

NC STATE Engineering

CSC NEWS

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LETTER FROM THE DEPARTMENT HEAD

GREGG ROTHERMEL



Gregg Rothermel

Dear Alumni and Friends,

This fall, the department marks 55 years of performing ground-breaking research along with educating technological leaders for the future. As we commemorate our position as one of the largest and most productive computer science departments in the nation, our faculty and staff boldly embrace our role in shaping the future of this department!

Looking ahead, we are excited about a new \$20 million funding initiative from the North Carolina legislature titled **Engineering North Carolina's Future**. The initiative recognizes the significant growth of science, technology, engineering and mathematics (STEM) workforce-dependent industries in our state. It will help grow the enrollment of engineering and computer science students at NC State and other engineering programs in the University of North Carolina System.

What will this mean to our department? **The goal is for the Department of Computer Science to add about 650 undergraduate and 300 graduate students.** This year, **CSC hired a record 14 new faculty members.** Of those, seven are tenure-track faculty members who were brought on with funding from Engineering North Carolina's Future. **Over the next few years, CSC will hire 20 tenure-track professors and 10 teaching professors.** With these new faculty and students, we will be able to increase the strength of our research and educational offerings. This expansion will further secure CSC's position as the preeminent computer science department in North Carolina, and one of the strongest departments in the nation (more on page 2).

We are well-positioned to achieve the goals set out in the plan for the future of the department, and we are excited to share that over the past year, the CSC department has experienced many successes, which are detailed in this year's *CSC News*. I am pleased to share below some statistics and highlights that deserve special notice:

- In 2021-22, research expenditures totaled over **\$13.2M**, while new research awards totaled over **\$19.5M**, both new records for the department. Research expenditures for the 2021-22 academic year were up 5.6% over 2020-21 (\$12.5M), and up 7.7% over 2019-20 (\$11.6M). New research awards were up 31% over 2020-21 (\$14.9M), and up 35% over 2019-20 (\$14.4M).
- NC State is the lead institution on a \$9M, multi-institution National Science Foundation (NSF) grant to research technical challenges in software supply chain security and to help build a diverse workforce for the software industry. The project establishes the **Secure Software Supply Chain Center (S3C2)**, with three CSC faculty members on the leadership team: **Laurie Williams, William Enck and Alexandros Kapravelos.**
- The **North Carolina Partnership for Cybersecurity Excellence (NC-PaCE)**, a new coalition that will enhance North Carolina's economy and keep its citizens safe through education, research and outreach work in cybersecurity, is benefitting from a \$2M grant from the National Centers of Academic Excellence in Cybersecurity located within the National Security Agency. **Laurie Williams**, Distinguished University Professor of Computer Science, is the co-director of the coalition, which is headquartered in NC State's Secure Computing Institute (SCI).
- **Munindar Singh**, Alumni Distinguished Graduate Professor of Computer Science, was named a **2021 Fellow of the Association for Computing Machinery (ACM).**
- **James Lester**, Distinguished University Professor of Computer Science, was one of five NC State faculty members who received the **Alexander Quarles Holladay Medal for Excellence**, the highest honor bestowed by NC State and the University's Board of Trustees.
- **James Lester** was also one of six faculty members to receive the University's top research and mentorship award, the **Outstanding Research Award.**
- The National Center for Women & Information Technology (NCWIT) has named **Tiffany Barnes**, Distinguished Professor of Computer Science, the recipient of the **2022 Harrold and Notkin Research and Graduate Mentoring Award.**
- **Bradley Reaves**, assistant professor of computer science, has received a **Faculty Early Career Development (CAREER) Award** from the National Science Foundation. The CSC department has now had 34 faculty members receive CAREER Awards, to date.

We hope you'll stay connected with the department through our website, social media channels and our departmental publications. We welcome you to attend Homecoming activities in November.

Thank you for continuing to support our department, and as always, Go Pack!

Sincerely,

Gregg Rothermel

Department Head



NEXT LEVEL

“NC State is providing the workforce, research and partnerships that are fueling the Triangle’s flourishing tech industry that is driving huge economic impact benefits across the state of North Carolina.”

**CHANCELLOR
RANDY WOODSON**

Engineering expansion will help Department of Computer Science grow

A funding initiative from the state legislature titled Engineering North Carolina’s Future will help grow the enrollment of engineering and computer science students at NC State and other engineering programs in the University of North Carolina System.

The initiative recognizes the significant growth of science, technology, engineering and mathematics (STEM) workforce-dependent industries in North Carolina and was spurred, in part, by several significant hiring announcements in the state by leading technology companies in 2021.

NC State plans to add about 4,000 engineering and computer science students over the next few years and hire more than 100 new faculty members. This growth will bring the enrollment in the College of Engineering to more than 14,000 students and the University’s total student population to more than 40,000.

Engineering North Carolina’s Future will provide NC State with \$20 million over the next two years to catalyze the hiring of additional faculty members and staff members including academic advisors and laboratory personnel to support the larger student body.

The legislature is also providing the University with \$30 million to support facility upgrades to accommodate these additional students.

“NC State is providing the workforce, research and partnerships that are fueling the Triangle’s flourishing tech industry that is driving huge economic impact benefits across the state of North Carolina,” said **Chancellor Randy Woodson**. “We greatly appreciate the General Assembly’s support and recognition of NC State’s critical role in Engineering North Carolina’s Future.”

GROWING COMPUTER SCIENCE

This year, the Department of Computer Science (CSC) hired 14 new faculty members. Of those, seven are tenure-track faculty members who were brought on with funding from Engineering North Carolina’s Future.

Over the next few years, the department will hire 20 tenure-track professors and 10 teaching professors.

The department will also increase its enrollment by 650 undergraduate students and 300 graduate students.

“With these new faculty and students, we will be able to increase the strength of our research and educational offerings in cybersecurity, software engineering, computer systems, computer networks, computer-assisted learning and artificial intelligence, while also building new groups in cyber-physical systems, human-computer interaction and theoretical computer science,” said **Gregg Rothermel**, CSC department head. “This expansion will further secure CSC’s position as the preeminent computer science department in North Carolina, and one of the strongest departments in the nation.”

INVESTING IN OUR FUTURE

Helping the College grow its student enrollment, faculty and infrastructure is also critical to assuring that NC State Engineering continues to move forward to meet its full potential.

While the College has made significant advancements in its research enterprise, national reputation and rankings, none of its peers are standing still, so it must grow to continue its move up among the country’s top public colleges of engineering.

Recent economic development announcements by Apple, Google, FUJIFILM Diosynth and many others show the rapid growth of the tech industry in North Carolina. The demand for NC State’s well-prepared STEM graduates — as well as

partnerships with NC State’s world-leading faculty members and their research — has never been greater. As just one example, Google’s new unit in Durham, NC, will be led by **Kamala Subramaniam**, an NC State electrical and computer engineering alumna who received her M.S. and Ph.D. in 2006. Subramaniam is on the Department of Computer Science’s Strategic Advisory Board and gave the department’s December 2021 commencement address.

As the workforce needs of the state grow, however, NC State has not kept pace with demand; last year alone, the University turned down undergraduate admissions to 1,400 engineering applicants who had a 3.75 or higher unweighted GPA due to lack of faculty members and space.

“These new funds will enable NC State to keep our best and brightest students in state, and will allow us to meet the needs of North Carolina’s growing technical workforce,” Woodson said.

Engineering North Carolina’s Future will also help the College of Engineering take the next step toward its goal of becoming the leading public college of engineering in the United States.

Thanks, in part, to more than \$50 million in funding support from the state legislature beginning in 2007, the College was able to add 90 additional faculty members and make major infrastructure investments, including the completion of Engineering Building III on Centennial Campus. An additional state investment of \$75 million in capital funding combined with \$60 million in private investment enabled the completion of Fitts-Woolard Hall on Centennial Campus.

These investments helped spur a period of significant enrollment growth and research expansion between 2006 and 2018. The College reached \$200 million in annual research expenditures and climbed as high as eighth nationally in annual expenditures among all engineering colleges. Along with that growth came national recognition; the College was ranked as high as 11th among all public colleges of engineering in *U.S. News & World Report* rankings of the best graduate engineering programs in the country.

While the College has continued to operate at a high level since then, peer institutions are making major investments to grow their engineering and computer science programs. The solution for continuing NC State Engineering’s upward trajectory is simple: the College must continue to grow.

“Virtually every college ranked ahead of us isn’t better,” **Dean Louis Martin-Vega** said. “They’re just bigger. We hope that Engineering North Carolina’s Future will help spur the enrollment growth and faculty hiring that we need to close that gap.” ■

Homegrown Leadership

CSC advisory board member Kamala Subramaniam leads Google's new hub in the Triangle

Kamala Subramaniam carries with her a number of positive memories from her time at NC State, including favorite classes, homework and project work with her classmates and eating on a graduate student budget at Golden Dragon, a local Chinese restaurant that is popular with students.

Now, Subramaniam has returned to the Research Triangle to lead Google's new hub in Durham, NC, and is poised to create more memories.

In 2021, the company announced plans to establish a new engineering unit dedicated to its cloud computing business in downtown Durham, creating more than 1,000 new jobs. Subramaniam, who came to Raleigh from her native India to earn master's and doctoral degrees in electrical and computer engineering, joined Google in 2016 after holding positions with Microsoft and other technology companies.

"North Carolina has retained a very special place in my heart and returning to the Triangle has always been something my husband and I have discussed for our family," she said. "When you touch down in North Carolina and, especially, the Triangle, after being away for so long, you can instantly see why this is one of the fastest-growing regions in the country."

A substantial part of her role will include recruiting from the strong talent pool available in the Triangle, including from NC State. Google's first intern in Durham was an NC State student who began a full-time position in January.

She describes NC State as "a place where relationships come first."

"I have had a wonderful time ever since stepping foot into the University," she said. "I remember first having to check in with the immigration office, then the grad programs office, and the College of Engineering office. Every interaction I had was kind. It was only natural that I made my best friends for life at State."

Professors and advisors helped Subramaniam create a portfolio of classes toward her degree that incorporated what the industry in her affinity field of networking would be looking for when she graduated while also providing training in core programming, system design, data structures and algorithms.

"This allowed me to experiment in any field and taught me early on that a combination of affinity and the need to constantly learn is key to satisfaction," she said.

Subramaniam has stayed connected as a member of the Department of Computer Science's Strategic Advisory Board and delivered the department's December 2021 commencement address. ■



NC State to lead multi-institution software supply chain security grant from NSF

The S3C2 leadership team, from left: Michel Cukier, Christian Kästner, Laurie Williams, Will Enck, Yasemin Acar and Alexandros Kapravelos.

NC State University is the lead institution on a \$9 million, multi-institution National Science Foundation (NSF) grant to research technical challenges in software supply chain security and to help build a diverse workforce for the software industry.

Modern software is vulnerable to malicious activity, and software professionals must address software supply chain attacks. This project establishes the Secure Software Supply Chain Center (S3C2), bringing together researchers, industry partners and government agencies to develop scientific tools, metrics, data formats and methods to reduce risks with software.

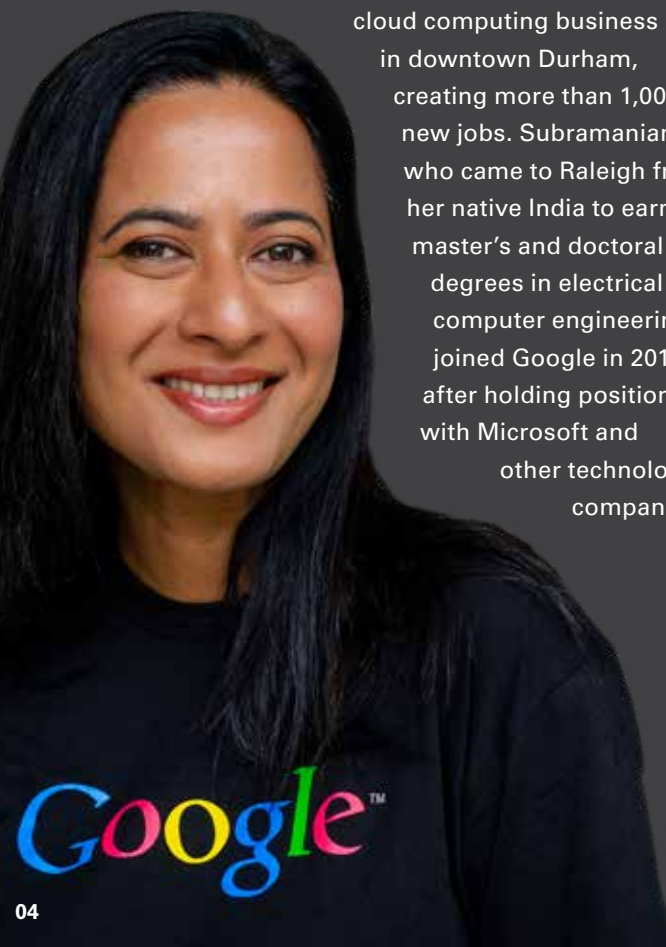
Through education, outreach and training, the project will also foster a diverse workforce of technical leaders and practitioners capable of problem-solving in software supply chain models. Summer programs and new course modules will prepare current and future technical leaders and practitioners to build more secure software.

Three NC State faculty members are on the S3C2 leadership team: **Laurie Williams**, Distinguished University Professor;

William Enck, professor; and **Alexandros Kapravelos**, assistant professor.

NC State has made a name for itself in cybersecurity and technology. The Secure Computing Institute has connected cybersecurity research and education efforts among NC State departments and throughout the Triangle area since its founding in 2019. It's home to the North Carolina Partnership for Cybersecurity Excellence (NC-PaCE), in which universities, community colleges, public agencies and private businesses across the state collaborate through education, research, service and outreach to establish cybersecurity as an economic development tool. NC-PaCE received a \$2 million grant from the National Centers of Academic Excellence in Cybersecurity last year.

NC State was awarded \$6 million as the lead institution. Other university partners include Carnegie Mellon University, The George Washington University and the University of Maryland, College Park. ■





Statewide cybersecurity coalition receives \$2 million NSA grant

state through education, research, services and outreach. In helping to protect the state's financial and intellectual property assets from cyber threats, the coalition will help drive the state's economy by giving North Carolina businesses the skilled workers, knowledge and support that they need to grow.

Cyberseek, an organization that tracks the cybersecurity job market, ranks North Carolina sixth in the country in terms of the number of cybersecurity job openings and puts the state at twice the national average in terms of geographic concentration/location quotient, a measure of the concentration of cybersecurity job demand. Its data lists 17,660 security job openings in the state.

Average annual salaries for such roles exceed \$100,000.

"The need for cybersecurity-trained professionals is real in North Carolina," said **Laurie Williams**, Distinguished University Professor in NC State's Department of Computer Science and co-director of the coalition. "NC-PaCE will propel the development of cybersecurity expertise necessary to support NC industry and government and to establish cybersecurity as an economic development tool for the state."

NC-PaCE will be headquartered in NC State's Secure Computing Institute (SCI), which was created in 2019 to be a

leading center for security education and research. East Carolina University, North Carolina Agricultural and Technical State University, University of North Carolina at Charlotte, University of North Carolina at Wilmington and Forsyth, Wake and Pitt community colleges are partnering institutions. This coalition will provide companies and public-sector agencies with a diverse and specialized set of security education, research and services. Their coursework and research curriculum through NC-PaCE will be tailored to the needs of the state to ensure that the trained workforce is ready to address challenges that are impeding North Carolina's economic growth and entrepreneurial flourishing.

A planned government and industry advisory board includes representatives from across the state's finance, energy, technology and defense sectors. An NC-PaCE survey of representatives from these and other industries and government found a strong desire for access to research focused on foundational elements of secure system development and access to graduates of both four- and two-year college and university degree programs focused on cybersecurity knowledge and skills.

The Department of Computer Science at NC State has positioned itself as a national leader in the area of cybersecurity through research, education and extension. Along with the creation of SCI, in recent years the department has added undergraduate and master's tracks and an undergraduate concentration in security and has launched a CyberCorps Scholarships for Service program available to undergraduate and graduate students with help from National Science Foundation funding. Since 2012, the department has led an NSA Science of Security Lablet. These multi-disciplinary labs at a handful of leading U.S. research institutions promote security and privacy science as a recognized field of research and encourage rigorous research methodologies.

"Our vision is to become a national model for cybersecurity education, and economic development through cybersecurity, and to enable businesses and governments to thrive despite the ever-growing aggression and creativity of hackers," said **William Enck**, professor of computer science at NC State and the other co-director of NC-PaCE.

NC-PaCE will establish a membership model that will allow businesses and government agencies to benefit from the group's research and expertise. For more information on membership, contact Williams at lawilli3@ncsu.edu. ■

NC State ranked #1 best online Master of Computer Science Program

ZDNet ranked NC State's Master of Computer Science (MCS) program as the #1 online computer science master's degree for 2021 last November. The Master of Computer Science program is a flexible program for working professionals looking to earn their graduate degree in computer science. It is a 31-credit hour degree program available exclusively online with streamed courses, online coursework and exams (taken under properly proctored conditions).

Because most courses are recorded versions of on-campus classes, MCS distance education students have the same coursework as any other MCS graduate student. While the program is available to be taken exclusively online, MCS distance education students have the option to attend on-campus courses as well. Students have the same access and privileges available to them as on-campus students, and are also encouraged to fully interact with their professors and classmates.

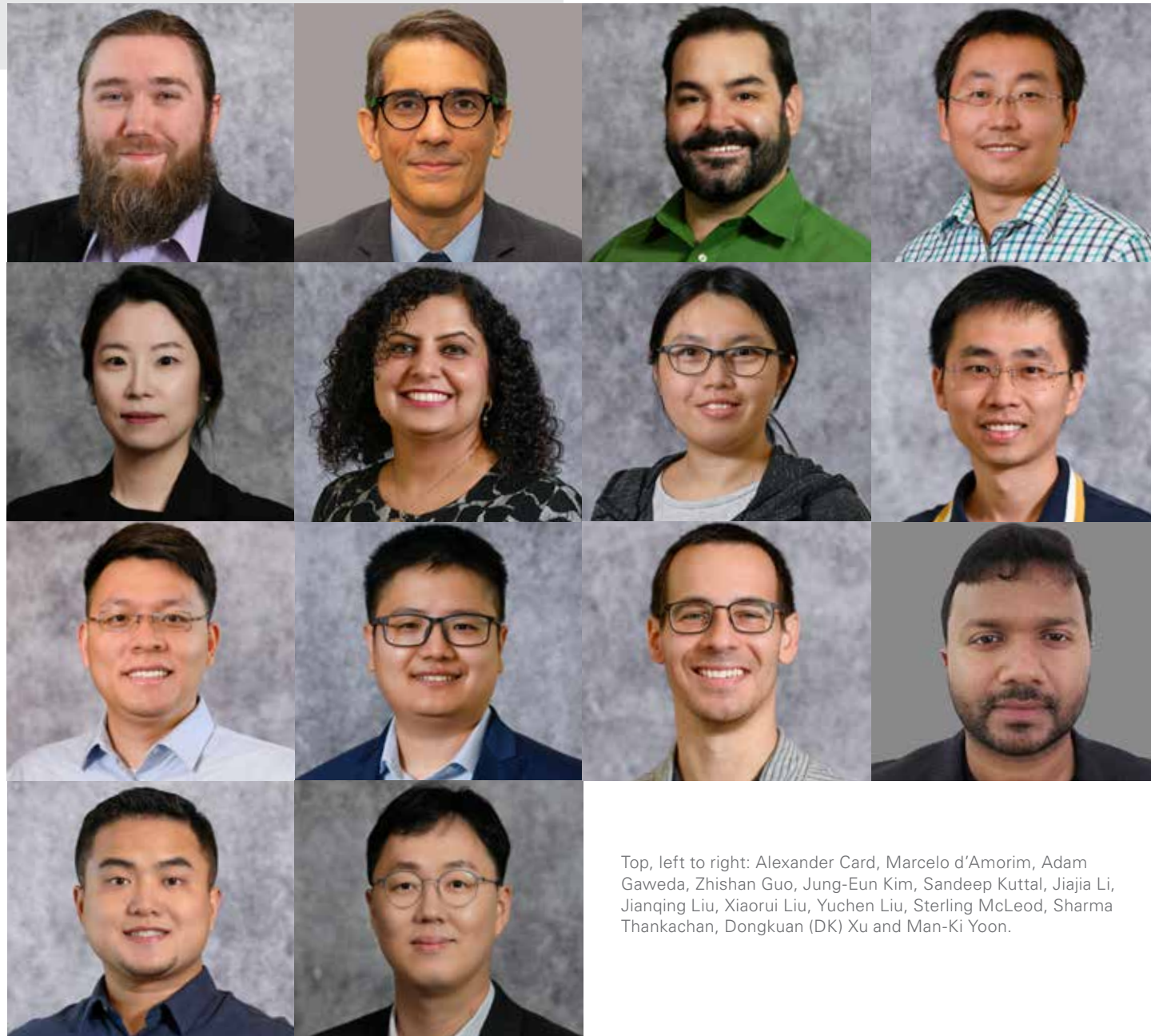
ZDNet is a business technology website that keeps readers up-to-date with the latest trends and news within IT. ZDNet's mission is "to help readers by providing expert insight on IT related topics."

ZDNet uses data collected from the National Center for Education Statistics (NCES) annual survey completed by every school in the United States that receives federal financial aid. Their proprietary ranking algorithm, Integrated Postsecondary Education Data System (IPEDS), weighs over a dozen factors across academics, reputation, affordability and programmatic excellence. Each dataset is reviewed by a team of expert consultants and their education editorial board that consists of researchers, scientists and experts in the fields of higher education, computer science and information technology, in their five-layer review process. ■

14 NEW FACULTY MEMBERS JOIN CSC

The Department of Computer Science (CSC) has welcomed 14 new faculty members this fall.

These new faculty members are part of Engineering North Carolina's Future, a state-funded initiative to expand the College of Engineering over the next few years. The College will hire more than 100 new faculty members and increase its student population by 4,000. Get to know the new faculty members and their research interests.



Top, left to right: Alexander Card, Marcelo d'Amorim, Adam Gaweda, Zhishan Guo, Jung-Eun Kim, Sandeep Kuttal, Jiajia Li, Jianqing Liu, Xiaorui Liu, Yuchen Liu, Sterling McLeod, Sharma Thankachan, Dongkuan (DK) Xu and Man-Ki Yoon.

Alexander Card | Computer science and game design education especially in project-based courses featuring design work, as well as procedural content generation.
Assistant Teaching Professor, Ph.D. (2022), NC State

Marcelo d'Amorim | Software testing and debugging, runtime verification, artificial intelligence (AI) for software engineering (SE), SE for AI, code repair.
Associate Professor, Ph.D. (2007), University of Illinois at Urbana-Champaign

Adam Gaweda | Activity sequences, educational data mining, novel exercise types, training regimens, student modeling, personalized student feedback, general student attitudes toward computer science.
Assistant Teaching Professor, Ph.D. (2022), NC State

Zhishan Guo | Real-time scheduling, machine learning (time series prediction and sparse discriminant learning), cyber-physical systems (autonomous driving and medical).
Associate Professor, Ph.D. (2016), University of North Carolina at Chapel Hill

Jung-Eun Kim | Resource-/time-dependent machine learning, AI/machine learning for cyber-physical and embedded systems, safety-/time-critical systems and real-time multicore systems.
Assistant Professor, Ph.D. (2017), University of Illinois at Urbana-Champaign

Sandeep Kuttal | Human-computer interaction, software engineering, artificial intelligence, with a focus on the human aspects of software engineering by studying and modeling programmer behavior and then designing and developing mixed-initiative programmer-computer systems.
Associate Professor, Ph.D. (2014), University of Nebraska-Lincoln

Jiajia Li | High performance computing, tensor algorithms, auto-tuning.
Assistant Professor, Ph.D. (2018), Georgia Institute of Technology

Jianqing Liu | Computer communications and networking with emphasis on MAC- and network-layer design and evaluation; network security, data privacy; low-power Internet-of-Things and quantum networks.
Assistant Professor, Ph.D. (2018), University of Florida

Xiaorui Liu | Large-scale machine learning, distributed optimization; trustworthy artificial intelligence, security and fairness in AI; deep learning on graphs, graph neural networks.
Assistant Professor, Ph.D. (2022), Michigan State University

Yuchen Liu | Networking and wireless systems; mobile computing; machine learning for networking and sensing; new communication paradigms; optimization and resilience; software and simulator development for computer networks.
Assistant Professor, Ph.D. (2022), Georgia Institute of Technology

Sterling McLeod | Robot motion planning, software testing for robotics, computer science education.
Assistant Teaching Professor, Ph.D. (2019), University of North Carolina at Charlotte

Sharma Thankachan | String algorithms, compressed data structures, bioinformatics.
Associate Professor, Ph.D. (2014), Louisiana State University

Dongkuan (DK) Xu | Parameter efficiency (network pruning, knowledge distillation); data efficiency (few-shot learning, self-supervised learning); computation efficiency (weight-sharing learning, reduced-cost training); domains (natural language understanding, computer vision, neuroinformatics); applications (model compression for memory-limited devices, privacy-preserving deep learning, energy-efficient AI systems).
Assistant Professor, Ph.D. (2022), Pennsylvania State University

Man-Ki Yoon | Security of safety-critical cyber-physical systems, real-time embedded computing, accountable computing for autonomous systems. ■
Assistant Professor, Ph.D. (2017), University of Illinois at Urbana-Champaign

New CSCenter offers connection and support for CSC students



The Department of Computer Science (CSC) launched the **Computing Success Center (CSCenter)** in Fall 2021 under the leadership of **Sarah Heckman**, director of undergraduate programs and Alumni Distinguished Undergraduate Professor. The CSCenter is a new initiative to develop a departmental community and provide educational support for computing students. The CSCenter's vision is to provide a locus of student support that provides both physical and virtual spaces for students to find resources and help; connect with peers, advisors and faculty members; and find ways to engage in outreach, service and research. The CSCenter currently has two ePartner sponsors, Deutsche Bank and Truist.

With the goal of ensuring the success of computing students, the CSCenter hosts a variety of workshops each month. These workshops are led by NC State faculty members and other university representatives, and provide helpful information and connect undergraduate and graduate students to campus resources. Some of the topics include studying abroad, doing a co-op, becoming a CSC service course grader and pursuing the Accelerated Bachelor's / Master's (ABM) program. In addition to workshops about NC State programs, the center hosts workshops that provide students with valuable skills to help them experience success in college and in their future careers. Some of these include overcoming imposter syndrome, resume building, internship/job search strategies, time management and note-taking skills.

"Attending that workshop benefitted me just by learning what imposter syndrome is ... Having a word to assign to what I'm feeling," said **Timothy Japit**, an aerospace engineering major

with a computer science minor, about the imposter syndrome workshop. "Having the conversation, and just having to talk to people who've experienced the same thing, and who've had more experience with it, really helped kind of assuage that kind of irrational fear ... I would recommend these workshops just because they're fun. They're fun because these are things that you don't really learn in class. These are life skills. These are things you can put on your resume."

"I've attended Dr. Heckman's 'Semester Planning,' 'Weekly Reviews,' and 'Habits and Rituals' workshops, and I have also attended the 'Tips to Become a CSC Service Course Grader' workshop," said CSC student **Raphael Phillips**. "Dr. Heckman's workshops were all ... based on organizing your life in the midst of complicated college life. I've been keeping more weekly goals over the semester based on these talks."

"The goal of the Computing Success Center is to provide support for computer science students academically, professionally and socially. We have provided events on time management/productivity/wellness, advising and university resources and careers," Heckman said. "In the future, we're planning technical workshops on technologies and tutorial sessions for topics in early computing courses. The Computing Success Center centralizes the out-of-class resources in our department and the university."

Watch the CSC calendar for upcoming CSCenter events. ■



Using defensive deception to prevent information and operational technology manufacturing threats

By *Lauren Thompson, SecureAmerica Institute*
Image credit: *Texas A&M Engineering*

Protecting information technology (IT) and operational technology (OT) networks is crucial to safeguard the manufacturing industry. As part of the SecureAmerica Institute's (SAI) nationwide initiative to empower the U.S. manufacturing enterprise, SAI and partners at North Carolina State University and Airgap Inc. are developing technology to resist attacks, detect attacks in progress and ensure an IT/OT system can automatically restore itself to a trusted state.

Cyberattacks are one of the biggest threats to any organization and commonly target IT networks (which share information, data and resources between computers in an organization). The manufacturing industry is particularly vulnerable because its IT networks are linked to operational technology networks that directly control machine functions and processes. If an attacker corrupts the entire IT/OT system, it can lead to a complete business shutdown resulting in financial losses and ripple effects across the industry.

"Most of the manufacturing in the U.S. happens in small and medium size firms making them an ideal target," said Rob Gorham, SAI's executive director. "The NC State team's effort to protect valuable manufacturing capabilities across IT and OT is important in the SecureAmerica Institute's journey to enable robust manufacturing supply chains."

"Manufacturing equipment is expensive, and many smaller manufacturers have limited resources when it comes to technical expertise and budget," said **Munindar Singh**, Alumni Distinguished Graduate Professor in NC State's Department of Computer Science. "This means their

networks are not always following the best practices needed to quickly isolate and mitigate potential threats."

Singh and his partners, Abhi Muthiyar, architect of Airgap Inc., and Samudra Vijay, president and CEO of SAM Analytic Solutions, are collaborating on a two-fold automated approach for manufacturers to detect and resist cyberthreats. A virtual honeypot (a security mechanism that creates a trap to lure bad actors) is created to deceive potential attackers paired with an appliance to isolate an OT network from its backup.

"Malware and ransomware can easily penetrate an entire system," Muthiyar said. "We are trying to prevent entire manufacturing plants from shutting down due to attacks and help them recover swiftly. Our isolation methods retain local backup copies, which enable recovery in hours, as compared to recovery in days for cloud backups."

Backups should be immediately separated from the network to protect sensitive data in the event of a cyberattack. Vijay and his colleagues are developing a device to immediately cut off backups from the network and prevent attackers from accessing the entire system.

"Isolation of threats permits companies to continue operations while assessing the problem and decreasing severe impacts," Vijay said. "This technology can dramatically increase the resilience of small businesses and manufacturing entities."

The NC State team applies layers of detection and deception to IT/OT networks including vulnerability detection, file system monitoring and dynamic provisioning of honeypot resources for programmable logic controllers, human-machine interface and supervisory control and data acquisition systems.

This intentionally compromised system will mimic a vulnerable manufacturing machine and trick the attacker. Once malicious intent is discovered, the risk analyzer categorizes the threat and triggers alerts, specific device isolation or entire network isolation. "We want to trap the attacker in the least disruptive way to an organization and convince them they're getting something valuable when they're not," Singh said.

Most traditional approaches to cybersecurity assume the attacker is outside the walls — that an organization or business is like a walled city and is safe.

"In reality, most attacks come from within. This could happen through phishing attempts, corrupted USB drives and more," Singh said. "That's why we need to isolate different parts of the walled city from one another. If an attack only corrupts one small corner, we can limit further harm and strengthen the industry." ■

New study reveals why Facebook ads can miss target



New research from NC State University offers insight into why Facebook’s targeted advertising can sometimes be more like a wild pitch. Researchers already knew Facebook creates interest profiles for users based on each user’s activities, but the new study finds this process doesn’t seem to account for the context of these activities.

“For example, if you posted something about how much you dislike green cheese, the algorithm Facebook uses to infer your interests would likely notice that you shared something about green cheese,” said **Aafaq Sabir**, lead author of a paper on the work and a Ph.D. student at NC State. “But Facebook’s algorithm wouldn’t register the context of your post: that you do not like green cheese. As a result, you may start getting targeted ads for green cheese.”

Facebook has been open about targeting advertising to individual users based on each user’s interests. It has also made clear that it infers a user’s interests based on that person’s activities. However, it hasn’t been clear exactly how that process works.

“It’s well established that Facebook’s targeting algorithm often sends people ads for things they have no interest in,” Sabir said. “But it wasn’t clear why people were getting the wrong ads.”

“The implications of inferring inaccurate interests on one of

the largest social media platforms in the world are significant in two ways,” said **Anupam Das**, co-author of the paper and an assistant professor of computer science at NC State. “This inaccuracy has both economic ramifications — since it is relevant to the effectiveness of paid ads — and privacy ramifications, since it raises the possibility of inaccurate data being shared about individuals across multiple platforms.”

To learn more about how Facebook generates its interest profiles for users, the researchers performed two studies.

In the first experiment, researchers created 14 new user accounts on Facebook. Researchers controlled the demographic data and behavior of each account, and tracked the list of interests that Facebook generated for each account. (Every user can see the list of interests Facebook has compiled for them by clicking on their ad preferences, then “Categories used to reach you,” and then “Interest Categories.”)

“This first experiment allowed us to see which activities were associated with Facebook inferring an interest,” Sabir said. “And the key finding here is that Facebook takes an aggressive approach to interest inference.

“Even something as simple as scrolling through a page led to Facebook determining that a user has an interest in that subject. For the 14 accounts we created for this study, we found 33.22

percent of the inferred interests were inaccurate or irrelevant.”

“We then wanted to see if these findings would hold true for a larger, more diverse group of users, which was the impetus for the second experiment,” Das said.

In the second experiment, the researchers recruited 146 study participants from different parts of the world. Study participants downloaded a browser extension that allowed researchers to collect data from each participant’s Facebook account about their interests. Researchers then asked participants questions about the accuracy of the interests Facebook had inferred.

“We found that 29.3 percent of the interests Facebook had listed for the study participants were actually not of interest,” Das

said. “That’s comparable to what we saw in our controlled experiments.

“We also found that most study participants didn’t even know Facebook’s ad preference manager exists. They didn’t know there was a list of interests they could look at, or that Facebook provides at least a basic explanation of why it has assigned a given interest to a user.

“This is an interesting finding in itself,” Das said. “Because the goal of providing all of this information regarding interests is ostensibly to be transparent with users. But given that many users don’t even know this information is available, Facebook is not achieving that goal.”

The paper, “Analyzing the Impact and Accuracy of Facebook Activity on Facebook’s Ad-Interest Inference Process,” was presented at the 25th ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW), held online Nov. 12-16, 2022. The paper was co-authored by **Evan Lafontaine**, a recent graduate from NC State. ■

CSC students BY THE NUMBERS

A record of **2,541** students (including FR CSC Intents) are currently studying computer science at NC State!



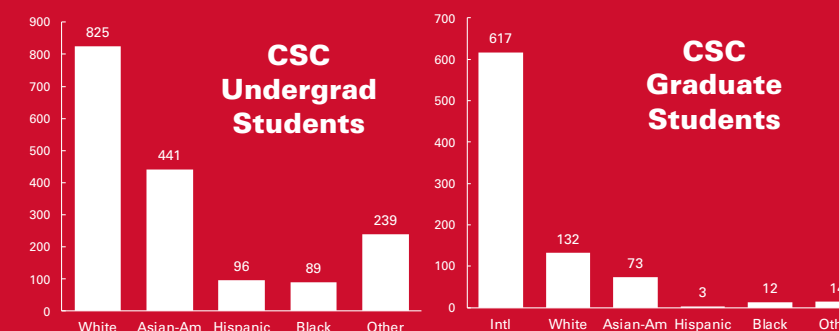
WOMEN IN COMPUTER SCIENCE

24 PERCENT (603) of the students studying computer science at NC State are women — **A NEW RECORD** for CSC.

DEGREES AWARDED 2021-22

294 B.S. DEGREES **103** M.S. DEGREES **28** Ph.D. DEGREES

ENROLLMENT DIVERSITY



SALARY AND PLACEMENT DATA

B.S. CSC — \$90,000

M.S. CSC — \$129,000

May 2022 graduates had NC State’s **highest median starting salaries.**

69.7 PERCENT of bachelor’s degree graduates reported having accepted a full-time position at the time of graduation.

13.2 PERCENT of bachelor’s degree graduates reported plans to pursue a graduate degree.

Study: Benefits outweigh risks for autonomous vehicles — as long as you regulate them

An interdisciplinary panel of experts has assessed the risks and potential benefits associated with deploying autonomous vehicles (AVs) on U.S. roads and predicts that the benefits will substantially outweigh potential harms — but only if the AVs are well regulated.

“We wanted to assess the potential harms and benefits associated with AVs and determine what the best implementation strategies would be to minimize harms and maximize benefits,” said Veljko Dubljevic, first author of the study and an associate professor in the Science, Technology & Society (STS) program at North Carolina State University.

Deploying AVs onto public roads is a complex social issue, which touches on everything from ethics to transportation engineering to artificial intelligence programming.

“And there aren’t many methods for assessing such complex social problems,” Dubljevic said. “One approach is to break the large problem down into a collection of more specific questions, assessing different risks and potential benefits separately. This approach is called multi-criteria decision analysis, and it’s what we did here.”

For this study, the researchers outlined four different scenarios for the future of AVs:

- No AVs allowed on public roads;
- AVs are allowed, with no regulations;
- AVs are allowed, but are regulated;
- AVs are regulated and can only be owned by commercial fleet operators.

The researchers then convened a panel of 19 experts with expertise in subjects such as computer science, political science, transportation and ethics.

The researchers also created a list of 13 potential harms and eight potential benefits associated with deploying AVs.

The list was developed based on documents from the National Academies and other federal agencies, as well as input from the expert panel convened for the study. Potential harms included assessments of increased risk of accident deaths or cases of injury. Potential benefits included assessments of economic benefits and curtailing environmental impact by reducing traffic jams.

The expert panel then reviewed the four AV deployment scenarios with the goal of determining which scenarios had the best ratio of benefits to harms.

“To assess the potential impact of AV deployment, you have to compare it to a baseline,” said George List, co-author of the study and a professor of civil engineering at NC State. “The baseline was our current state of affairs. And our current state of affairs is that there are a tremendous number of deaths and injuries on U.S. roads.

“While AVs are not perfect, all of our predictions suggest that they will be a step in the right direction. Prohibiting the use of AVs on U.S. roads was the least promising scenario.”

However, the expert panel also highlighted the extent to which government regulations could help reduce risk.

“For example, regulations could limit use of AVs in urban environments and areas with high pedestrian traffic,” Dubljevic

said. “Either of the regulated scenarios is better than allowing unregulated AVs on the road.”

So, which scenario offered the most benefits and the fewest risks?

“Regulating AV use and limiting ownership to commercial fleet operators is a little more promising than allowing the general public to own and operate their own AVs,” Dubljevic said. That’s because fleet ownership makes it more likely that AVs will be properly maintained, software updates will be made on time, and so on.

“We hope that federal, state and local governments use our findings to review whatever regulations they have in place concerning the use of autonomous vehicles — or to develop regulations if there are none on the books,” Dubljevic said.

The study, “Toward a Rational and Ethical Sociotechnical System of Autonomous Vehicles: A Novel Application of Multi-criteria Decision Analysis,” is published in *PLOS ONE*. The paper was co-authored by William Bauer, an associate teaching professor of philosophy at NC State; **Munindar P. Singh**, Alumni Distinguished Graduate Professor of Computer Science at NC State; Eleni Bardaka, an assistant professor of civil, construction and environmental engineering at NC State; Thomas Birkland, a professor of public administration at NC State; Roger Mayer, a professor of leadership at NC State; M. Shoaib Samandar, a research associate at NC State; Jovan Milojevich of Oklahoma State University; Nirav Ajmeri of the University of Bristol; Charles Edwards of the University of North Carolina at Chapel Hill; Ioan Muntean of the University of North Carolina at Asheville; Thomas Powers of the University of Delaware; Hesham Rakha of Virginia Tech; and Vance Ricks of Guilford College.

The work was done with support from the Kenan Institute of Science and Technology and North Carolina State University Research and Innovation. ■





NC State researchers collaborate as part of Quantum Leap Challenge Institute for Robust Quantum Simulation

Researchers in NC State's Department of Computer Science (CSC) and Department of Electrical and Computer Engineering (ECE) are collaborating with colleagues at other mid-Atlantic universities to help develop quantum simulation devices that can understand, and thereby exploit, the rich behavior of complex quantum systems.

The Quantum Leap Challenge Institute for Robust Quantum Simulation, led by the University of Maryland (UMD), brings together computer scientists, engineers and physicists from five academic institutions and the federal government. Funded by a \$25 million award from the National Science Foundation (NSF), researchers in the institute will develop theoretical concepts, design innovative hardware and provide education and training for a suite of novel simulation devices that can predict and understand quantum phenomena.

Andrew Childs, a UMD professor of computer science and co-director of the Joint Center for Quantum Information and Computer Science, is the lead principal investigator of the NSF award and will serve as director of the new institute. **Frank Mueller**, professor in NC State's CSC, and Greg Byrd and Huiyang Zhou, professors in ECE, will partner with the other awardees of the institute.

NC State will receive \$1.125 million from NSF over five years to fund research on auto-generation of approximate quantum circuits and their simulation; verification of quantum simulations; domain-specific quantum software; co-design of simulation for quantum topologies of tomorrow; and education and workforce development in electrical and computer engineering and computer science.

Quantum simulation is a fundamental step toward realizing a world where general-purpose quantum

computers can transform medicine, break encryption and revolutionize communications. Even the most powerful of today's "classical" computers struggle to represent even relatively small quantum systems, an obstacle that could be overcome by building next-generation quantum simulators.

"Quantum simulation is arguably the most compelling application of quantum computers," Childs said. "Through dedicated research, education and outreach, we will nurture the quantum simulation community and provide a sharp focus on new discoveries and applications involving quantum simulation."

In addition to faculty members, postdocs and students from Maryland and NC State, the NSF Quantum Leap Challenge Institute for Robust Quantum Simulation will include quantum experts from Duke University, Princeton University and Yale University, as well as researchers from the National Institute of Standards and Technology (NIST).

The researchers believe that by evaluating the best approaches to small-scale quantum simulation, they can provide a detailed blueprint for what could be early practical applications for quantum computers. They have identified three major scientific challenges to focus their efforts on: methods for verifying the correctness of simulations, the interaction of simulators with their environments and the development of scalable quantum simulators for science and technology applications.

To do this, the researchers plan to explore the theoretical foundations of quantum algorithms and error correction — in conjunction with experimental implementations of reconfigurable quantum simulators — on four leading hardware platforms: trapped ions, arrays of Rydberg atoms, quantum photonics with solid-state defects and superconducting circuits.

They envision tight collaboration between theoretical and experimental approaches to co-design near-term simulation protocols with current and next-generation devices. This includes the joint development of optical and microwave control techniques across different experimental platforms, allowing for rapid advances in system size and controllability.

NC State efforts in quantum computing include an IBM Quantum Hub based on Centennial Campus. IBM Quantum Hubs are part of a worldwide community of leading Fortune 500 companies, startups, academic institutions and national research labs working with IBM to advance quantum computing. NC State was the first university-based IBM Quantum Hub in North America.

The ongoing mission of the NSF Quantum Leap Challenge Institute for Robust Quantum Simulation will also include a strong educational component. Plans call for a new flagship conference on quantum simulation and other outreach and education programs that engage diverse groups of students in quantum science, including partnerships with Morgan State University and NC State.

Faculty in the new institute also plan to introduce cross-disciplinary undergraduate specializations in quantum information and provide quantum information training for postgraduates and professionals.

The creation of this institute is the latest in a series of federal grants establishing a cohort of Quantum Leap Challenge Institutes nationwide. Three Quantum Leap Challenge Institutes launched last year, with the Quantum Leap Challenge Institute for Robust Quantum Simulation and the Quantum Leap Challenge Institute for Quantum Sensing in Biophysics and Bioengineering — led by the University of Chicago — being funded in 2021.

With science currently undergoing a quantum revolution, NSF is leading the charge through large-scale investments into centers that further the understanding of basic quantum phenomena, fundamental discoveries that will translate into transformative technologies.

"Our Quantum Leap Challenge Institutes program is developing the foundation of quantum information sciences, as well as developing the future students, faculty, startups and industry partners who are engaged in it," said Sean L. Jones, NSF assistant director of mathematical and physical sciences. "These two new institutes are tapping into challenging fields that have the potential to develop the next generation of tools that will establish the United States at the forefront of quantum innovation." ■

Wireless tech measures soil moisture at multiple depths in real time

Researchers from North Carolina State University have developed a wireless system that uses radio transmitters and receivers to estimate soil moisture in agricultural fields at multiple depths in real time, improving on existing technologies that can be used to inform irrigation practices that both improve crop yield and reduce water consumption.

“Estimating soil moisture is important because it can be used by growers to irrigate their fields more efficiently — only irrigating fields when and where the water is needed,” said **Usman Mahmood Khan**, first author of a paper on the work and a Ph.D. student in the Department of Computer Science at NC State. “This both conserves water resources and supports things like smart agriculture technologies, such as automated irrigation systems. What’s more, conserving water resources can also help reduce carbon emissions, because less energy is used to pump water through the irrigation system.”

The new technology, called Contactless Moisture Estimation (CoMEt), does not require any in-ground sensors. Instead, CoMEt assesses soil moisture using something called “phase,” which is a characteristic of radio waves that is affected by both the wavelength of the radio waves and the distance between the radio wave’s transmitter and the wave’s receiver.

Wireless signals are radio waves, and the medium that these signals are traveling through affects the wavelength of those radio waves. When the signal travels through a medium like air, it will have a specific wavelength. But when the signal travels through a different medium, such as soil, its wavelength changes.

“We know that these phase shifts are also influenced by the amount of water in the soil. If we know how far the signal has traveled, and we measure how a wireless signal’s wavelength has changed, we can determine the phase shift of the signal,” Khan said. “This, in turn, allows us to estimate the amount of water in the soil.”

CoMEt relies on an above-ground wireless device that transmits radio waves into the soil. Some portion of the radio waves passes through the soil before being reflected back into

the air, where the wireless device can receive the signal and measure the phase shift. The system allows users to assess soil moisture at multiple depths by increasing the power of the transmitted signal — the more powerful the signal, the deeper the assessment.

“This process allows us to assess soil moisture at multiple depths using a single signal, without using any sensors in the soil or in contact with the ground surface,” said **Muhammad Shahzad**, co-author of the paper and an associate professor of computer science at NC State.

“For example, we’ve demonstrated in experimental testing that if we use a signal that is powerful enough to penetrate 38 centimeters into the soil, we are able to assess how the phase of the signal changed at the surface level of soil, 38 centimeters beneath the surface, and at an intermediate level between those two.”

This is possible because the CoMEt device contains multiple antennas, allowing it to capture a significant amount of data from the radio waves that “bounce” out of the soil. The measurements collected by the device’s suite of antennas are then plugged into an algorithm that can determine both changes in the signal’s wavelength and how deep the signal traveled into the soil. This allows the CoMEt device to accurately assess the phase change of the signal, which in turn gives users a soil moisture estimate for the relevant depths.

“Estimating the soil moisture at multiple depths is important, because farmers often need to maintain certain levels of moisture at different depths depending on the crop and where they are in the crop-cycle,” Khan explained.



“We think CoMEt could be used in multiple ways,” said Shahzad. “Growers could manually move the CoMEt device to measure soil moisture at various points in the field; they could use CoMEt in conjunction with a manually operated drone to assess soil moisture; or they could use CoMEt with an automated drone that flies a defined pattern over the field.”

Technologies that are currently in use by growers to measure soil moisture rely on in-ground sensors. However, this approach requires farmers to place multiple sensors around the field in order to capture moisture levels, since moisture levels vary due to differences in drainage, proximity to irrigation lines, and so on. For large fields, growers need a lot of sensors — and that gets expensive.

“We think it would be possible to manufacture CoMEt devices for about the same amount of money as an accurate

in-ground sensor,” said Khan. “But where a grower would only need one CoMEt device, they would have to buy quite a few in-ground sensors to collect the same amount of information on soil moisture. In short, we think CoMEt would be significantly more cost effective.”

“What’s more, installation and maintenance of in-ground sensors is time-consuming and inconvenient. And CoMEt requires neither.”

“At this point, we’re looking for industry partners to explore how we can get this technology into the hands of growers who will be able to make use of it,” Shahzad said.

The paper, “Estimating Soil Moisture Using RF Signals,” was presented at the 28th Annual International Conference on Mobile Computing And Networking (ACM MobiCom), held Oct. 17-21 in Sydney, Australia. ■

Six alumni honored at 2021 CSC Hall of Fame ceremony



Top, right to left, Ilya Baldin, Drew Banks, Tiffany Barnes, Paul Jones, Brian Onorio and Veronica Cateté.

The NC State Computer Science Alumni Hall of Fame officially inducted five new members during a special ceremony held at the Park Alumni Center on Friday, Nov. 19, 2021. In addition, the department formally recognized the 2020 class of inductees, who were unable to celebrate in person last fall due to COVID-19 restrictions in place at the time. More than 70 faculty members, staff members, award winners, their families and special guests were in attendance.

A photo gallery with pictures from the special event can be found at go.ncsu.edu/sakcoq8.

The CSC Alumni Hall of Fame was established in 2017 to celebrate and recognize the exemplary contributions our outstanding graduates have made to their profession, their community and to the world at large. With more than 10,000 CSC alumni, only a select number will be chosen for recognition in the Alumni Hall of Fame, making this a truly exceptional and noteworthy honor.

This class of inductees brings the total number of alumni honored in the Hall of Fame to 52.

Award winners are presented with a specially designed award to take home, and they will be featured on a permanent display wall on the third 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 at ncsucsc.touchpros.com.

The 2021 inductees into the NC State Computer Science Alumni Hall of Fame are:

- **Ilya Baldin** (M.S. '95, Ph.D. '98)
Director, Network Research and Infrastructure, RENCI
- **Drew Banks** (B.S. '84)
Retired Silicon Valley Tech Entrepreneur
- **Tiffany Barnes** (B.S. '95, M.S. '00, Ph.D. '03)
Distinguished Professor of Computer Science, NC State University
- **Paul Jones** (B.S. '72)
Professor Emeritus, and former Professor and Director of [ibiblio.org](https://www.ibiblio.org), University of North Carolina at Chapel Hill
- **Brian Onorio** (B.S. '04)
Serial Tech Entrepreneur

In addition, the department recognized one "Rising Star," a computer science graduate who has graduated within the past 10 years:

- **Veronica Cateté** (B.S. '10, Ph.D. '18)
Assistant Professor in Computer Science, NC State University

"As Hall of Fame honorees, we hope that you will serve as an inspiration for current and future students, while promoting the department's global impact for producing incredible talent that embodies the University's mantra to 'Think and Do the Extraordinary.'"

GREGG ROTHERMEL

CSC Department Head **Gregg Rothermel** extended his congratulations to the group.

"COVID-19 forced us to cancel last year's event, so today, we will celebrate for both 2020 and 2021, recognizing the early career achievements of three alumni designated as 'Rising Stars' and honoring the career achievements of 10 outstanding computer science alumni by formally inducting them into our Alumni Hall of Fame," he said during the ceremony. "As Hall of Fame honorees, we hope that you will serve as an inspiration for current and future students, while promoting the department's global impact for producing incredible talent that embodies the University's mantra to 'Think and Do the Extraordinary.'"

"Collectively, this group has made its mark in the public and private sectors with dozens of patents producing new and innovative technologies," said **Ken Tate**, director of engagement and external relations. "They've written hundreds of award-winning papers, and authored scientific books, poetry and novels. They have launched startups creating jobs and economic prosperity, they've launched content enjoyed by our kids and grandkids on Netflix, and they have helped put a library on the moon and a rover on Mars. From training middle and high school teachers how to help us broaden participation in computer science, to providing tools for breast cancer survivors, to crafting legislation on renewable energy and workplace safety, this group not only cares about the world, it has found a way to use their talents to make this a better world.

"Every single year, we discover alumni doing amazing things and we look forward to discovering more in the future," Tate added. ■

Olingers establish largest scholarship endowment in department history



“This scholarship enables young adults who may have monetary issues to finish their educations. We also hope that it will help identify creative and innovative individuals who can have an impact on the state of North Carolina.”

CHRIS OLINGER

The department is proud to announce that Department of Computer Science (CSC) alumni couple **Anne-Marie and Chris Olinger** have made a securities gift valued at more than \$264,000 to establish the **Anne-Marie and Chris Olinger Entrepreneur Scholarship Endowment**. This stands as the largest fully funded scholarship endowment in the history of the department to benefit computer science students.

This endowment will be used to provide scholarships to outstanding students who are pursuing an undergraduate degree in computer science and who are affiliated with entrepreneurial efforts at NC State such as, but not limited to, being involved with NC State Entrepreneurship and/or the CSC Undergraduate Entrepreneurship Track.

“This is an incredibly generous gift from the Olingers that is most certainly a reflection of their admiration for the impact NC State had on their success, but it also represents their desire to help future generations of students who share their entrepreneurial passion and who may not otherwise be able to pursue their dreams,” said CSC Department Head **Gregg Rothermel**.

“Giving back like this is vitally important. I want to live in a place where people are well-educated, informed and love the things that they do. NC State enabled that for us,” said Chris Olinger. “This scholarship enables young adults who may have monetary issues to finish their educations. We also hope that it will help identify creative and innovative individuals who can have an impact on the state of North Carolina.”

As undergraduate students at NC State, Anne-Marie and Chris Olinger met in the D.H. Hill Jr. Library cafe. Chris graduated in 1989 from NC State with his degree in computer science. Anne-Marie graduated magna cum laude in computer science at NC State in 1987. She is honored to have cheered Coach Jim Valvano and the Cardiac Pack to their NCAA men’s basketball championship in 1983.

Anne-Marie has worked at SAS since graduating, and she currently serves as a principal software developer. Chris also joined SAS after graduation, but left after 15 years to co-found d-wise, a successful pharmaceutical analytics consulting company. As chief technology officer at d-wise, he served for six years on the department’s strategic advisory board. In 2019,



Chris was inducted into the NC State Computer Science Alumni Hall of Fame. Together they have raised three sons in the Raleigh area.

The Olingers are avid Wolfpack fans, supporting both athletics and academics. They set up this scholarship as a tribute to their NC State friends and colleagues, whose academic rigor ranged somewhere between mediocre and top-level, yet managed to develop into successful business people, amazing parents and cherished, lifelong friends. Their generosity even inspired one of these longtime friends. An anonymous gift of \$10,000 was given by the “Tucker Basement Friends of 1983 and 1984” to the department in support of the Olingers’ scholarship endowment.

The Olingers acknowledge that, although grades are important, they are not the single determinant of one’s success. The ability

to think creatively with the courage to try new things can help people to achieve great things — you don’t have to be the leader of every group or the top of your class to make significant, lasting and positive impacts on the world and those around you.

“It’s an effort to try and give back and to say thank you, to ensure that others can come to NC State and have an opportunity to learn, and to recognize how important that opportunity was to us... To be able to assist others in being able to get a higher level of education, it’s just very meaningful to be able to participate in that journey,” Anne-Marie said.

“Simply, Anne-Marie and I would like to help creative and passionate young people experience and leverage the same NC State educational gift that we received,” Chris said. “I hope this gift will help.” ■



NC State alumni couple establishes Troan Scholarship for Computer Science Endowment

The Department of Computer Science (CSC) is proud to announce that NC State alumni **Erik and Brigid Troan** have made a commitment of \$250,000 to establish the **Troan Scholarship for Computer Science Endowment**. When fully funded, this will be one of the largest scholarship endowments ever created specifically for computer science students.

The Troan endowment will provide scholarships to students who are pursuing a degree in computer science, with preference given to first-generation college students and to students who reside in counties designated as Tier 1 by the North Carolina Rural Economic Development Center. Tier 1 counties are the 40 most distressed counties in the state based on factors such as population growth, unemployment and household income.

“Brigid and I hope this gift helps people who grow up in isolated parts of our state,” Erik said. “It’s about providing equal opportunities for individuals across North Carolina to reach their full potential.”

Ken Tate, director of engagement and external relations, says the Troans’ gift is not only significant but transformative.

“Many people may not realize that, while we have more than 2,200 students in our department, we have just over 30 endowments providing scholarship support to them,” Tate said. “The need that many students have for financial support is great. An endowment of this magnitude, one of the largest in the department’s history, will help provide significant funds for computer science students — not just now, but in perpetuity.”

Erik Troan graduated from NC State with a bachelor’s degree in computer science and computer engineering in 1995, followed by a master’s degree in economics from the University of Virginia. Erik started his career at Red Hat as the company’s first engineer, leading the engineering team through the development of Linux, Rpm and Anaconda, as well as the company’s IPO. He also led product marketing and assisted in the acquisition and integration of nine other companies during his time at Red Hat.

In 2005, Erik founded rPath, which was then sold to SAS in 2012. Erik is also the co-founder and chief technology officer of Pendo, a venture-backed software company located in downtown Raleigh, NC.

Dr. Brigid Troan graduated from NC State’s College of Veterinary Medicine (CVM) in 1999 and then completed her pathology residency at the CVM in 2001. Brigid has been the diagnostic pathologist at the North Carolina Zoological Park and an adjunct professor at the CVM since 2005.

Brigid is a reviewer for multiple academic journals, a Diplomate of the American College of Veterinary Pathologists specializing in zoo and wildlife species, and serves as a pathologist for the Exotic Species Cancer Research Alliance. She is also a member of the Morehead Planetarium and Science Center Advisory Committee in Chapel Hill, NC.

“This is about talking to a girl from rural North Carolina and being able to say, ‘Here’s what you can do. Here are the scholarships that are available,’” Brigid said of the impact philanthropic gifts can have. “Being able to tell these kids

that opportunities are out there, and that they should absolutely believe in themselves and believe in their ability to achieve their goals is so rewarding.”

The Troans have been active supporters of the College of Engineering and the College of Veterinary Medicine since graduating from NC State. Erik currently serves as a member of the Computer Science Strategic Advisory Board and was inducted into the first class of NC State’s Computer Science Alumni Hall of Fame in 2017. He was also a Distinguished Alumni Speaker for the Leaders of the Pack Series in 2021.

“NC State helps people within our community,” Erik said. “North Carolina strives to make this school experience affordable for people from across our state. The commitment our state has shown to the education of our kids through institutions like NC State really sets our state apart.” ■

CSC alumna honored with Watauga Medal

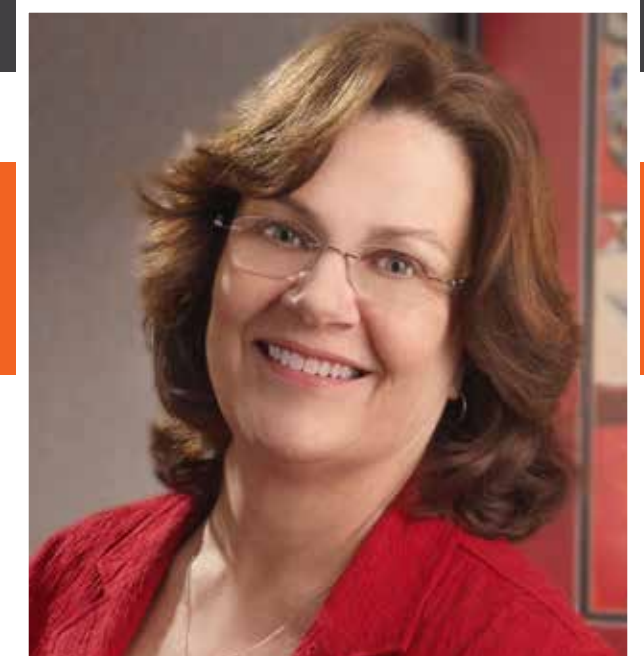
Suzanne Gordon, computer science and mathematics ’75, was one of three NC State alumni to receive the Watauga Medal, the University’s highest nonacademic honor, in 2021. Glenn Futrell and Bob Mattocks also received the award.

The Board of Trustees presents the annual award to recognize individuals who have made significant contributions to the advancement of NC State.

Gordon earned bachelor’s degrees in computer science and mathematics from NC State, followed by a master’s degree in statistics.

She spent more than 30 years with SAS Institute, retiring as chief information officer in 2012. She then started Gordon Services, a nonprofit organization that helps launch young adults into the workforce.

“Suzanne is a passionate trailblazer for women in STEM fields,” said **Chancellor Randy Woodson**. “She is committed to encouraging women and other underrepresented groups, to nurturing talent and to removing barriers to success for all young people.”



Suzanne Gordon

Gordon has been a member of the Alumni Association Board of Directors, served two four-year terms on the Board of Trustees and became the first female president of the Engineering Foundation Board of Directors. She also supports programs hosted by the Women and Minority Engineering Programs office.

Gordon and her husband Ralph Gordon, a graduate of NC State’s College of Engineering, have been generous donors as well, supporting scholarships, athletics, The Science House, Fitts-Woolard Hall and more. ■



James Lester III

LESTER RECEIVES SEVERAL UNIVERSITY HONORS

James Lester III, Distinguished University Professor of Computer Science, was recognized by NC State University in several ways for his scholarship, mentorship and leadership. This spring, he received the Holladay Medal, the University's highest

award for research and mentorship. Lester was also awarded the NC State Alumni Association Outstanding Research Award, and was named a member of the NC State Research Leadership Academy.

Lester is the director of the Center for Educational Informatics at NC State, and director of the National Science Foundation (NSF) AI Institute for Engaged Learning.

He received a bachelor of arts in history from Baylor University, and a bachelor of arts, master of science and Ph.D. in computer science from the University of Texas at Austin. His research centers on transforming education with artificial intelligence. His current work ranges from AI-driven narrative learning environments and virtual agents for learning to multimodal learning analytics and sketch-based learning environments. Lester is the author of more than 200 publications, primarily in the area of AI technologies for education. The AI-driven learning environments he and his team create have been used by thousands of K-12 students around the globe.

Lester's foundational work on pedagogical agents has been recognized with the IFAAMAS Influential Paper Award by the International Federation for Autonomous Agents and Multiagent Systems. He is the recipient of a NSF CAREER Award and Best Paper Awards at the International Conference on Artificial Intelligence in Education, the Association for Computing Machinery (ACM) International Conference on Intelligent User Interfaces, the Association for the Advancement of Artificial Intelligence (AAAI) International Conference on Artificial Intelligence and Interactive Digital Entertainment and

the International Conference on User Modeling, Adaptation and Personalization. He has been recognized with the North Carolina State University Outstanding Teacher Award.

Lester has served as editor-in-chief of the *International Journal of Artificial Intelligence in Education*. He served on the 2020 National Educational Technology Plan Technical Working Group. His research program is supported by the NSF, the U.S. Department of Education's Institute of Education Sciences, the National Institutes of Health, the National Institute of Standards and Technologies and the Army Futures Command. He is a Fellow of the Association for the Advancement of Artificial Intelligence.

One of five to receive Holladay Medal

Lester was one of five faculty members who received 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 an in-person Celebration of Faculty Excellence on May 4.

The award was named in honor of Alexander Quarles Holladay, NC State's first professor of history and its first president.

This year's award winners 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 were honored at NC State's spring commencement ceremony on May 7.

Lester honored with Outstanding Research Award, induction into Research Leadership Academy

Lester was also one of six faculty members who received the University's top award for research and mentorship this year. The Outstanding Research Award honors those who show excellence in the creation of new knowledge, concepts, methodologies or understandings; who commit to mentoring their fellow NC State faculty members; and who serve the NC State research community.

The Outstanding Research Award winners were inducted into the University's Research Leadership Academy, which consists of excellent faculty members in diverse fields who enhance NC State's research culture.

The Outstanding Research Award is given annually by the Office of Research and Innovation and the Alumni Association. The Research Leadership Academy was founded in 2016.



Munindar Singh

SINGH NAMED 2021 ACM FELLOW

Munindar Singh, Alumni Distinguished Graduate Professor of Computer Science, was named a 2021 Fellow of the Association for Computing Machinery (ACM) for his contributions to artificial intelligence and multiagent systems and their applications in service-oriented

computing and sociotechnical systems. He is the third ACM Fellow in the CSC department at NC State, joining **Laurie Williams** (2020) and **Frank Mueller** (2018).

The ACM has named 71 members ACM Fellows for wide-ranging and fundamental contributions in areas including algorithms, computer science education, cryptography, data security and privacy, medical informatics and mobile and networked systems, among many other areas. The program recognizes the top 1 percent of ACM members for their outstanding accomplishments in computing and information technology and/or outstanding service to ACM and the larger computing community.

The contributions of the 2021 Fellows run the gamut of the computing field, including cloud database systems, deep learning acceleration, high performance computing robotics and theoretical computer science, to name a few.

In keeping with ACM's global reach, the 2021 Fellows represent universities, corporations and research centers in Belgium, Canada, China, France, Germany, India, Israel, Italy and the United States.

Singh is a co-director of the Department of Defense-sponsored Science of Security Lablet at NC State, one of six nationwide. His research interests include computational aspects of sociotechnical systems, especially as a basis for addressing challenges such as ethics, safety, resilience, trust and privacy in connection with AI and multiagent systems.

In addition to being named an ACM Fellow, Singh has received many awards and recognitions including being named a Fellow of the Association for the Advancement of Artificial Intelligence

(AAAI), the American Association for the Advancement of Science (AAAS) and the Institute of Electrical and Electronics Engineers (IEEE). In 2021 he was elected a foreign member of Academia Europaea (honoris causa), the first at NC State. He has won the ACM / SIGAI Autonomous Agents Research Award, the IEEE TCSVC Research Innovation Award and the International Foundation for Autonomous Agents and MultiAgent Systems (IFAAMAS) Influential Paper Award. He won NC State's Outstanding Graduate Faculty Mentor Award as well as the Outstanding Research Achievement Award (twice). He was selected as an Alumni Distinguished Graduate Professor and elected to NC State's Research Leadership Academy.

Singh was the editor-in-chief of the *ACM Transactions on Internet Technology* from 2012 to 2018 and the editor-in-chief of *IEEE Internet Computing* from 1999 to 2002. His current editorial service includes *IEEE Internet Computing*, *Journal of Artificial Intelligence Research*, *Journal of Autonomous Agents and Multiagent Systems*, *IEEE Transactions on Services Computing* and *ACM Transactions on Intelligent Systems and Technology*. He served on the founding board of directors of IFAAMAS, the International Foundation for Autonomous Agents and MultiAgent Systems. He previously served on the editorial board of the *Journal of Web Semantics*. He also served on the founding steering committee for the IEEE Transactions on Mobile Computing. Additionally, he was a general co-chair for the 2005 International Conference on Autonomous Agents and MultiAgent Systems and the 2016 International Conference on Service-Oriented Computing.

Singh joined the NC State faculty in 1995. He earned his B.Tech in computer science and engineering (1986) from the Indian Institute of Technology in New Delhi, India, and his M.S.C.S. in computer science (1988) and his Ph.D. in computer science (1993) from the University of Texas at Austin.

Tao Xie, former NC State computer science faculty member who is now chair professor in the Department of Computer Science and Technology at Peking University, was also named a 2021 ACM Fellow for his contributions to software testing and analytics.

BARNES RECEIVES NCWIT AWARD

The National Center for Women & Information Technology (NCWIT) has named **Tiffany Barnes**, Distinguished Professor of Computer Science, the recipient of the 2022 Harrold and Notkin Research and Graduate Mentoring Award.



Tiffany Barnes

The Harrold and Notkin Research and Graduate Mentoring Award is sponsored by the NCWIT Board of Directors and recognizes faculty members from nonprofit institutions who distinguish themselves through outstanding research and excellent graduate mentoring, as well

as those who recruit, encourage and promote women and minorities in computing. It is given in memory of Mary Jean Harrold and David Notkin, to honor their outstanding research, graduate mentoring and diversity contributions.

Barnes, a 2021 NC State CSC Alumni Hall of Fame inductee, earned her B.S. (1995), M.S. (2000) and Ph.D. (2003) degrees in computer science from NC State. After graduation, she taught computer science and served as director of the Game Design and Development Program at the University of North Carolina at Charlotte before returning to NC State in 2012. Her efforts to boost the recruiting and retention of girls and women in computing date back to her graduate school days, when she helped to write a National Science Foundation (NSF) grant to run a year-round enrichment program centered on a math summer camp for girls. Barnes has a strong record of mentoring women students throughout her career, as well as students with disabilities, Black and Hispanic women, Black men, LGBTQ students and many students from underprivileged backgrounds. Her research focuses on AI for education, educational data mining, serious games for education, health and energy, computer science education and broadening participation in computing education and research.

NCWIT is a 501(c)(3) nonprofit chartered in 2004 by the National Science Foundation that convenes, equips and unites nearly 1,500 change leader organizations nationwide to increase the influential and meaningful participation of girls and women — at the intersections of race/ethnicity, class, age, gender identity, sexual orientation, disability status and other historically marginalized identities — in the field of computing, particularly in terms of innovation and development.

REAVES RECEIVES NSF CAREER AWARD

Bradley Reaves, assistant professor of computer science, has received a Faculty Early Career Development Award, also known as the CAREER Award, from the National Science Foundation



Bradley Reaves

(NSF). The award is one of the highest honors given by NSF to young faculty members in science and engineering.

Reaves received \$606,848 for his project, “Increasing Trust and Reducing Abuse in Telephone Networks.”

Telephone users are regularly besieged by unsolicited sales and

scam calls, cannot verify identities of callers, and enterprises frequently fall prey to expensive compromises of their telephone infrastructure.

The proposal will deliver techniques to detect these issues, conduct network-wide systematic measurement, and provide practical defenses for these problems. The vision of this five-year project is to provide technologies that will restore the telephone network to its former status as a trusted and trustworthy network.

Reaves is a member of the Wolfpack Security and Privacy Research (WSPR) Lab. His research is dedicated to measuring and improving the security and privacy of computer systems, with a particular emphasis on telephone networks and software for mobile platforms. This work has addressed detection and measurement of mobile malware in the wild, identified systemic risks in developing world mobile money systems, and provided new techniques to distinguish legitimate and fraudulent phone calls.

His research integrates knowledge from fields as diverse as signal processing and digital communications; data science, machine learning and statistics; cryptography; program analysis; reverse engineering; and internet and telephone networks.

Reaves earned bachelor’s and master’s degrees in computer engineering from Mississippi State University, a master’s in computer science from the Georgia Institute of Technology and a Ph.D. in computer engineering from the University of Florida.

He joined the NC State faculty in 2017.

SHEN’S TECH STARTUP, COCOPIE, WINS NSF SMALL BUSINESS INNOVATION FUNDING

CoCoPIE, a tech startup co-founded by **Xipeng Shen**, professor of computer science at NC State, has been awarded a \$250,000 Small Business Innovation Research (SBIR) grant from the National Science Foundation (NSF). The grant supports his proposal “Enabling Real-Time AI on End Devices Through Compression-Compilation Co-Design.”



Xipeng Shen

CoCoPIE was founded by Shen and collaborators Bin Ren, assistant professor in the College of William & Mary’s Department of Computer Science, and Yanzhi Wang, assistant professor in Northwestern University’s Department of Electrical and Computer Engineering.

CoCoPIE offers a novel software-based approach to endowing end-user devices with artificial intelligence (AI) functionality. For instance, the CoCoPIE website describes how the software can upscale low-resolution smartphone videos and images to high definition in real time.

The proprietary compression-compilation co-design technology of CoCoPIE makes AI models several times smaller and faster than state-of-the-art optimization technology while preserving the accuracy. It can hence significantly lower the cost of AI products and make many impossible tasks on mobile devices possible. As a pure software solution, it foregoes the needs for costly special AI hardware, shortening the time-to-market from years to minutes.

“NSF is proud to support the technology of the future by thinking beyond incremental developments and funding the most creative, impactful ideas across all markets and areas of science and engineering,” said Andrea Belz, Division Director of the Division of Industrial Innovation and Partnerships at NSF. “With the support of our research funds, any deep technology startup or small business can guide basic science into meaningful solutions that address tremendous needs.”

“CoCoPIE is an enabler and disruptor,” Shen said. “The revolutionary technology of CoCoPIE opens up limitless new opportunities for AI app developers, smartphone and IoT device vendors, robotics, health, autonomous driving and many other industries.”

Once a small business is awarded a Phase I SBIR/STTR grant (up to \$256,000), it becomes eligible to apply for a Phase II (up to \$1 million). Small businesses with Phase II funding are eligible to receive up to \$500,000 in additional matching funds with qualifying third-party investment or sales.

THREE FACULTY MEMBERS RECEIVE CARLA SAVAGE AWARDS

Min Chi, associate professor, and **Thomas Price**, assistant

professor, were named the winners of The Carla Savage Award for spring 2022. **Munindar Singh**, Alumni Distinguished Graduate Professor of Computer Science, received the award in fall 2021.

The Carla Savage Awards are an intra-departmental initiative, and were created by representatives in the Department of Computer Science (CSC) to recognize outstanding achievement and special people within the department, in the spirit of the incomparable department icon **Carla Savage**.

Each month nominations for The Carla Savage Awards focus on one of the following groups: Ph.D. students, administrative staff, research professors, teaching professors, assistant professors, associate professors and professors. The Carla Savage Awards committee is made up of representatives from the faculty, staff and graduate students. The names of nominators for the awards are kept private, but the nomination text will be public so voters can access this information when voting. Voting is open to everyone in the department. Two awards are given each month, with a maximum of 14 winners (one person cannot win more than once every six months). No awards are given in January, June, July, August or December.

Full Professor: Munindar Singh

In addition to being named an ACM Fellow and receiving several other accolades, **Munindar Singh** was named the winner of The Carla Savage Award in the full professor category in fall 2021.

Singh is a part of the newly established Academy of Outstanding Faculty Members at NC State, and he has graduated 27 Ph.D. students.

Per his nomination, “Dr. Singh is an amazing professor and his course is great fun. He is an excellent researcher and collaborator and is very active in research. He is supportive and encourages independent thinking for student projects and cares not only about academic research progress, but also his advisees’ career development. He always tries to find new opportunities for his students.”

Associate Professor: Min Chi

Min Chi joined the department in August 2013 as a Chancellor’s Faculty Excellence Program cluster hire in the Digital Transformation of Education. She earned her M.S. and Ph.D. in intelligent systems from the University of Pittsburgh, and her B.E. in information science and technology from Xi’an Jiaotong University, China.

Her specialty is applied machine learning and data mining, and her research lies at the intersection of educational data



Min Chi

mining and human-computer interaction. Chi's research primarily focuses on applying machine learning and data mining methods to improve human learning, and exploring new machine learning and data mining challenges posed by learning and social science.

The goal of Chi's research is to develop a shared vocabulary and theoretical data-driven framework at the intersection of education, health and wealth. She aims to develop methods for harnessing, securing, synthesizing and learning from structured and unstructured data from traditionally unconnected sources to inform and empower communities. She is committed to not only improving pedagogy induction, but also improving health care and social network analysis. As of January 2021, her research accomplishments have resulted in over 80 peer-reviewed publications (eight in high-impact journals and 60 in premier conferences), with more than 60 since joining NC State in 2013.

Per her nomination, Chi has consistently increased the effectiveness of her teaching, with both enthusiastic student feedback and peer evaluations strongly supporting this view. Another nomination said, "She's great to work with!!...And when you send her an email that needs a response, she usually answers it immediately!"

Assistant Professor: Thomas W. Price

Thomas W. Price is a two-time graduate of the CSC department earning his M.S. in 2015, and his Ph.D. in 2018. He directs the Help through INTelligent Support (HINTS) Lab, which develops learning environments that automatically support students through AI and data-driven help features. His work has focused on the domain of computing education, where he has developed techniques for automatically generating programming hints and feedback for students in real-time by leveraging student data. He has evaluated the efficacy of innovative programming technologies, including block-based and frame-based programming environments, and has designed intelligent support features that integrate with these technologies.

Price believes that every student should be able to learn computing with the support they need to be successful, working on projects that suit their values and interests. His research goal is to re-imagine educational programming environments as



Thomas W. Price

adaptive, data-driven systems that support students automatically as they pursue learning goals that are meaningful to them.

Price's nomination for The Carla Savage Award was fulsome in its praise: "...Being the greatest advisor, he introduces his students (with his

best effort) to the connections to help their future career. For papers, he helps students in detail and holds a high standard. He cares about people in the lab, and also enjoys a good reputation among the students in the classes he teaches."

PRICE NAMED DEPARTMENT'S 2021-22 'PERSON OF EXCEPTIONAL PERFORMANCE'

Price also received the 2021-22 "Person of Exceptional Performance," or PEP Award.

The PEP Award, launched by the department in 2018, is intended to recognize faculty or staff members who have exhibited truly outstanding performance, contributing significantly to the department's success as role models for what it means to "Think and Do the Extraordinary." The recognition includes a custom acrylic plaque and a cash award. Price becomes the department's fifth winner of the PEP Award joining **Lina Batestilli** (2021), **Leslie Rand-Pickett** (2020), **Sarah Heckman** (2019) and **Ken Tate** (2018).

In addition to his teaching and research, Price has made two key contributions to the department over the last year. First, he organized and led the CSC Department Handbook Taskforce, which has put together a collection of resources for faculty and staff to explain departmental policies, requirements and best-practices. The handbook's primary goal is to help new members of the department get up-to-speed more quickly, so they can focus on their research, teaching and administrative efforts. Second, he co-led the CSC Taskforce on Promoting Diversity and Inclusivity Discussions and Community. The taskforce has conducted a department-wide student survey, as well as listening sessions with students to better assess student needs. This led to the development of the CSC Diversity Equity and Inclusion Council, a group of students, faculty members and staff members working to better support Black students, and students of color more broadly, within the department. The 2022 council has now been formed and is beginning its work, with new faculty and staff leadership. ■



Manali Shirsekar

FOSTERING COMMUNITY TO HELP BATTLE ACADEMIC HARDSHIPS

Manali Shirsekar, computer science '22, realized early on that as a woman in a science, technology, engineering and mathematics (STEM) field, she'd have some extra hurdles to navigate.

Women make up just under a quarter of engineers in the workforce. Before they enter research facilities and offices, finding a supportive community and opportunities to grow outside of the classroom can provide vital help along the way.

Shirsekar felt supported by NC State's Scholars Program and the Women in Science and Engineering (WISE) Village her first year and the Department of Computer Science's (CSC) student ambassadors her second year. But progressing into upper-level coursework, she noticed that the targeted assistance she received as a first-year student wasn't as easily accessible.

Wanting to create opportunities and community for herself and other CSC students, Shirsekar decided to get involved.

Shirsekar, who graduated in May 2022, juggled many roles, including a researcher within NC State's Laboratory for Analytic Sciences (LAS), a student ambassador for CSC and president of NC State's ACM-W Chapter of Women in Computer Science. She attributes these experiences to her success within computer science.

"Service and research are where I grew the most," Shirsekar said.

Finding space to grow and bond

Shirsekar imagined building a stronger community within CSC, one that could withstand the trials of coursework and research, and eventually COVID-19.

"I wanted to give back after the awesome mentors I had while I was a Villager," Shirsekar said. "I was welcomed in by my mentors and they were invested in supporting me as a person and student to see me succeed."

Joining CSC's student ambassador program was Shirsekar's first step. Since her sophomore year, she has assisted with outreach efforts to high school students and first-year students.

Shirsekar later became involved in NC State's ACM-W Chapter of Women in Computer Science (WiCS). In 2021, she was elected president. During a time

when everyone was separated due to COVID-19, she saw a need to create a community where female computer science students could find camaraderie.

She went above and beyond to uphold WiCS' mission to provide opportunities for personal and professional development by initiating and then directing DiamondHacks NCSU, an annual hackathon funded by WiCS. Hosted in April 2021 and April 2022, the event invited students to collaborate on projects centered on industry technological advancements, social inequalities and sustainability.

"Taking this job, it was the best thing I did for myself and the best way to give back to the NC State community," Shirsekar said. "There is a lack of help for women and minorities that was exacerbated during COVID-19, and it was a special feeling bringing people together during these events that I could've only done through WiCS."

From classwork to lab work

Shirsekar came to computer science seeking opportunities in interdisciplinary research that engaged with the broader NC State community.

"I like software engineering and how the fundamentals of the degree help me do a variety of things, and it's exciting to apply my knowledge to research that is so novel," she said.

With assistance from the Women and Minority Summer

Research Program, her first research project was with Laber Labs, a statistics lab focused on data-driven decision making, where she worked on developing a self-driving car with reinforcement learning algorithms and low-capability hardware.

During her junior and senior years, Shirsekar worked with NC State's LAS in two different roles on projects centered on national security. First as a natural language processing (NLP) researcher, she identified disinformation propaganda being circulated on Twitter, using machine learning to discern which were organic tweets and which were created by foreign adversaries. Now, as a machine learning researcher, she has developed an optimized information retrieval algorithm using clustering and topic modeling.

Shirsekar is staying at NC State for another year to complete her accelerated master's degree in computer science with a concentration in data science, where she sees the different avenues to apply her skills while staying true to her interests in the areas of national security or cyber-threat detection.

"Getting my master's degree made sense," Shirsekar said. "There is a gap in where I am and where I want to be, so that extra training and to work on research more is important."

She will also continue working with the LAS on two projects. The first will expand on her current research in NLPs and information retrieval while the second will focus on building a geo-political analytics dashboard.

Over the summer, she traveled to Redmond, Wash., to work at Microsoft's headquarters as a software engineering intern.

AMBASSADOR FOR OPTIMISM

Vitus Putra lived in a small village on the Indonesian island of Java for the first 13 years of his life.

Before his family decided to immigrate to the United States, Putra — who recently graduated from NC State — had never been to a big city. When they settled in Cary, NC, nearby Raleigh felt huge to him at the time.

"In Indonesia, I was really just inside my own community — I never dreamed of leaving my own island," he said. "For me, [moving here] was an opportunity to explore the world and to challenge myself to be a better person."

Putra continues to hold on to that basic outlook — that with change comes the opportunity to learn, grow and explore — nearly a decade later.

As he prepared to graduate in May with a degree in computer science, Putra looked back on four years during which he not



Vitus Putra

only challenged himself academically but also grew as a person, helped others through service and enriched the lives of those around him with his upbeat, positive outlook on life.

Putra attended Panther Creek High School in Cary, where he developed a passion for computing and solving problems using computation. Knowing NC State had an excellent reputation in computer science, he decided to apply.

He then received an invitation to apply for the Goodnight Scholars Program at NC State. He admits that at first, he didn't know much about the program beyond the fact that it offered financial support to pay for college. But as he learned more, Putra said the financial support and the enrichment opportunities the program offered became central to his decision to enroll at NC State.

"It helped me to invest in my potential as a student," he said. "Goodnight Scholars offered a lot of programs that helped me personally and professionally grow myself and grow with other scholars, and prepared us for the future ahead of us."

Established in 2008 and funded by a gift from Dr. Jim and Mrs. Ann Goodnight, the Goodnight Scholars Program is designed to develop students into leaders within the STEM and education fields. The scholarship is available to students from low- and middle-income families from North Carolina. In addition to paying tuition, the program provides scholars with access to a range of developmental and enrichment programming.

Putra jumped in with both feet. As a freshman, he traveled on a service trip to Trinidad and Tobago, where he learned about conservation efforts and said he appreciated observing the different way of life in another country. He took seminar classes through the Goodnight Scholars Program that helped prepare him for a career, and helped him understand more about networking, using LinkedIn and even connecting with different professors on campus.

Those connections led him to an undergraduate research experience under **Min Chi**, an associate professor in the Department of Computer Science, using data science to improve personalized learning for students.

Putra said one of his favorite parts of the Goodnight program is what he calls the "pay it forward" aspect — helping in the community. He worked with Habitat for Humanity and other local service organizations while at NC State. He became a STEM coach to younger students, traveling to elementary schools to work on STEM projects with them and to encourage the next generation of STEM students.

"It helped me become a fearless leader in my community," he said. "I feel like I'm now able to lead others to reach a goal."

Although it seems like he has done plenty during his undergraduate career, Putra said his philosophy is "to not do too much, but to try to do it well."

That approach shows in his commitment to the Helping Hand Project, a student-led club at NC State using 3D printing and innovative design solutions to provide recreational prosthetic devices to people with upper-limb differences.

Putra worked with the group since his freshman year with the goal of developing a low-cost prosthetic arm for children. The organization brought together students from different majors; as of now, the group has developed a prototype that is inexpensive and has potential for the future, he said.

He was also a Computer Science Student Ambassador, reaching out to potential students, hosting open house tours, and helping with recruitment and student experiences.

The common theme with Putra seems focused on helping and sharing knowledge with others, and encouraging them to find their own passions.

"My love is to always share what I know," he said. "My passion is to be a teacher and a learner — you never stop learning — and all of these experiences I have, I can transfer it to the next generation of students as well."

This self-proclaimed optimist was taught well by his parents. They were never wealthy, he said, but always told him, "if you have enough things, don't be afraid to give more."

"In spite of not having a lot, try your best to pay it forward," Putra said.

After graduation, Putra started a job at Cisco in Morrisville, NC. He is still exploring options for the long-term, unsure if he will continue in industry or perhaps return to school down the road to pursue a doctorate.

One thing he's sure of: He would like to continue to make an impact on his community. He hopes to be a mentor to others exploring similar education or career paths.

For those considering NC State, Putra is quick to tell them not to be afraid and to challenge themselves.

"You can't grow when you stay in the same environment," he said. "Challenge yourself to new opportunities and experiences no matter how scared you are — you may face rejection, but there's always one 'yes' that could change your life."

PH.D. STUDENT WINS SPRING 2022 CARLA SAVAGE AWARD



Kai Presler-Marshall

Kai Presler-Marshall

is a Ph.D. student working with **Sarah Heckman** and **Kathryn Stolee**. His research interests include software engineering and, in particular, computer science education. He is currently working on understanding the characteristics of successful software engineering teams to help put more students on

a trajectory toward a better outcome. He is also developing a tool that can analyze Java projects to understand the types of changes made, and summarize contributions made by individual developers, with the hope of enabling teaching assistants (TAs) to provide students with more timely and more actionable feedback on their contributions to their team.

The Carla Savage Awards are an intra-departmental initiative, and were created by representatives in the Department of Computer Science (CSC) to recognize outstanding achievement and special people within the department, in the spirit of the incomparable department icon **Carla Savage**.

For this award, Presler-Marshall's nominators called out all the work he does supporting all the other teaching assistants in the department's biggest SE class: CSC 326. He is a dedicated leader, teaching them how to deal with various situations that can arise in class or lab. "It has been a great relief for us having Kai as TA last fall as he was always there to help us when needed," said the nomination text.

After graduation, Presler-Marshall will be joining Bowdoin College in Brunswick, Maine, as its Department of Computer Science's first teaching faculty member. ■

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