volkswagen manipulated its technology that monitored vehicle emissions. And developers will continue to face work-related challenges that touch on ethical issues, such as the appropriate use of artificial intelligence."

For the study, researchers developed 11 written scenarios involving ethical challenges, most of which were drawn from real-life ethical questions posted by users on the website Stack Overflow. The study included

105 U.S. software developers with five or more years of experience and 63 software engineering graduate students at a university. Half of the study participants were shown a copy of the ACM code of ethics, the other half were simply told that ethics are important as part of an introductory overview of the study. All study participants were then asked to read each scenario and state how they would respond to the scenario.

"There was no significant difference in the results — having people review the code of ethics beforehand did not appear to influence their responses," Murphy-Hill says.

"While we believe maintaining an up-to-date, robust code of ethics is an admirable thing for ACM to do, we were unable to find any effect of the code of ethics on developer decision making. The question now becomes: What can the computing profession do to promote ethical behavior?"

The paper was co-authored by Justin Smith, a Ph.D. student at NC State, and Andrew McNamara, a former graduate student at NC State. ■

## Five new Strategic Advisory Board members named

The department is pleased to welcome five new members to its Strategic Advisory Board (SAB):

- **Lance Berberian:** Chief Information Officer at LabCorp
- **Bob Garrell:** Senior Director, Software Engineering at Oracle
- **Darrell Hubbard\*:** Founder and Chief Executive Officer at Yetta Corporation
- **Yogesh "Yogi" Jashnani:** Chief Marketing Officer and Senior Vice President of Insights and Analytics at Advance Auto Parts
- **Erik Troan\*:** Founder and Chief Technology Officer at Pendo

\*NC State Alumnus

The SAB is a group of industry executives and academic leaders who play critical roles in shaping the department's vision and strategic focus. The group is the foundation of the department's strategic planning efforts that are an essential part of the department. They meet annually on campus and act as a virtual working team through member involvement on subcommittees, executive panels and other engagement opportunities. Each term with the SAB group is three years and membership may be renewed for a second term.

The SAB is currently chaired by Joe Bastante, vice president of enterprise architecture and strategy at Blue Cross Blue Shield of North Carolina. Tracy Doaks, deputy state chief information officer and chief services officer at the NC Department of Information Technology, is the current vice-chairperson. ■



## Design flaws create security vulnerabilities for 'Smart Home' Internet-of-Things devices

Researchers in the department have identified design flaws in "smart home" Internet-of-Things (IoT) devices that allow third parties to prevent devices from sharing information. The flaws can be used to prevent security systems from signaling that there has been a break-in or uploading video of intruders.

"IoT devices are becoming increasingly common, and there's an expectation that they can contribute to our safety and security," says Dr. William Enck, co-author of a paper on the discovery and an associate professor of computer science. "But we've found that there are widespread flaws in the design of these devices that can prevent them from notifying homeowners about problems or performing other security functions."

"Essentially, the devices are designed with the assumption that wireless connectivity is secure and won't be disrupted — which isn't always the case," says Dr. Bradley Reaves, co-author of the paper and an assistant professor of computer science. "However, we have identified potential solutions that can address these vulnerabilities."

Specifically, the researchers have found that if third parties can hack a home's router — or already know the password — they can upload network layer suppression malware to the router. The malware allows devices to upload their "heartbeat" signals, signifying that they are online and functional — but it blocks signals related to security, such as when a motion sensor is activated. These suppression attacks can be done on-site or remotely.

"One reason these attacks are so problematic is that the system is telling homeowners that everything is OK, regardless of what's actually happening in the home," Enck says.

These network layer suppression attacks are possible because, for many IoT devices, it's easy to distinguish heartbeat signals from other signals. And addressing that design feature may point the way toward a solution.

"One potential fix would be to make heartbeat signals indistinguishable from other signals, so malware couldn't selectively allow heartbeat signals to pass through," says TJ O'Connor, first author of the paper and a Ph.D. student at NC State.

"Another approach would be to include more information in the heartbeat signal," O'Connor says. "For example, if a device sends three motion-sensor alerts, the subsequent heartbeat signal would include data noting that three sensor alerts had been sent. Even if the network layer suppression malware blocked the sensor alert signals, the system would see the heartbeat signal and know that three sensor alerts were sent but not received. This could then trigger a system warning for homeowners."

"No system is going to be perfect, but given the widespread adoption of IoT devices, we think it's important to raise awareness of countermeasures that device designers can use to reduce their exposure to attacks," Enck says. ■

## Grant will support broadening participation in computer science and computational thinking

A team of faculty members and researchers at NC State University were recently awarded a three-year, \$1 million National Science Foundation grant in collaboration with the Wake County Public School System, UNC-Charlotte and Charlotte-Mecklenburg Schools to broaden participation in computer science (CS) and computational thinking (CT) in North Carolina. Dr. Eric Wiebe, Dr. Dave Frye and Dr. Sherry Freeman from the NC State College of Education's Friday Institute for Educational Innovation and Dr. Tiffany Barnes from the Department of Computer Science at NC State will lead this project, titled EcoCS: Developing a Systemic, Scalable Model to Broaden Participation in Middle School Computer Science Using an RPP Approach.

The grant will allow the EcoCS team to expand their work at Wake County Public School System's Reedy Creek Magnet Middle School: Center for the Digital Sciences in Raleigh, NC. They will work with the newly formed Digital Sciences School Leadership Team, using a research-practice partnership (RPP) approach to deepen the school culture of computational thinking.

Project goals include:

- Providing equitable access to underrepresented students in computing
- Preparing middle school students for computing curriculum in high school
- Developing and testing effective CS/CT modules that will integrate into existing math and science curriculum
- Investigating CS/CT-focused barriers and supports
- Sharing RPP findings and replicating the process at other schools

The past two years laying the RPP groundwork between the Friday Institute and Reedy Creek has been crucial to the success of this project because it works in collaboration with the educators at Reedy Creek instead of simply adding to their heavy workloads.

"Traditionally with research partnerships between universities and schools, the university faculty drive the research," Freeman said. "They have the idea for an 'innovation' they want to research, they get the grant, and their ideas drive the work. A research-practice partnership turns that approach on its head. We start by going in and asking practitioners or school administrators, 'What are the biggest challenges you're facing?' Then we think about how we can use research and our expertise

to help address that problem. It is a long-term collaboration that is driven by the needs of the practitioners."

The EcoCS team will also use their model of school-wide CS/CT integration at Reedy Creek to inform the development of an RPP at another newly formed CS/CT focused magnet school, Northridge Middle School, in Charlotte, NC. Staff and faculty from UNC-Charlotte's College of Computing and Informatics and the Center for STEM Education will facilitate the work at Northridge.

"We are replicating evidence-based practices that have been demonstrated by NC State's partnership and developing partnerships within a different context that will allow us to propagate lessons learned in both the research-practice partnership approach, the STEM Ecosystem model and the pedagogies that work well in middle school CS education," the UNC-Charlotte team said in a joint statement. "We foresee that this partnership will facilitate broader understanding in other K-12 educational contexts."

The EcoCS team hopes that their work in Charlotte will show them what can and can't be replicated so they can expand this approach to other schools, which is desperately needed right now in K-12 education. This integration of computational thinking and computer science principles into core K-12 curriculum has been recognized as imperative to fostering key 21st century thinking skills for students entering the future workforce.

Unfortunately, there is no established pathway or assessment standards on how to infuse these skills into mainstream educational experiences, nor are teachers equipped with the content knowledge to implement these principles into their classrooms.

Despite these challenges, North Carolina schools have joined this growing movement to incorporate computational thinking and computer science into mainstream K-12 curriculum. The Friday Institute has brought together practitioners, policymakers and researchers to help develop teacher and school capacity to add these principles to curriculum. Its RPP work with Reedy Creek to integrate CS/CT is just the beginning.

"We have explored and experimented with little bits and pieces of this, but we saw the potential for doing so much more," Wiebe said. "That's why we're really excited. Now we've got funding and a school willing to buy in and work with us on growing this research-practice partnership to look at what a whole-school ecosystem looks like." ■

## Scholarship endowment to honor Dr. Robert Funderlic

The Department of Computer Science is pleased to announce the creation of the Dr. Robert E. Funderlic Scholarship Endowment to honor the professor emeritus and former department head, who passed away in 2009.

The endowment, seeded by a lead pledge from computer science alumnus Dr. Andy Smith (B.S. '95, M.S. '97, Ph.D. '04), will generate merit-based scholarship funds with a preference for computer science undergraduates at the junior level or higher who are at least eight years post-graduation from a high school in North Carolina. Smith is pledging to match dollar-for-dollar the collective donations from other alumni, family and friends up to \$25,000 to help create the endowment.

Smith recalls the impact that Funderlic made on his life as his academic mentor. "Bob Funderlic was a learned, wise and caring man who was an inspiration to me as my Ph.D. advisor. He was a fine numerical analyst, mathematician and computer scientist, justifiably proud to have been Alston Householder's student. He also seemed to enjoy human interaction at least as much as the joy of discovery and proof. He did not proselytize, but those who spent much time with him could see his faith informed his daily life. He advocated for including a course in computer ethics, and taught it, because he believed computer scientists would necessarily confront ethical issues. How prescient that seems in light of ethical lapses at several of the larger tech firms. I still miss him."

"We are so thankful to Andy for this most thoughtful and generous gift," says Dr. Gregg Rothermel, current department head. "What a wonderful way to honor Dr. Funderlic's impact and legacy as a former department head."

Funderlic provided transformative leadership during his tenure as department head from 1986 to 1992. During this period, computer technology was advancing so quickly that equipment and laboratories quickly became obsolete. He helped establish the Computer Systems Laboratory (CSL) to help maintain the

latest technologies. Additionally, he worked to secure dedicated teaching spaces in Leazar and Withers Halls for the growing discipline. In 1990, Withers Hall became the home of the NC State Department of Computer Science, where it remained until moving to Engineering Building II on Centennial Campus in 2006.

Besides the improvements in facilities and equipment, under Funderlic, the department expanded its areas of research specialties and minor fields, including minors in computer science and a graduate minor in artificial intelligence, which at the time was one of the most important trends in the department.

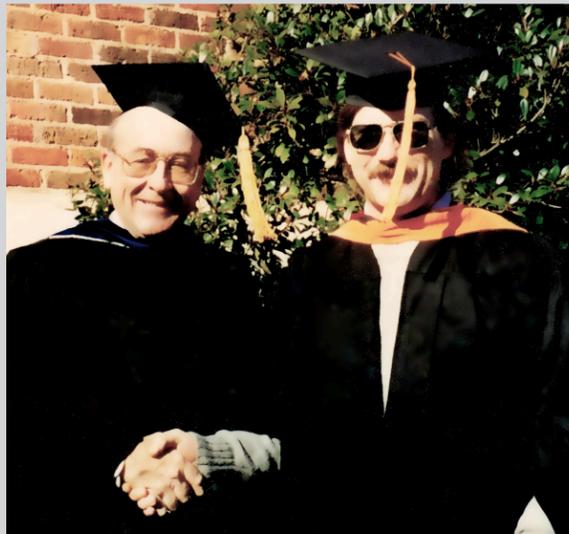
Also under his leadership, computer science became a department within the College of Engineering, and a Ph.D. program was established. The independent Ph.D. program placed NC State on solid footing in order to compete with other topflight computer science programs in the country and improved the university's reputation and its ability to strengthen areas of faculty interest.

Not only was Funderlic an exceptional administrator, he was also a beloved educator. Because his best university times were spent with students as they

explored their potential, Funderlic received the George H. Blessis Teaching and Advising Award in 1997. He also proudly served as the liaison for Aquinas House, the Catholic center at NC State.

"Bob Funderlic was a leader, a visionary, an award-winning educator, and an internationally recognized numerical analyst," said Dr. Mladen Vouk, former department head and current vice chancellor for research and innovation. "He provided critical leadership during the formative years of the department, and he laid the foundations of the department we know today."

Individuals or corporations interested in contributing to this fund can complete and submit a pledge form along with a check made payable to the NC State Engineering Foundation noting for the Dr. Robert E. Funderlic Scholarship Endowment in the memo section. Donations can be sent to the NC State Department of Computer Science, Attn: Ken Tate, Campus Box 8206, Raleigh, NC 27695. ■



Funderlic, left, with Smith in 1997.



## How AI will help train the soldiers of the future

Job training is always important, but in the military it can mean the difference between life and death. Researchers in the department are working with the U.S. Army Futures Command (AFC) to develop artificial intelligence (AI) tools that can be used to improve squad training — and save lives.

"We're developing AI programs that address two aspects of training, specifically for the synthetic training environments the Army uses to prepare its personnel," says Dr. Randall Spain, a research scientist in the Center for Educational Informatics (CEI) within the Department of Computer Science who is working on the project.

"One tool is focused on assessing team-level communication, which is critical to mission success and soldier safety. The second tool is focused on identifying the most effective ways of providing feedback to trainees."

The work is being done under a three-year, \$2 million cooperative agreement between AFC's Combat Capabilities Development Command Soldier Center and NC State's CEI. In addition to funding, the AFC is giving researchers access to team training data, which will expedite the AI development process.

The team communication component of the project focuses on developing a "deep learning" model that can be

trained to listen in on team chatter during a training exercise and predict — in near-real time — how the team will perform.

The goal of the project is to give human trainers information they can use to pinpoint team communication failures and help trainees both develop and practice stronger communication skills.

The second element of the project is aimed at creating what is effectively an automated AI "coach" that can give trainees constructive feedback on their performance in synthetic training environments.

"We'll be testing a range of variables to determine which coaching approaches work best," Spain says. "For example, should feedback be given immediately? Should the feedback be written text or audio?"

"Ultimately, our goal with both aspects of this work is to develop intelligent, adaptive tools that improve soldier training."

"We are looking forward to continuing our long-term collaboration with the Army to create significant advances in AI-driven training capabilities for synthetic training environments," says Dr. James Lester, Distinguished University Professor of Computer Science and director of CEI, who is principal investigator for the project. ■



## Department announces Undergraduate Track in Security

The department launched an Undergraduate Track in Security in the Computer Science Undergraduate Program curriculum in fall 2019.

“As technology permeates all aspects of our lives, the real-world impact of the security and privacy of computing systems has never been more critical,” says Dr. Gregg Rothermel, department head. “The launch of this new undergraduate track will allow us to better prepare our students to meet the ever-growing demand for highly skilled security-focused talent that we see in today’s workforce.”

The launch of the new track was led by Dr. Sarah Heckman, director of undergraduate programs. “The Undergraduate Track in Security teaches students the skills necessary to build, analyze and reason about secure and private systems beyond the security topics in the core curriculum,” says Heckman.

Topics will include both an overview of computer and network security and a variety of more in-depth topics, including software security, privacy and cryptography.

Security is of primary concern to many of the department’s ePartner companies. Dan Corgan, senior vice president and cyber threat intelligence officer for BB&T, is thrilled about the new track. Corgan, a member of the department’s Strategic Advisory Board, says “At BB&T and throughout the FinTech space, we are faced with solving new security challenges on a daily basis. The landscape for security-centric computer science talent is extremely competitive, and we certainly applaud NC State for their efforts to create more talent in this space, especially at the undergraduate level.”

This is one of two new undergraduate tracks available to NC State Computer Science students starting in the fall of 2019, the other being a track focused on entrepreneurship.

In 2017, the department launched a Master’s Track in Security.

For more information on the Undergraduate Track in Security and its course requirements, visit [csc.ncsu.edu/academics/undergrad/tracks/security.php](http://csc.ncsu.edu/academics/undergrad/tracks/security.php). ■

## Department ranks second in Technical Games Research

Over the last 10 years, NC State ranks second in the world in publishing at conferences and journals dedicated to games and interactive entertainment computing research.

Mark J. Nelson, a senior research fellow at the MetaMakers Institute of Falmouth University in Falmouth, England, collected

the data on universities and institutions and compiled the rankings.

The rankings’ top 10 were: UC Santa Cruz, University of Alberta, NC State, Queen Mary University of London, Georgia Institute of Technology, New York University, Drexel University, University of Malta, University of York and Maastricht University. ■

## Department adds Undergraduate Entrepreneurship Track

The department launched a new Undergraduate Entrepreneurship Track in the Computer Science Undergraduate Program curriculum in fall 2019.

“The entrepreneurial spirit runs deep in the computer science community,” says Dr. Gregg Rothermel, department head. “At our core, computer scientists are innovative problem solvers, and we are called on to create the exciting new technologies that have permeated literally every aspect of our lives. As a department that fuels the economy in the state of North Carolina, while also nurturing the creation of systems that affect the entire world, we have a fundamental responsibility to develop and nurture the entrepreneurial spirit of our students.”

According to the *Princeton Review* and *Entrepreneur* magazine, NC State is the top college for undergraduate entrepreneurship in North Carolina and ranked 11th nationally for undergraduate entrepreneurship.

Despite NC State’s growing and highly successful entrepreneurship initiative with its broad multi-disciplinary participation and support, official entrepreneurship opportunities for computer science undergraduate students have been limited, with none officially sanctioned by the department. That is, until now.

“Computer science is fundamental and integral to entrepreneurship, yet it has not been easy for computer science students to follow their entrepreneurial dreams here at NC State,” says Dr. Sarah Heckman, director of undergraduate programs.

Heckman, who along with Drs. Laurie Williams (former interim department head) and Vince Freeh (assistant director

of undergraduate programs), were instrumental in the launch of the new track says, “We’ve overcome some of the curriculum challenges so that our undergraduate students can now engage in entrepreneurship as part of their academic coursework and connect with the broader and vibrant entrepreneurial community here at NC State.”

CSC students have always been able to participate in the Engineering Entrepreneurs Program (EEP), however, the associated courses could be counted only as Other Restricted Electives. Heckman says few students had the bandwidth to accommodate this within the rigorous CSC curriculum. “We are now partnering with the EEP to support the CSC Undergraduate Entrepreneurship Track, allowing students to complete the track by customizing 13 hours of required coursework that can fit within their CSC Restricted and Other Restricted Electives,” says Heckman.

CSC alum and entrepreneur DeShawn Brown was excited to hear of the news. “When I was a student at NC State, I had to forge my own entrepreneurial path without a lot of structure or direction,” says Brown, founder of Lithios Apps. “This new track will expose many more aspiring computer science entrepreneurs to the terrific resources available to them at NC State.”

The Entrepreneurship Track is one of two new undergraduate tracks available to NC State Computer Science students starting in the fall of 2019, the second being a track focused on security.

For more information on the CSC Undergraduate Entrepreneurship Track and its curriculum requirements, visit [csc.ncsu.edu/academics/undergrad/tracks/entrepreneurship.php](http://csc.ncsu.edu/academics/undergrad/tracks/entrepreneurship.php). ■

## IBM-NC State Pathfinder Mentoring Program wins 2018 Volunteer Excellence Award

The IBM-NC State Pathfinder Mentoring Program has been awarded a 2018 IBM Volunteer Excellence Award. Presented by IBM Chairman and CEO Ginni Rometty, this is the highest form of global volunteer recognition given by IBM to its employees.

For the first time in the award’s history, IBM will contribute a \$10,000 grant to each partner organization supported by the award-winning IBM volunteers. These grants are intended to amplify the impact of the IBM volunteer’s social responsibility and reflects IBM’s commitment to the communities in which it does business.

This year recipients of the IBM Volunteer Excellence Award are from 13 countries including Argentina, Belgium, Brazil, Costa Rica, Hong Kong, India, Indonesia, Japan, Philippines, Spain, Taiwan, United Kingdom and the United States.

This year’s winners applied IBM strategic technologies such as Watson, analytics and social media to serve critical community issues and the environment. They created innovative programs to help close gender and skills gaps, and provided immigrant students with role models; they worked with rural and under-served communities, cancer patients and organizations around the world. ■



## NC State re-designated a National Center of Academic Excellence in Cyber Defense Research

In 2008, NC State was selected by the National Security Agency (NSA) and the Department of Homeland Security (DHS) as one of the first 23 National Centers of Academic Excellence in Information Assurance Research (CAE-R). NC State, one of only two universities from the state of North Carolina to receive the CAE-R distinction, recently had the designation renewed, and will hold this distinction until 2024.

The CAE-R program recognizes schools that foster an Information Assurance (IA) research focus in curriculum and labs. It establishes a process that will present opportunities for IA research centers to drill deeper into solutions to securing the global information grid and also provide NSA, DHS and other federal agencies insight into the academic IA programs that can support advanced academic research and development. These

agencies recognize the need for robust IA technology, policy and practices in order to enable the nation to prevent or respond to a catastrophic event.

CAE-R universities are eligible for scholarships and grants through both the Federal and Department of Defense Information Assurance Scholarship Programs. The designation can lead to many opportunities for advanced research in the field, and it is a testament to the outstanding IA research already being conducted at NC State, and in particular, within the Department of Computer Science.

Presentations were made to some of the designated centers in April during an awards ceremony at the 2019 CAE Executive Leadership Forum in Pensacola, Fla.

Dr. William Enck, associate professor of computer science, serves as the NC State CAE point of contact. ■

## College places in Top 10 of best online programs

The online engineering and information technology programs offered by the College of Engineering at NC State are both among the top such programs in the country, according to 2019 *US News & World Report* rankings of the Best Online Programs.

NC State's Engineering Online ranked eighth nationally on the list of Best Online Engineering Programs and sixth on the list of Best Online Computer Information Technology Programs.

The online graduate engineering program was also rated in the top 10 on a list of Best Online Graduate Engineering Programs for Veterans.

Established in 1978, Engineering Online is the College's master's degree or professional certificate distance education program. Engineering Online is fully accredited by the Commission on Colleges of the Southern Association of Colleges and Schools, and is authorized in every U.S. state for delivery of online degree programs.

Engineering Online offers 16 different graduate engineering degree programs that are the same high-quality engineering and computer science degree programs offered on campus, but with the flexibility of online learning to help meet students' educational and professional goals.

The *US News* rankings look at metrics including faculty credentials and training, services and technologies made available to students, student excellence and how engaged faculty members are.

Five Engineering Online programs secured top spots in the 2018 online master's degree rankings published by Best College Reviews.

The university's online master's degree programs in nuclear engineering, chemical engineering, environmental engineering, electrical engineering and industrial and manufacturing engineering were named the best in the nation. ■



## Undergraduate game design program ranked among the nation's best

The department's undergraduate game design program is being recognized as one of the best in the United States.

*The Princeton Review* recently released its annual list of Top 50 Undergraduate Schools to Study Game Design for 2019. This year, NC State ranked 23<sup>rd</sup> overall. Additionally, the program has been ranked fifth on The Bachelors Degree Center list of the 25 Best Bachelor's in Game Design Degree Programs for 2019.

*The Princeton Review* list was created based on data collected in a 2018 survey of administrators at 150 institutions in the U.S., Canada and abroad that offer game design courses, majors or degree programs.

The Bachelor's Degree Center ranked the programs according to the factors it considers most important for judging a bachelor's degree program. The center used five factors, with data drawn from the Integrated Postsecondary Education Data System (IPEDS), College Scorecard and Niche student reviews: average alumni salary, employment rate, graduation rate, reputation and tuition cost.

Dr. David Roberts, associate professor of computer science, views the ranking as a large step forward for the program itself.

"*The Princeton Review* methodology takes a broad view of game design as a discipline, so for our program, which is heavily focused on the development of video games and enabling technologies, to earn this recognition is especially exciting," Roberts said.

Dr. Arnav Jhala, associate professor of computer science and co-director of the Digital Games Research Initiative,

credits the ranking to additions to the game design program and recent interdisciplinary collaborations.

"Last year we offered a couple of additional Visual Narrative classes focused on Virtual Reality, which strengthened our project courses," said Jhala. "It is also partly due to our collaboration with College of Design on the Visual Narrative courses that are game themed."

The collaboration between the College of Design and the Department of Computer Science began in 1995 with the first co-taught classes between Dr. James Lester, Distinguished Professor of Computer Science, and Patrick FitzGerald, associate professor of art and design. Throughout the years, the collaboration has grown and developed including the establishment of the IntelliMedia Group. The group, housed in the Department of Computer Science, works to incorporate design and computer science elements to cater to the twenty-first century learning and teaching demands for a high-impact adaptive learning environment.

Recently, Jhala and Todd Berreth from Design have joined forces to further develop the interdisciplinary collaboration.

FitzGerald has seen firsthand the exciting synergy created between the disciplines, which has resulted in various courses, collaborations and grants.

"The College of Design is excited for future collaborations, potential shared courses and potential graduate degrees in game design between CSC and the Department of Art and Design in the College of Design," says FitzGerald. ■



## Department honors 2018 Alumni Hall of Fame inductees

In conjunction with NC State's Red & White Week homecoming celebration, the NC State Computer Science Alumni Hall of Fame officially inducted 10 new members during a special ceremony held at the Park Alumni Center on Friday, November 2<sup>nd</sup>, 2018. The event was attended by more than 70 faculty and staff members, award winners and their families and special guests.

The CSC Alumni Hall of Fame was established to celebrate and recognize the exemplary contributions the department's outstanding graduates have made to their profession, their community and to the world at large.

Award winners were presented a specially designed award to take home and they will be featured on a permanent display wall on the 3<sup>rd</sup> floor of Engineering Building II, near the department's main office. The Hall of Fame wall features an interactive component that is also accessible online ([ncsucsc.touchpros.com/SearchBy.aspx](https://ncsucsc.touchpros.com/SearchBy.aspx)).

The 2018 inductees into the NC State Computer Science Alumni Hall of Fame include:

- Brad Abrams (B.S. '97) – Group Product Manager, Google
- Tanya Estes (M.S. '04) - Lieutenant Colonel in US Army, Associate Professor, Program Director for the Information Technology major, United States Military Academy at West Point
- Jim Fletcher (B.S. '76) – Retired CTO, Distinguished Engineer, Watson IOT, IBM
- Darrell Hubbard (M.S. '88) - Founder and Chief Innovation Officer, Yetta Corporation
- Nathan "Nate" Johnson (B.S. '00) – Director of Weather Operations, NBC-Owned Television Stations
- Stacy Joines (B.S. '88) - IBM Fellow & CTO, Watson Implementations, IBM
- William G. Pagán (M.S. '03) - Senior Patent Attorney, Coats and Bennett PLLC

- John Toebes (B.S. '83) – Co-founder & CTO, Escape Velocity
  - Mark Wyatt (B.S. '80) - Retired Duke Energy Executive, Philanthropist
  - John 'Carl' Zeigler (B.S. '84) – Former CIO of Midway Airlines, SAS Solution Architect for the United States Citizenship and Immigration Service
- In addition, the department recognized four Outstanding Young Alumni including:
- KaMar Galloway (B.S. '13) – Program Manager, "CS First" Program, Google, Inc. (2017 Inductee)
  - Christopher J. Hazard (Ph.D. '10) – Founder & CEO, Hazardous Software
  - Lucy Kosturko (M.S. '10) – Curriculum Development Manager, SAS
  - Scott McQuiggan (M.S. '05, Ph.D. '09) – Director, Curriculum Pathways, SAS
  - Jennifer Sabourin (B.S. '08, M.S. '12, Ph.D. '13) – Research Scientist / Sr. Software Developer, SAS

New department head Dr. Gregg Rothermel was on hand along with former interim department head Dr. Laurie Williams to congratulate and take pictures with the honorees during the special breakfast ceremony in the Park Alumni Center's Grand Ballroom.

"What an incredible group of individuals we have honored today," he said after the event. "They collectively embody the University's mantra to 'Think and Do the Extraordinary'!" says Rothermel. "And we hope that by recognizing our most distinguished alumni, they will serve as an inspiration for current and future students."

Hall of Fame inductee Darrell Hubbard who, at the age of 23 was the youngest person ever to serve as a chairperson in the International Standards Organization, had this to say about the honor. "I've always been self-motivated to excel beyond the odds. However, this day of recognition encourages me in my continued pursuit of social, technological and business excellence."

Ken Tate, director of engagement and external relations, says this is a very special class of inductees. "By my count, this group holds well over 330 patents, has authored at least six books and has created products, applications and technology enhancements that have positively impacted the lives of millions of people around the globe."

But Tate adds, "With more than 9,600 alumni scattered all over the globe, we don't know about everyone's accomplishments."



To nominate someone for future consideration, please visit the CSC Alumni Hall of Fame page. ([csc.ncsu.edu/alumni/hall-of-fame.php](https://csc.ncsu.edu/alumni/hall-of-fame.php))

## Graduates find technical solutions to teachers' problems with Curriculum Pathways



Jennifer Sabourin

A computer science career encompasses many different fields. From math to English to Spanish, computer science provides a future of limitless opportunities.

NC State computer science graduates Lucy Kosturko (M.S. '10), Scott McQuiggan (M.S. '05, Ph.D. '09) and Jennifer Sabourin (B.S. '08, M.S. '12, Ph.D. '13) embody this every day in their careers at

SAS. They serve on the Curriculum Pathways team directed by McQuiggan, where Kosturko is a curriculum development manager and Sabourin is a research scientist and senior software developer.

Their shared passion for computer science and education has helped grow a collaborative, interdisciplinary program benefitting students and teachers across the globe.

Curriculum Pathways from SAS is a platform that uses technology to enhance learning. To do this, Curriculum Pathways develops free resources to find technical solutions for common problems teachers face in the classroom. It offers more than 2,000 resources for students in grades K-12, and spans five core subjects of English, math, science, social studies and Spanish.

The program plays an important role in SAS's philanthropic mission to create brighter futures for younger generations. McQuiggan points to Curriculum Pathways as being a major cornerstone of that commitment.



Scott McQuiggan

"At Curriculum Pathways, we're fortunate to live out the company's passion in education every day," says McQuiggan. "There is no better place than SAS to have the freedom to solve the problems of teachers and students. That's one of the things that makes SAS a great place to work."

Kosturko, Sabourin and McQuiggan communicate with teachers about challenges and problems in their

classroom, then collaborate with the Curriculum Pathways team to create solutions. The team's interdisciplinary approach goes beyond computer science to include psychology, art, social studies, math and other topics. The resulting resources, tools and apps address many classroom needs, and include popular free resources such as CodeSnaps, Writing Reviser and most recently, Crio.

"Coding is only a small part of computer science and software

development. It really takes a village and it's very collaborative," says Kosturko. "Computer science has a reputation of being isolating when, in practice, it requires significant communication and teamwork."

Sabourin credits her NC State education specifically for preparing her for such a rewarding and multi-faceted career.

"I really appreciated the flexibility to make my degree what I wanted by combining electives in areas such as psychology and education with courses within the department, on interesting topics like AI and machine learning," says Sabourin. "I use what I learned in those different classes daily. It really prepared me for such an interdisciplinary career."

Dr. James Lester's lab at NC State is a place that all three fondly remember as being an open environment that promoted cross-disciplinary collaboration among students.

"Dr. Lester's lab is where we learned to work together —



Lucy Kosturko

building on each other's creativity and critical thinking to spur innovation. It's the spirit of teamwork we apply every day at Curriculum Pathways," says McQuiggan. "We see this type of collaboration replicated across the other divisions at SAS, too. It is an effective approach to solving problems."

The three wrote a book in 2015 entitled "Mobile Learning: A Handbook for Developers, Educators, and Learners." The book presents a comprehensive look at mobile learning by synthesizing relevant theories and drawing practical conclusions for developers, educators and students. With the launch of the iPad and Curriculum Pathways first mobile app, Flash Cards, in 2010, the landscape of technology in the classroom was forever changed. With new technologies come new challenges discussed in the book.

"The book unites different perspectives of those who build, deploy and use educational technology to ensure everyone is working with a common understanding," says Sabourin.

Kosturko, Sabourin, McQuiggan and the entire Curriculum Pathways team combine their shared passions and unique educational backgrounds to create free, high-quality resources used by more than 4.5 million teachers and students.

"A mentor of mine once shared that the best measure of success is getting to work with the people that you want to work with," says McQuiggan. "I take great pride in sharing this meaningful mission with SAS and the Curriculum Pathways team." ■



## Gordon receives DEA Award

The College of Engineering at NC State bestowed the Distinguished Engineering Alumnus award on computer science alumna Suzanne Gordon and three others.

Dr. Louis A. Martin-Vega, dean of the College, recognized Gordon, Peter Lehrer, Alan Weinberg and Gil West at a banquet on Oct. 31, 2018.

Gordon earned her bachelor's degree in computer science and mathematics in 1975 and master's degree in statistics from NC State in 1980. During her 30+ years at SAS Institute, she held a variety of key leadership roles, rising to vice president of information technology, and eventually chief information officer, at the world's largest privately held software company. While at SAS, Gordon was named a Premier 100 IT Leader by Computerworld and was recognized by the Triangle Business Journal as one of the region's top 25 women in business.

She is the current president of the NC State Engineering Foundation Board of Directors and is the first woman to hold that position. She was a member of the NC State Board of Trustees from 1999 to 2009 and has served on the Alumni Association Board of Directors and on the College of

Management Advisory Board. She is a Distinguished Alumna of the College of Physical and Mathematical Sciences. Additionally, Gordon has made a significant impact over time in the area of community and public service. For more than a decade, she has worked with Communities in Schools (CIS) of Wake County, serving on the CIS board for most of that time and serving as board chair from 2012 to 2014. She launched a nonprofit, Gordon Services, which provides young, at-risk people with guidance and experience in the professional world.

Under the leadership of the late Dean Ralph Fadum, the Distinguished Engineering Alumnus Award was established by the faculty of the College of Engineering at NC State in 1966 to honor engineering graduates who have been recognized for outstanding achievements in one or more of the following categories:

- Planning and direction of engineering work
- Fostering professional development of young engineers
- Contributing to knowledge in the field of engineering
- Bringing, in other ways, distinction to the University through engineering achievement. ■

## Seltzer joins staff as director of development



The department is pleased to announce the addition of Sara Seltzer as director of development, a role in which she will be responsible for engagement and major gift cultivation for the department's 9,000+ alumni.

Officially a member of the NC State Engineering Foundation staff, Seltzer will also serve as director

of development for the Department of Materials Science and Engineering.

Seltzer joined NC State in February 2013 as a development specialist for Arts NC State, where she helped make the Gregg Museum Building Campaign a success. Shortly thereafter, she was promoted to assistant director of development for the Division of Academic and Student Affairs' development office to build the division's pipeline of support from the ground up. She secured several major gifts for the division and developed many valuable relationships, both externally and internally.

Prior to NC State, Seltzer worked in development for the Brevard Music Center, just south of Asheville, NC. She

received her bachelor's degree in management from Stetson University's School of Business and holds a master's degree in arts administration from the Savannah College of Art and Design. She brings nearly eight years of experience working in advancement including major gifts, annual giving, planned giving, prospect management, development writing, alumni affairs, communications, board development and discovery work.

"We are very excited to have Sara join our team", says Dr. Gregg Rothermel, department head. "Sara brings not only an impressive track record as a major gifts officer, but also a passion for data analytics that would impress anyone in our discipline. She has a very positive and energetic personality, and I think our alumni are going to really appreciate the passion she brings to her role. We look forward to her developing strong relationships with our incredible alumni and helping them discover how they can make a difference in the life of our department."

Ken Tate, director of engagement and external relations, says that Seltzer's addition is very timely. "One of the very first things we're going to ask Sara to do for us is to coordinate a series of 'Meet the new Department Head' events. It's just as important that our alumni in Silicon Valley and Seattle get to meet Dr. Rothermel as it is for our North Carolina alums," says Tate. "This is the perfect time for Sara to get out and meet lots of our alumni across the nation." ■



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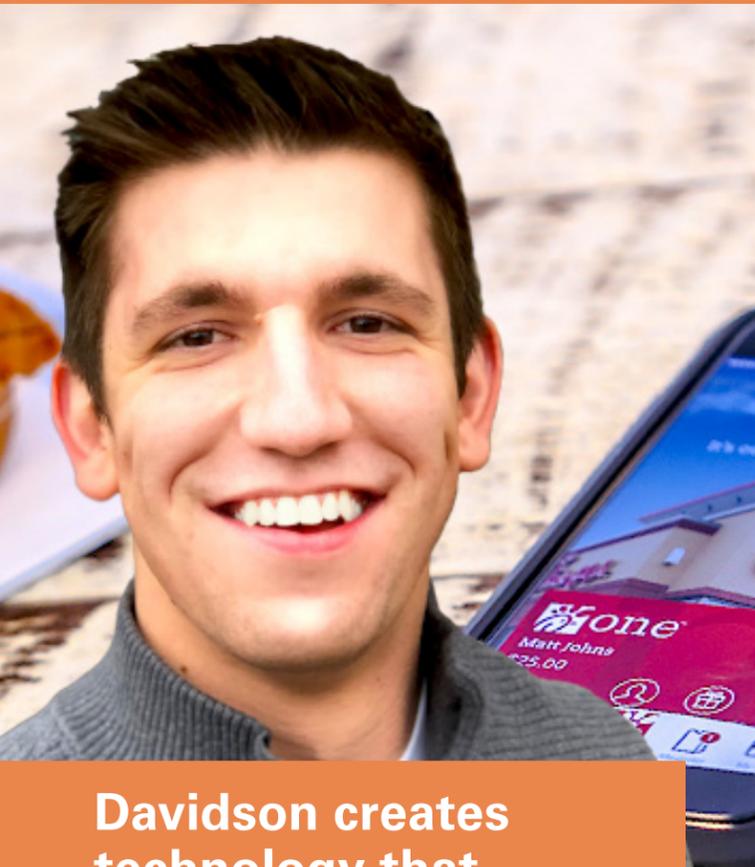
- Who will receive the home? The car? The stocks? The jewelry? Who will take care of the children if they are not yet of legal age?
- Do you have relatives, even children, who should not receive assets?
- Are there charities you wish to benefit from your estate?

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- **Living will:** Articulates your wishes concerning heroic, life-sustaining measures
- **Durable power of attorney:** Designates a trusted individual to handle legal and financial matters on your behalf
- **Health care power of attorney:** Stipulates who will make health care decisions on your behalf, should you be unable to do so

"We wanted a way to help qualifying students get a much-deserved education in a rising cost environment. Working with CSC development officers over the years gave us the opportunity to establish an endowment that would provide scholarship opportunities today as well as many years into the future. We strongly encourage others to join us by including NC State/CSC in their estate planning."

**Robin and Mark Wyatt ('80)**



## Davidson creates technology that encourages us to eat more chicken

When you are consistently ranked as the top fast food restaurant, year after year, how do you improve? This is the challenge faced by Chick-fil-A. The answer — embrace technology to enhance the customer experience.

If you are a Chick-fil-A fan, you have surely noticed the increasing number of customers who are using the restaurant’s mobile app to order (and pay for) food in advance, allowing them to quickly stop in (or drive thru) to pick up their orders. Or you may have noticed the efficiency with which staff uses mobile technology to take orders to speed you through the drive-thru process.

As you marvel at Chick-fil-A’s speed and efficiency, one of the people you can thank is NC State alum Eric Davidson (B.S. ’17), a software development engineer working at Chick-fil-A’s corporate office in Atlanta. Eric and his quality engineering team are working on more than 30 projects designed to improve the customer experience through efficiency and quality, each with their own unique automation barriers. Two of these projects, the Point of Sale (POS) systems and the mobile application, are most recognizable to the average customer.

“My team influences quality over all development teams and we champion this idea that quality in technology is a shared responsibility with everyone,” says Davidson. “My role specifically is working with the people across all of these technologies to support their automation efforts.”

Davidson is impressed with the company’s roots in technology.

“Technology is deeply integrated into their restaurant in ways that the customer doesn’t always see,” says Davidson, “Technology makes sure our customers get quality food quickly.”

Out of the team’s many projects, the mobile application as well as the POS system have a direct impact on the customer on a day-to-day basis. The application allows members to place orders from their devices and earn points for every purchase to redeem rewards of their choice. The POS system is a combination of software and hardware that Chick-fil-A uses to make transactions and simplify business operations.

His work with both the app and their POS system focuses on functionality and efficiency to ensure consumers have unparalleled service. Not surprisingly, Davidson’s team’s work has paid off since his start at the company.

**“Every company is a technology company — even a fast food restaurant. Many of the things I learned in the classroom, I use every day in my job here at Chick-fil-A. It’s very applicable in the real world.”**

**- Eric Davidson ’17**

“In the past two years, I’ve been with the Quality Engineering team I’ve seen a ton of progress and innovation,” says Davidson. “Every day we’re all working to drive quality and look for better ways to do things or just create those ways ourselves. It’s working well and I’m excited to see what we can accomplish in 2019.”

Davidson’s interest in computer science was spurred by a high school class that caused him to fall in love with the problem-solving aspect of the discipline. He credits much of his success at Chick-fil-A to his computer science education at NC State.

“What they taught me at NC State is absolutely true,” says Davidson. “Every company is a technology company — even a fast food restaurant. Many of the things I learned in the classroom, I use every day in my job here at Chick-fil-A. It’s very applicable in the real world.”

What is his favorite Chick-fil-A menu item? “That’s easy,” says Davidson. “I’m a huge fan of the Grilled Chicken Club.” And how does he order his Grilled Chicken Club? “With the Chick-fil-A app, of course.” ■

## Alumnus is one of Raleigh’s shining entrepreneurial stars



For an aspiring entrepreneur, there are many educational paths to take, and for NC State graduate DeShawn Brown (B.S. ’14), one stood out — computer science.

As the founder and CEO of Lithios, some might say Brown took an unconventional route to get to where he is today. When he arrived at NC State as a prestigious Park Scholar, he was sure about his passion for technology, art and entrepreneurship. But as for his ultimate major, he remained undecided until one particular computer science course spurred his interest.

Brown recalls that he originally enrolled in a graphics course to fulfill an elective requirement.

“That class really triggered something in me. I knew I wanted to create and build. I just didn’t know which major would help me do that,” said Brown. “I had lots of ideas, but it became obvious to me that a computer science degree could help me take an idea from concept to reality.”

Shortly after taking the class, he had the answer he was looking for, so he met with his advisor to declare computer science as his major.

A “people-person” with an extensive background in theatre, Brown participated in the NC State University Theatre’s production of *Little Women*, performing in 14 shows. He credits his theatrical background for his people skills he uses on the job every day.

“Through acting, I learned the fundamentals of getting the audience’s attention, holding it and delivering my message at precisely the right time,” said Brown. “I attribute many of the skills I rely on as an entrepreneur to my experience in the theater.”

As a student, Brown found himself looking for ways to combine this newfound interest in computer science with his entrepreneurial passion. He quickly made friends in his new major and formed a study group with two of his classmates. Unbeknownst to them, this study group would one day become a leading mobile application development firm in the Research Triangle.

The firm’s name, Lithios, combines the element Lithium, which is used in batteries for long-lasting and powerful results, with the team’s original passion for the Apple operating system iOS (Lithium + iOS). Lithios prides itself on its core beliefs: creativity, innovation, transparency, entrepreneurship and community.

Lithios’ core beliefs are central to who Brown is as a developer, entrepreneur and person. His passion is apparent in everything he does from his interactions with others to the quality of product his firm produces.

However, Lithios is not Brown’s first endeavor. While at NC State, Brown worked on a variety of entrepreneurial projects, including a ride share application called Campus Cruiser. The popular app was used by students for about a year, but it was quickly replaced by the disruptive Uber app. While disappointed, Brown viewed this not as a failure, but rather an opportunity to learn and grow as an entrepreneur.

“Campus Cruiser taught me that college students will always pick what’s quickest, cheapest and most convenient,” he said. “They aren’t always worried about brand loyalty like older demographics.”

Among his many other developments is an application similar to a combination of Snapchat and FlappyBird. It was his team’s first viral application reaching 7,000 downloads in the first few weeks. Brown said the app eventually shut down because his team wasn’t ready to effectively market the product. He chalked this up as another learning opportunity.

A self-proclaimed “champion for computer science and entrepreneurship,” Brown aspires to act as an example for others interested in his career path and encourage them to explore the combinations’ endless possibilities.

“I’m super excited about the recent announcement of a new Entrepreneurship Track in the CSC Undergraduate Program,” said Brown. “I think this is going to be a huge draw for others like me to NC State and the Computer Science department.”

Brown’s office is located in HQ Raleigh, a co-working space in Raleigh that houses a variety of entrepreneurial ventures. The collaborative spirit and exciting energy of startups fuel Brown’s hunger for innovation and pushes him to create at the same caliber as his previous ventures, all while growing and learning.

And that’s the path to success he takes to work each day. ■



Bitra Akram

**BITA AKRAM** joined the department in fall 2019 as a teaching assistant professor. Her research focus is on designing advanced learning technologies for instructional support and improving access and quality of computer science education by developing innovative computer science curricula. Prior to joining the faculty, she was a research assistant at the NC State University Center for Educational Informatics and the Friday Institute for Educational Innovation. She earned her Ph.D. (2019) from NC State University.



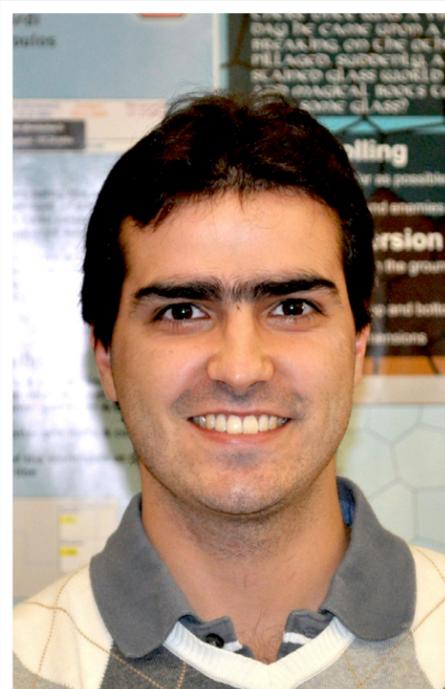
John-Paul Ore

**JOHN-PAUL ORE** joined the department in fall 2019 as an assistant professor. His research interests are in the areas of software engineering, robotics, program analysis and system testing using high-resolution physical simulators. He received his Ph.D. (2019) from the University of Nebraska - Lincoln.



Ruozhou Yu

**RUOZHOU YU** joined the department in fall 2019 as an assistant professor. His research interests are broadly in the areas of computer networks, distributed systems and cybersecurity. He received his B.S. from the Beijing University of Posts and Telecommunications, and his Ph.D. (2019) from Arizona State University.



Ignacio Dominguez

**IGNACIO DOMINGUEZ** joined the department in fall 2019 as a teaching assistant professor. His research studies human behavior in video games and virtual environments to create computational models of interaction that can be used to identify, predict and influence behavior and decision-making. He earned his B.S. from the Universidad Catolica Andres Bello, and his M.S. and Ph.D. (2018) in computer science from NC State University.



Don Sheehy

**DON SHEEHY** joined the department in fall 2019 as an associate professor. His research is in the areas of computational geometry and topological data analysis. Prior to coming to NC State, he was on the faculty at the University of Connecticut. He received his B.S.E. in computer science from Princeton University, and his Ph.D. (2011) from Carnegie Mellon University. ■



Tammy Coates

## MUELLER RECEIVES GAUSS AWARD AT ISC 2019

Dr. Frank Mueller, professor of computer science, recently received the Gauss Centre for Supercomputing (GCS) Best Paper Award at the International Supercomputing Conference (ISC 2019) held in June in Frankfurt, Germany. The award included a 5,000 Euro monetary award to the NC State Engineering Foundation in support of Mueller's research.

The paper, "End-to-End Resilience for HPC Applications," was co-authored by Arash Rezaei, Harsh Khetawat, Onkar Patil (from NC State) and Paul Hargrove and Eric Roman (from Lawrence Berkeley National Laboratory).

"Our work investigates the impact of making multiple kernels in a high-performance application fault tolerant to address resilience at large scale," Mueller said. "We discovered that a window of vulnerability is created between kernels that are otherwise protected. This often-overlooked window tends to result in half of the data structures to remain subject to silent data corruption. We developed techniques to close such vulnerabilities and deliver true end-to-end data protection between HPC kernels."

"We appreciate the GCS award as an encouragement for our work and an acknowledgment of the relevance of our contribution to HPC, and hope that many practitioners can benefit from our work."

## COATES HONORED WITH COLLEGE'S 2019 AWARD FOR EXCELLENCE

Two outstanding staff members from the department were recognized as nominees for the annual College of Engineering Awards for Excellence at a ceremony held May 9, 2019, at the James B. Hunt Jr. Library on NC State's Centennial Campus. Dr. Louis Martin-Vega, dean of the College of Engineering, presented the awards to nominees Tammy Coates, assistant director of external relations, and Linda Honeycutt, director of business administration.

The department is pleased to announce that Tammy Coates was named one of two EHRA Award for Excellence recipients.

Coates was nominated in the Customer Service category. Per her nomination, "The great pop icon and philosopher Bob Dylan said, 'It may be the devil or it may be the Lord, but you're gonna have to serve somebody.' I nominate Tammy Coates because she serves everyone! And it is not just that she serves, but the fact that she does so in such a selfless way, always putting the other person's or department's needs ahead of her own. Her complete and total focus on customer service has made an indelible mark on the lives of so many. After a decade of outstanding service, the results of her efforts are woven into the fabric of our department. She has left her mark, and continues to do so, and we are most fortunate to have her on our team."

Honeycutt was also nominated in the Customer Service category. Per her nomination, "Linda is amazingly efficient and hardworking, does an excellent job of supervising staff, and juggles more responsibilities than I even know. She is extremely reliable, is very careful with sensitive information and is always a pleasure to work with. It is inspiring to work with employees like her."

The Awards for Excellence program recognizes the accomplishments and achievements of permanent NC State employees at both the unit and University levels who do not hold faculty rank. Award recipients received eight hours of paid time off, a \$250 check and a plaque.

Coates became a nominee for the university-wide Awards for Excellence, where the 12 possible winners receive an additional eight hours of paid time off, a cash award of \$1,000, and an engraved award plaque. The NC State University Awards for Excellence recipients are then submitted for consideration for the Governor's Awards for Excellence, which is the highest honor awarded to a State of North Carolina employee.



Dr. Sarah Heckman

## HECKMAN WINS PERSON OF EXCEPTIONAL PERFORMANCE AWARD

The department is pleased to present the 2018-2019 "Person of Exceptional Performance" or PEP Award to Dr. Sarah Heckman, director of undergraduate programs and teaching associate professor.

A three-time graduate of the department (B.S. '04, M.S. '05, Ph.D. '09), Heckman was the first teaching-track faculty member hired in computer science at NC State. And what an incredible teacher she is, making an indelible mark on the department's students every day. Heckman was recognized with the NC State University Outstanding Teacher Award and the Alumni Association Outstanding Teacher Award in 2015. She is a member of the Academy of Outstanding Teachers at NC State, and in 2017 was presented with an NC State Computer Science Outstanding Young Alumni Award.

In 2018, she was named Alumni Distinguished Undergraduate Professor. Despite her role as a teaching professor, she has still been very active in research, such as working with

colleagues at Duke and UNC to create a scalable, effective and evidence-based peer teacher training program designed to increase undergraduate retention and diversity in introductory programming courses. And, she continues to work on funded projects to improve the effectiveness of the department's undergraduate curriculum.

More recently, Heckman has been the driving force behind the undergraduate research effort, and the department has seen a steady increase in the number of students participating in that program since its launch.

This year, she has not only made a smooth transition into the director of undergraduate program position, she took the lead in orchestrating the launch of two new undergraduate tracks in security and entrepreneurship.



Dr. James Lester

## LESTER NAMED DISTINGUISHED UNIVERSITY PROFESSOR

Dr. James Lester has been named a Distinguished University Professor in the Department of Computer Science. A Fellow of the Association for the Advancement of Artificial Intelligence (AAAI), he is the founding director of the Center for Educational Informatics (CEI).

Lester is internationally recognized for his research on artificial intelligence technologies for education. His current work spans intelligent game-based learning environments, multimodal learning analytics, affective computing and computer-supported collaborative learning. The adaptive learning environments he and his colleagues create have been used by thousands of K-12 students throughout the U.S.

Lester founded CEI in 2014 to establish a unique interdisciplinary R&D center with the mission of developing next-generation learning technologies leveraging artificial intelligence. CEI designs adaptive learning environments for K-12 and higher education, defense and first responder training and healthcare. With a portfolio of broadly interdisciplinary projects, CEI is housed in the NC State College of Engineering and collaborates with partner research institutions across the country and internationally.

Lester is the author of more than 200 peer-reviewed publications. His research program is supported by the National Science Foundation (NSF), the National Institutes of Health, the US Army Research Laboratory and the National Institute of Standards and Technology. Additional support has been provided by DARPA, the Social Sciences and Humanities Research Council of Canada, EDUCAUSE, SAS, the William and Flora Hewlett Foundation and the Bill & Melinda Gates Foundation.

Lester has served as editor-in-chief of the *International Journal of Artificial Intelligence in Education*. He is the recipient of the NSF CAREER Award, the NC State University Outstanding Teaching Award and the Best Paper Awards at the International Conference on Artificial Intelligence in Education, the ACM International Conference on Intelligent User Interfaces, the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment and the International Conference on User Modeling, Adaptation, and Personalization. His foundational work on pedagogical agents has been recognized with the IFAAMAS Influential Paper Award by the International Federation for Autonomous Agents and Multiagent Systems.

Lester joined the NC State faculty in 1994. He received his B.A. in history from Baylor University and his B.A., M.S.C.S., and Ph.D. in computer science from the University of Texas at Austin.



Dr. Carla D. Savage

#### **SAVAGE NAMED 2019 SIAM FELLOW**

Dr. Carla D. Savage, professor of computer science, has been named a Society for Industrial and Applied Mathematics (SIAM) Fellow, Class of 2019. Savage is being recognized for outstanding research in algorithms of

discrete mathematics and in computer science applications, alongside exemplary service to mathematics.

Members were nominated for their exemplary research as well as outstanding service to the community. Through their contributions, SIAM Fellows help advance the fields of applied mathematics and computational science.

In 2012, Savage was invited to join the inaugural class of Fellows of the American Mathematical Society (AMS). In 2013, she was named secretary of the AMS, becoming only the 10th secretary in the organization's 131-year history.

Savage received her B.S. in mathematics from Case Western Reserve University in 1973, and her M.S. and Ph.D. in mathematics from the University of Illinois, Urbana-Champaign in 1975 and 1977, respectively. Her research interests lie in

combinatorics; enumeration and structure in combinatorial families; theory of partitions; linear Diophantine enumeration; lattice point enumeration; permutation statistics; and the combinatorics, geometry and number theory of lecture hall partitions. Savage joined the department in 1978.

#### **EXECUTIVE DIRECTOR, CHIEF SCIENTIST NAMED FOR IBM Q HUB**

NC State has named two leaders for the new IBM Quantum Computing Hub on Centennial Campus.

Dr. Daniel Stancil, Alcoa Distinguished Professor and head of NC State's Department of Electrical and Computer Engineering, will be executive director of the hub, and Dr. Patrick Dreher, research professor in the Department of Computer Science and associate faculty member in the Department of Physics, will be the hub's chief scientist.

In May 2018, NC State became the first university in North America to establish an IBM Q Hub as part of the global IBM Q Network, a collaboration between IBM and top Fortune 500 companies, national research labs and leading universities to advance quantum computing. The network provides early access to IBM's quantum computing systems, with the goal of exploring practical applications important to business and science. Those include molecular modeling, machine learning, physics, materials science, chemical simulations, complex optimization problems and quantitative finance.

As executive director, Stancil will oversee the hub's strategic operations, including partnerships with industry, government and other universities. Dreher will identify strategic research opportunities for quantum computing at NC State and guide the development of curriculum and education programs. Stancil and Dreher also will work closely with the hub's steering and research and education advisory committees.

"Dr. Stancil has vast experience leading complex interdisciplinary initiatives within research universities," said Dennis Kekas, associate vice chancellor for partnerships and economic development, and Q Hub steering committee member. "He is a great fit to oversee the development of the IBM Q Hub at NC State."

Stancil has spent many years as a professor of electrical and computer engineering at both Carnegie Mellon University and NC State. While at Carnegie Mellon, he served as associate head of the electrical and computer engineering department, and associate dean for academic affairs in the College of Engineering. He has been department head at NC State since 2009. Stancil received his doctorate and master's degree in engineering from MIT.

"Dr. Dreher brings decades of experience from industry, government and academia," said Mladen Vouk, vice chancellor for research and innovation, and Q Hub steering committee

member. "His leadership will advance NC State's quantum computing research and education initiatives."

Dreher has more than 25 years of research experience in the applications of computer technologies to science and engineering research problems. Prior to joining NC State, he held senior scientific and R&D management positions at MIT, and served in similar roles in both government research labs and industry. Dreher's scientific interests range from potential quantum computing applications for fundamental physics to interfaces with computer science and areas of quantitative finance. Dreher received his doctorate in physics from the University of Illinois Urbana-Champaign and MBA from Rensselaer Polytechnic Institute.

The IBM Q Hub at NC State became operational on Centennial Campus in fall 2018, providing NC State remote access to IBM Q commercial quantum computing devices, including the most advanced and scalable universal systems available. The current 20 qubit IBM Q system will be followed by a 50 qubit prototype in the next generation.

NC State students, faculty and staff interested in learning more or requesting access to the IBM Q Hub at NC State commercial network should visit [quantum.ncsu.edu](http://quantum.ncsu.edu).



Dr. Timothy Menzies

#### **MENZIES ELECTED AS FELLOW OF IEEE**

Dr. Timothy Menzies, professor in the department, has been elected as a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for 2019.

Menzies is the department's 10th IEEE Fellow, joining Drs. George

Rouskas, Harry Perros, Donald Bitzer, Wushow "Bill" Chou, Mladen Vouk, Munindar Singh, Frank Mueller, Laurie Williams and Gregg Rothermel.

The IEEE Fellow is one of the most prestigious honors of the IEEE, and is bestowed upon a very limited number of Senior Members who have contributed importantly to the advancement or application of engineering, science and technology bringing significant value to the society.

Menzies, who joined the NC State faculty in 2014, was recognized for his contributions to software engineering for artificial intelligence.

His research focuses on software engineering (SE), data mining, AI optimization, and search-based SE, and better methods for open access science. He is the director of the NC State RAISE

lab (real world AI for software engineering) and is the curator of the PROMISE repository (storage for SE project data).

Amongst his many awards, he received the Mining Software Repositories Foundational Contribution Award in 2017; the Carol Miller Graduate Lecturer Award in 2016; the IBM Faculty Award in 2016 and 2017; the LexisNexis Faculty Award in 2015, 2016 and 2017; and the Laboratory for Analytical Science funding in 2017 and 2018.

He received his B.S. in computer science, Master of Cognitive Science and Ph.D. in cognitive science, all from the University of New South Wales.



Dr. Frank Mueller

#### **MUELLER NAMED DEPARTMENT'S FIRST ACM FELLOW**

Dr. Frank Mueller, professor of computer science, was recently named a 2018 Association for Computing Machinery (ACM) Fellow for his contributions to the predictability of real-time systems, resilience in high-performance computing

and multi-threading techniques.

Mueller is the first faculty member in the Department of Computer Science to be recognized with this distinguished honor.

ACM Fellows are composed of an elite group that represents less than 1 percent of the Association's global membership. ACM named 56 members Fellows for their significant contributions in areas including computer architecture, mobile networks, robotics and systems security. According to the ACM, "The accomplishments of the 2018 ACM Fellows underpin the technologies that define the digital age and greatly impact our professional and personal lives."

Fellows hail from universities, companies and research centers in Finland, Greece, Israel, Sweden, Switzerland and the U.S. They have been cited for numerous contributions in areas including accessibility, augmented reality, algorithmic game theory, data mining, storage, software and the World Wide Web.

In addition to being named an ACM Fellow, Mueller has received numerous awards and recognitions including being named an Institute of Electrical and Electronics (IEEE) Fellow in 2016, a member of the IEEE Golden Core in 2012 and an ACM Distinguished Scientist in 2011.

Mueller joined the department in 2001. He earned his B.S. from the Technical University of Berlin and his M.S. and Ph.D. from Florida State University in 1991 and 1994, respectively.

His research interests include architecture and operating systems, cloud computing, embedded and real-time systems, parallel and distributed systems, scientific and high-performance computing, quantum computing and software engineering and programming languages.



Dr. Xipeng Shen

**SHEN NAMED DISTINGUISHED MEMBER OF THE ACM**

Dr. Xipeng Shen, professor in the department, has been named a 2018 Distinguished Member of the Association for Computing Machinery (ACM).

The ACM has named 49 Distinguished

Members for their contributions to the field of computing. The Distinguished Member Grade recognizes those ACM members with at least 15 years of professional experience and five years of continuous Professional Membership who have achieved significant accomplishments or have made a significant impact on the computing field. The 2018 ACM Distinguished Members are exemplars for their peers, and represent ACM's worldwide geographic reach, as well as the exciting range of subdisciplines that constitute today's technology landscape.

The 2018 ACM Distinguished Members work at leading universities, corporations and research institutions around the world. They represent countries including Australia, Canada, Chile, China, France, Germany, Japan, New Zealand, Singapore, Sweden, the United States and the United Kingdom. These innovators have made contributions in a wide range of technical areas including algorithms, artificial intelligence, computer architecture, computer science education, cybersecurity, graphics, human-computer interaction and networking.

The ACM Distinguished Member program recognizes up to 10 percent of ACM worldwide membership based on professional experience as well as significant achievements in the computing field.

**VOUK LEADS OFFICE OF RESEARCH AND INNOVATION**

Dr. Mladen Vouk, Distinguished Professor in the department and former department head, took over NC State's research enterprise with the retirement of Alan Rebar from his position as vice chancellor for research and innovation.

Vouk will serve as vice chancellor for research and innovation for two to three years. After that, the university will conduct a national search to fill the position.



Dr. Mladen Vouk

Engineering Laboratory.

He also has served as technical director of the Center for Advanced Computing and Communication and associate vice provost for information technology.

Vouk is an IEEE Fellow who has received the organization's Distinguished Service and Golden Core awards. He is the author or co-author of more than 300 publications and has conducted groundbreaking research in software engineering, scientific computing and analytics, information technology and education, and high-performance computing.

He earned a doctorate in solid state physics at King's College London and a master's degree in computer science at NC State.

"Mladen is a distinguished professor and a highly respected computer scientist," NC State Chancellor Randy Woodson says. "He has played a significant role in the research growth NC State has experienced in recent years, and I'm confident he will do an outstanding job in this new position."



Dr. Donald Bitzer

A faculty member at NC State for more than 30 years, Vouk directs the university's Data Science Initiative. He is co-creator of NC State's Virtual Computing Laboratory, one of the world's first cloud computing systems, and co-founder of NC State's Computer Science Software Systems and

**BITZER WINS HOLLADAY MEDAL**

Dr. Donald Bitzer, Distinguished University Professor in the department, was one of two faculty members in the College of Engineering to receive the Alexander Quarles Holladay Medal for Excellence, the highest honor bestowed by NC State and the university's

Board of Trustees. Chancellor Randy Woodson recognized the awardees during the 2019 Celebration of Faculty Excellence on May 1.

Dr. Youngsoo (Richard) Kim, Jimmy D. Clark Distinguished University Professor in the Department of Civil, Construction, and Environmental Engineering, was the other recipient.

The award was named in honor of Alexander Quarles Holladay, NC State's first professor of history and its first president. The 2019 award winners have made outstanding and sustained contributions to the university through achievements in research, teaching, or extension and engagement. Honorees receive an engraved medal and framed certificate, and are recognized at spring commencement.

Bitzer earned his Ph.D. in electrical engineering from the University of Illinois. His scholarship focuses on computer systems, computer displays, data communications, voice analysis and genetics to amplify protein production. He is also the inventor of plasma panel displays used for flat panel television displays. Bitzer is a member of the National Academy of Engineering and is a Fellow in the American Association for the Advancement of Science, the Institute of Electrical and Electronics Engineers and the International Engineering Consortium.

In 2002, he received the National Academy of Television Arts and Sciences Emmy for Scientific Development and Technical Achievement for the development of plasma displays. Bitzer was elected a Laureate of the Lincoln Academy of Illinois, an honor bestowed by the State of Illinois for achievement of Illinois citizens in the betterment of human endeavors. He has also received the Vladimir K. Zworykin award of the National Academy of Engineering.

**DEPARTMENT ESTABLISHES GOODNIGHT PROFESSORSHIP**

Building on its success as a global leader in the artificial intelligence space, the department is pleased to announce the addition of an endowed Goodnight Distinguished Professorship in Artificial Intelligence and Machine Learning. The individual who accepts this new faculty position will hold tenure in the department and will be positioned as a key leader in the vibrant and expanding artificial intelligence community at NC State, the Research Triangle and beyond.

As one of the largest and oldest departments in the nation, the department has firmly positioned itself among the global leaders in the space, transforming the fields of artificial intelligence and machine learning through technological and scientific breakthroughs. The department boasts several highly recognized research centers and laboratories. For example, the Center for Educational Informatics (CEI) led by Dr. James Lester, is driving a broad interdisciplinary research portfolio in excess of \$25M, with the overarching objective of making transformative advances in technology-rich learning. On the Gaming front, the department's undergraduate Game ■



**TATE RECOGNIZED AS 2018 LEADER IN DIVERSITY**

Every year, the *Triangle Business Journal* (TBJ) honors companies and individuals who have shown an exceptional commitment to promoting practices that advance diversity in the workplace and in business leadership.

Ken Tate, director of engagement & external relations for the department, was among eight local leaders recognized by the TBJ as one of the 2018 Leaders in Diversity.

Tate was recognized for his leadership efforts over the last decade to work closely with the department's Strategic Advisory Board, industry partners, College of Engineering admissions and a variety of department and university resources to develop and deploy a comprehensive outreach strategy designed to increase the attraction of females and under-represented students into the computer science discipline at NC State.

In spring 2007, there were just 57 females in the computer science undergrad program at NC State, representing a mere 9.6 percent of the total CSC undergraduate population. Flash forward 10 years to the fall of 2017, when the department celebrated its 50th year, and the female CSC undergraduate population had grown more than threefold to 186, representing over 18 percent of the total undergraduate enrollment. Net growth of females in the undergraduate population is almost 88 percent over the decade. The department has experienced similar growth in undergraduate Hispanic and Asian American populations over that period.

Humbly accepting the award on behalf of the department, Tate says he will never consider this an individual award. "I feel very honored to have been selected by the *Triangle Business Journal* for this award," Tate said, "but I am not deserving of the recognition alone. There were so many others who were involved and played a huge role in the strides we have made to bring more females and diversity into the computer science discipline."

Ironically, Tate's passion for outreach was fueled by his failure to recruit his own daughter into the discipline. "Back in 2006, when she was applying to colleges, I tried my best to persuade my daughter to consider a degree in computer science," said Tate. "She respectfully listened to my pitch for months and finally gave me a firm NO."

In talking to his daughter, Tate said it was obvious that the images the department used to portray the degree on its Future Students page did nothing to dispel the "nerdy, geeky" stereotype the computer science discipline had at the time.

At the same time, Tate said that the department's ePartners, who provide so much financial support to the department, began expressing serious concerns about the diversity in the undergraduate pipeline. "Businesses exist for one reason," says Tate, "to make money. And they do this by solving problems with products and solutions that are creative and innovative. Diversity plays a key role in business success. Not just ethnic and gender diversity, but diversity of thought, understanding and perspective."

With the financial support from its ePartners, input from its Strategic Advisory Board, and the support of department leadership, Tate led an effort to "blow up" and completely redesign the department's Future Students page with much more focus on diversity and changing the narrative about computer science and its application in improving the human condition.

The campaign greatly expanded the number of potential recruits by looking at students who not only express an interest in software technology, but by identifying students with strong math abilities and an interest in music. They then reached out to more than 10,000 middle and high school math, science and technology teachers, with a graphic-intensive poster campaign to help them better explain what computer scientists do. Alumni doing extremely interesting jobs were identified and featured online in video snippets. A Faces of Computer Science campaign was launched to showcase the diversity of more than a dozen alumni who are making a difference in the world with their degrees.

Tate then launched the Computer Science Student Ambassadors program, believed to be the first such ambassadors program developed on campus by a department. This group of about 30 of the department's very best undergrads is an extremely diverse group that doesn't mirror the current undergraduate population; rather, it mirrors the undergrad population the department aspires to have. Under the mentorship and guidance of Tate and Tammy Coates, the CSC student ambassadors amass more than 700 volunteer hours supporting about 90 unique events each year as they engage prospective students and their parents, give

tours, host open houses, provide demos and presentations across the state at middle and high schools and conduct fun games and other engagements at places like Marbles Museum.

Tate represents the department as an Academic Alliance member of the National Council for Women in Technology (NCWIT). The partnership with NCWIT has led to numerous collaborations including hosting a major Sit With Me event sponsored by Eastman Chemical and Unconscious Bias training for faculty members and staff. He also has raised significant corporate funds to provide annual scholarships to every female student who has won a regional or national NCWIT Aspirations award. Tate has served on a dean-appointed committee to increase diversity across a number of targeted disciplines. In addition, he has worked with the department's Strategic Advisory Board and several key alumni to help launch a diversity-focused endowment, which provides scholarships and programmatic support.

"Something that we have learned in our journey to broaden participation in computer science at NC State is that we cannot simply focus all our attention on attracting and recruiting more diversity into the pipeline," says Tate. "Equal attention must be given to retention. This has challenged us to take a very hard look at our curriculum, our physical spaces, our networking and support capabilities and perhaps most important — to look at ourselves as faculty and staff to recognize our own unconscious biases and to make changes that create a diverse-friendly environment."

According to Tate, the culture and general diversity-related climate within the department has really gotten much stronger over the last decade. The department spends a considerable amount of time as faculty members and staff focused on the strategic plan, and how to make the department a "joyful" place to excel academically and professionally. Tate says he thinks this unique climate has certainly contributed to the fact that the department is ranked first in the nation in the number of tenure-track female faculty members among all computer science departments in colleges of engineering.

It takes time, Tate says, but between the comprehensive campaign, the associated programs and initiatives and the diversity-conscious and supportive culture within the department, the diversity-related results are really gaining momentum.

Over the last 10 years, applications from female students have grown steadily, reaching a 30 percent year-over-year growth rate recently. The incoming CSC class for the fall of 2018 alone includes 164 accepted female students, which was up 48 percent over last year. ■

# JOIN the Department of Computer Science for special events **ON CAMPUS**



**NOVEMBER  
19**

**Fidelity Investments Leadership in Technology Speakers Series**

*Christian Hubicki, former contestant on CBS' Survivor and assistant professor at Florida State University*

1231 ENGINEERING BUILDING II  
6:30 p.m.

**DECEMBER  
6**

**CSC Senior Design Center Fall "Posters and Pies" Event**

JAMES B. HUNT, JR. LIBRARY  
5:30 p.m.  
*RSVP requested*

**DECEMBER  
20**

**Fall Diploma Ceremony**

WILLIAM NEAL REYNOLDS COLISEUM  
1:00 p.m.

## Questions?

Contact Ken Tate at **919.513.4292**  
or **kmtate2@ncsu.edu**.

**JANUARY  
28**

**Fidelity Investments Leadership in Technology Speakers Series**

*Dr. Chris Hazard, founder and CEO of Hazardous Software*

1231 ENGINEERING BUILDING II  
6:30 p.m.

**MARCH  
21**

**College of Engineering Open House**

9:00 a.m. - 1:30 p.m.

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