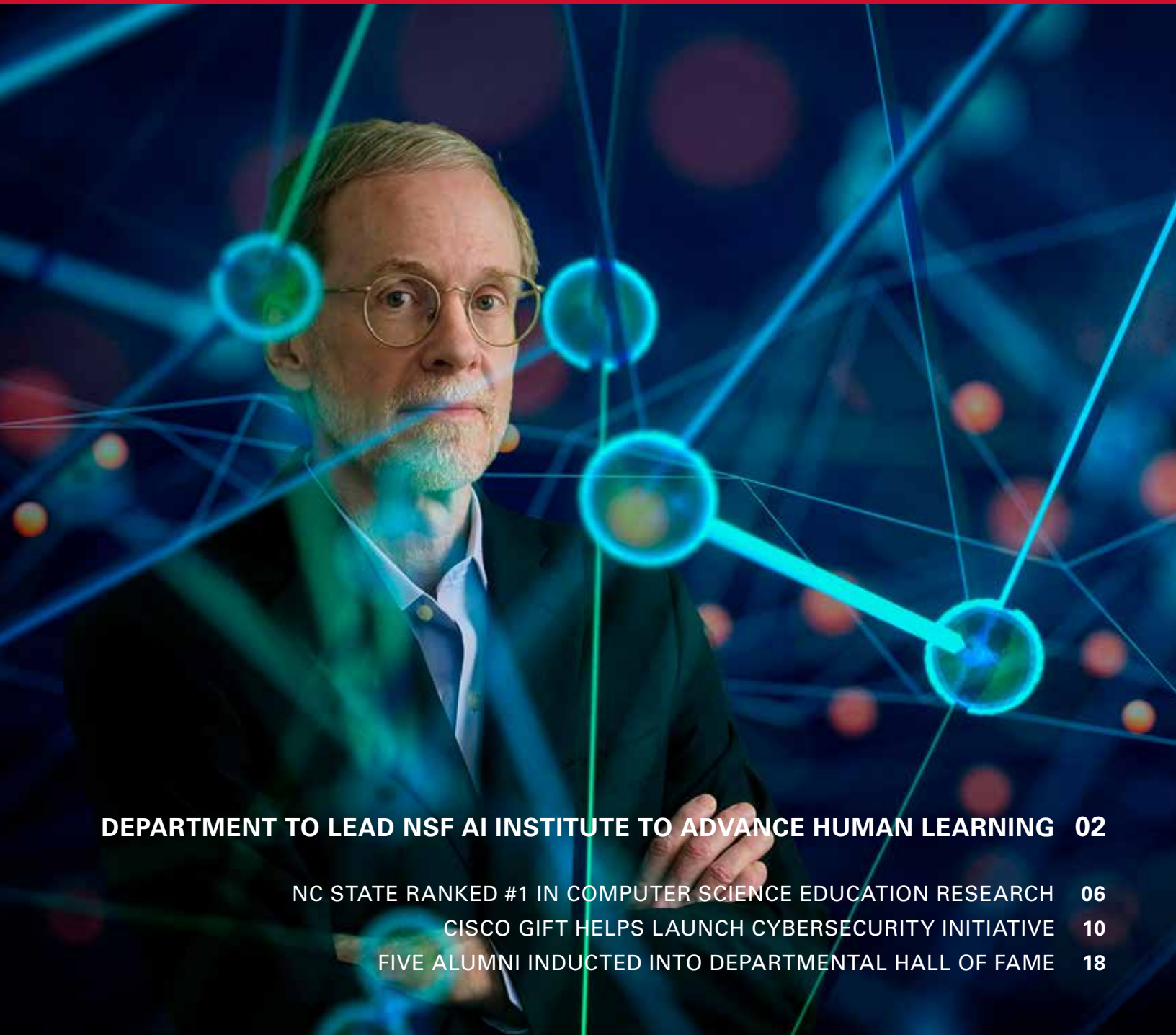


NC STATE Engineering

CSC NEWS

DEPARTMENT OF COMPUTER SCIENCE | FALL 2021 / WINTER 2022



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#1 FOR COMPUTER SCIENCE EDUCATION RESEARCH: PAGE 06

NC State was cited as the top institution in the world for computer science education research, generating 73 research publications focused on how people teach and learn computing, as well as new ways to learn and teach computer science.



ABOUT THE COVER

The National Science Foundation named NC State the lead on the AI Institute for Engaged Learning, which is supported by a five-year, \$20 million grant. James Lester, Distinguished University Professor, will lead the institute, which aims to develop tools that improve human learning.



WHAT'S NEW IN CSC PAGE 02

Faculty members are helping students cope with the effects of the pandemic, strengthening the department's cybersecurity initiative and working to use robots to improve shellfish farming.



ALUMNI AND DEVELOPMENT NEWS PAGE 18

CSC alumni are making a difference through their work and research across the world.



STUDENT NEWS PAGE 32

CSC students have won prestigious awards for their research and achievements, including two who were announced as NC State's third and fourth Churchill Scholars.

LETTER FROM THE DEPARTMENT HEAD GREGG ROTHERMEL



Dr. Gregg Rothermel

Dear Alumni and Friends of the Department of Computer Science (CSC):

Welcome to the Fall 2021 / Winter 2022 issue of the Department of Computer Science's newsletter. We were excited to welcome our CSC students back on campus for in-person classes this fall. Our students, faculty members and staff are doing a phenomenal job of following NC State's campus-wide protocols for mask-wearing, physical distancing and getting the COVID-19 vaccine. I am proud of the way our Wolfpack community has continued to stay strong in the face of the COVID-19 pandemic.

We are also very proud of the people who make up the CSC department, including our students, faculty members, staff and alumni, and we are happy to recognize them and their accomplishments and recognitions over the last 12+ months. Here are some of this year's highlights:

- The National Science Foundation (NSF) announced that NC State will lead a new research initiative aimed at creating artificial intelligence (AI) tools to advance human learning and education to a wide variety of audiences. **James Lester**, Distinguished University Professor of Computer Science, is the principal investigator for the new **NSF AI Institute for Engaged Learning**. The institute will be supported by a five-year, \$20 million grant from NSF.
- NC State was recently recognized as the **#1 institution worldwide for computer science education research** based on publication data collected between 2015-20 and presented at the 2021 SIGCSE Technical Symposium on Computer Science Education.
- Three assistant professors in the department have received a **Faculty Early Career Development Award**, also known as the **CAREER Award**, from NSF. The award, one of the highest honors given by NSF to young faculty members in science and engineering, was received by **Alexandros Kapravelos**, **Christopher Parnin** and **Ruozhou Yu**. The CSC department has now had 34 faculty members receive CAREER Awards, to date.
- The UNC System Staff Assembly presented **Veronica Cateté**, a computer science research scientist, with the **2020 Erskine Bowles Staff Service Award**. Cateté is the first recipient of this award from NC State.
- **Laurie Williams** was named a **Distinguished University Professor**. Williams is co-director of the NC State Science of Security Lablet, the Secure Computing Institute and the North Carolina Partnership for Cybersecurity Excellence (NC-PaCE).
- **Laurie Williams** was also named a **2020 Association for Computing Machinery (ACM) Fellow**. Williams is the second ACM Fellow in the department, joining Professor **Frank Mueller**, who became a Fellow in 2018.
- **Munindar Singh**, Alumni Distinguished Graduate Professor of Computer Science, recently became NC State's **first Elected Foreign Member of Academia Europaea**. Academia Europaea is the Pan-European Academy of Sciences, Humanities and Letters. Singh was elected a member of the Informatics section for his distinguished contributions to computer science, especially in decentralized AI, multiagent systems and service-oriented computing.
- **Munindar Singh** was also recently presented with the **NC State Outstanding Graduate Faculty Mentor Award** in the area of mathematical sciences, physical sciences and engineering.
- **Tiffany Barnes**, Distinguished Professor, has been named a **2020 Distinguished Member of the Association for Computing Machinery (ACM)** for her outstanding educational contributions to computing.
- The ACM Symposium on Cloud Computing 2020 (SoCC '20) recently awarded **Helen Gu**, professor of computer science, and her co-authors the **10-Year Best Paper Award** for their paper "CloudScale: Elastic Resource Scaling for Multi-Tenant Cloud Systems."
- **William Enck**, associate professor of computer science, along with his fellow researchers recently won the **2020 ACM Special Interest Group in Operating Systems (SIGOPS) Hall of Fame Award**.
- In 2020, the department was **ranked first in the nation in the number of women tenured/tenure-track faculty members** among departments of computer science in colleges of engineering by the American Society for Engineering Education (ASEE).

As you can see, even though we've been faced with challenges unlike any that we have experienced before, our department has worked hard and continued to excel! Thank you for your continued support of the department.

Sincerely,

Dr. Gregg Rothermel

Department Head



NC State, NSF unveil institute focused on artificial intelligence and the future of education

The National Science Foundation (NSF) has announced that NC State will lead a new research initiative aimed at creating artificial intelligence (AI) tools to advance human learning and education for a wide variety of audiences.

"We have been designing, developing and implementing AI technologies for education for many years," said James Lester, principal investigator of the new institute and Distinguished University Professor of Computer Science at NC State. "The new NSF AI Institute for Engaged Learning will leverage our work, and that of our collaborators, to develop new tools that radically improve human learning and education."

The institute will be supported by a five-year, \$20 million grant from NSF. The investment is part of a broader effort by NSF to advance our understanding of AI technologies and how they can drive innovation to address real-world challenges.

"We appreciate NSF's recognition of NC State's leadership in artificial intelligence, and greatly appreciate their support for the new AI Institute for Engaged Learning," said Chancellor Randy Woodson. "We're proud to partner with the NSF and collaborators on this important project that has the potential to transform education and learning."

In addition to NC State, the new institute will include researchers from Indiana University, the University of North Carolina at Chapel Hill, Vanderbilt University and the educational non-profit organization Digital Promise.

The institute will focus on three areas that complement each other.

First, the institute will create AI platforms that generate interactive story-based problem scenarios that foster teamwork, communication and creativity as part of the learning process.

Second, the institute will create AI characters capable of communicating with students through their speech, facial expression, gesture, gaze and posture. These characters, or "agents," will be designed using state-of-the-art advances in AI research to foster interactions that engage students effectively in the learning process.

Lastly, the institute will create a sophisticated analytics framework that analyzes data from students in order to make the tools truly interactive. In other words, the system will be able to customize educational scenarios and processes to help students learn, based on information the system collects from the conversations, gaze, facial expressions, gestures and postures of students as they interact with each other, with teachers, and with the technology itself.

Researchers involved with the institute will be working with a broad range of stakeholders, including schools, museums and

non-profit organizations. This collaborative approach is designed to ensure that the institute creates tools that can be used to meet educational goals while also ensuring that its AI-driven learning environments are ethically designed and promote diversity, equity and inclusion.

"All of our activities in the new institute will include a strong focus on ethics," said Lester, who also serves as director of NC State's Center for Educational Informatics (CEI). "We create effective educational tools that are informed by considerations of fairness, accountability, transparency, trust and privacy."

"Our work at the CEI has demonstrated that AI tools can be tremendously valuable in supporting education. But they do not exist in a vacuum, and we know how important it is to ensure that we are working with teachers, students and other community members to develop tools that meet their expectations in terms of safety, respect and privacy." ■

NC State ranks in top 10 for online master's engineering programs

NC State has been recognized as one of the top 10 online engineering master's programs in the nation for the past several years in a row. According to the *U.S. News & World Report* 2021 list of best online programs, NC State's Engineering Online ranked sixth nationally.

The Engineering Online master's program also landed in the top 10 for Best Online Graduate Engineering Programs for Veterans, coming in at seventh nationally. In rankings of online engineering specialties, the College of Engineering landed fourth for its mechanical engineering program. The College also ranked 11th in civil engineering, 11th in industrial and systems engineering, 13th in electrical engineering and 15th in engineering management.

NC State ranked 15th on the list of Best Online Master's Computer Information Technology Programs.

"Part of our success in being ranked in the top 10 online engineering programs for the past several years is our focus on student services," said Linda Krute, director of distance engineering education programs. "We have faculty members

who are dedicated to working with our distance students and we provide the services they need to be successful. We've been working with adult learners for several years and our faculty value the input and contributions they can make to their classes."

Engineering Online offers 17 different graduate engineering degree programs that are the same high-quality engineering and computer science degree programs offered on campus, but with the flexibility of online learning to help meet students' educational and professional goals.

"We've been able to develop a reputation of providing quality educational experiences for our distance students," Krute added. "The College of Engineering is dedicated to providing lifelong learning experiences for our alumni and professional engineers."

The *U.S. News & World Report* rankings look at metrics including faculty credentials and training, services and technologies made available to students, student excellence and how engaged faculty members are. ■



LexisNexis partnership grows alongside researchers, students

In 2014, global analytics firm LexisNexis opened its North American corporate innovation center on NC State's Centennial Campus. In seven years, the center has grown from just 150 employees to nearly 800 computer and software programmers, analysts, legal and business experts, sales and marketing professionals and support staff. The partnership with NC State has expanded, too — largely fueled by research collaborations, unique branding opportunities and access to talent just around the corner.

"NC State's collaborations with LexisNexis have led to technology breakthroughs while equipping our researchers and students with real-world training and insight," said Leah Burton, director of NC State's Office of Partnerships. "The benefit is definitely mutual. We view this as a case study for effective university-industry partnerships."

"There are many major technology challenges that have to be addressed if you're going to do large, big data stuff in the 21st century," said Tim Menzies, NC State computer science professor and key research collaborator with

LexisNexis. "We've worked with LexisNexis on many of these challenges over the years."

Reading a large quantity of emails to find a small number of relevant ones is one of these challenges, Menzies explained. "The problem of reading is actually much more general. We read a lot of things. Any researcher going to an online database tries to find relevant papers. If you're reading software source code, looking for security vulnerabilities, you're reading code. Reading is a technology problem where, based on feedback of what you've read so far, AI can run ahead and say, 'I think you should read this next.'"

Menzies and his team of grad students have also conducted extensive research related to industrial-scale text mining data — looking for predictors for significant business events. "As the world looks at complex streams of news, we're all suffering from information overload," Menzies added. "There is a need to recognize big events sooner. Our goal is to provide predictive analytics way earlier in the life cycle."

COLLABORATION LEADS TO SOLUTIONS

Another challenge is the impact of slow performance, which is made more challenging in a world where everyone is competing for the cloud. Menzies' team worked with LexisNexis engineers to better anticipate breakdowns in cloud services so that they can be corrected before a slowdown occurs.

"Industrial practitioners often are racing to get their products out to the marketplace before their competitors," Menzies said. "They may not have time to explore all the trillions of options inside their devices. NC State researchers can investigate these options and work alongside industry to find better solutions. NC State's Department of Computer Science has been working with LexisNexis for many, many years now. Dozens of Ph.D. students have been funded and have also completed internships at LexisNexis in Raleigh and Atlanta."

Zhe Yu earned his Ph.D. in computer science at NC State while working in the Real-World Artificial Intelligence for Software Engineering (RAISE) Lab under Menzies, collaborating with LexisNexis on several research projects and interning with the company for two summers. Yu is now an assistant professor in the Department of Software Engineering at Rochester Institute of Technology. "I think industry-university collaboration is really important because we can focus on more practical problems that the industry really needs and decide which problems are most worth solving.

"We worked together on one project called 'Discover a Cure,'" said Yu. "LexisNexis helps legal experts solve problems. It is a huge burden for the legal industry to find useful evidence from, say, millions of documents. We applied machine learning and data mining techniques trying to assist in this process. The AI assistant also trained a model to learn how the human makes the decisions and then help the human to make such decisions more efficiently.

"This collaboration had a major impact on my Ph.D. study because I found that problem really interesting," Yu continued. "And the solution we developed is, I think, quite powerful. It's beneficial for students to take part in these collaborations because it helps them decide where they want to work in the industry after graduation."

TALENT RIGHT AROUND THE CORNER

Joanne Henderson, who leads talent acquisition for LexisNexis North America, said the proximity and access to qualified interns and other employees has been invaluable.

"We have a really strong focus on cultivating talent because we know that a lot of the innovation is going to be driven by new ways of thinking that are being taught at NC State and how they're preparing the future workforce," Henderson said. "We're able to take advantage of that."

One of the primary campus talent attraction initiatives is the annual Rise to Code Hackathon, where NC State students participate in a two-day challenge to solve and present a solution to a business problem. Before the pandemic, the students would come to the Centennial Campus office, learn more about LexisNexis' culture and meet with internal mentors who would help ensure their success throughout that experience. Mentors also identify high-performing students for potential internships and full-time opportunities within the company.

"Access to NC State talent has been instrumental to the success of our early-career programs, including our internship and co-op programs, and our new graduate technology program, called Aspire," said Tabbi Fink, university programs lead at LexisNexis and 2018 alumna in business administration. "Our Super ePartner sponsorship with NC State's Department of Computer Science gives us niche access to student groups and organizations from which we heavily recruit."

Some examples include roundtable events with women in computer science, résumé reviews, senior design projects and hackathons, as well as sponsoring cybersecurity projects. Through these initiatives alone, LexisNexis has recruited more than 50 NC State students to join its programs over the past three years.

"I think being an alumna of NC State has really put me in a unique position to understand the student perspective," Fink added. "So, working for LexisNexis, I've gotten to connect with and meet a lot of students who are currently in the programs, and also really share my own unique experiences, and connect with them on that level. Being located on Centennial Campus has been excellent because it's really enhanced our company's brand recognition with NC State talent."

"Our growth on Centennial Campus has been sustained and supported by the leadership within NC State," said Henderson. "And when you see that type of partnership, you are able to tell your story — what you'll be able to do here, what LexisNexis means, the type of innovation and culture that we're trying to drive. That ties directly to how being on NC State's campus has been a key driver to that growth and that innovation.

"We hire many NC State alums who graduated years ago and coming back to campus, it's like coming home for them." ■

NC State ranked first in the world for computer science education research

NC State has been cited as the number one institution worldwide for computer science education research based on publication data collected between 2015-20 and presented at the 2021 SIGCSE Technical Symposium on Computer Science Education. This ranking was based on factors including publications by institution, participation in doctoral consortia and participation as contributors to computer science education (CSEd).

Computer science education research is not the act of teaching, nor is it educational technology research. As defined by Amy Ko from the University of Washington, Seattle, CSEd research is “the study of how people learn and teach computing, broadly construed.” This includes inventing new ways of learning and teaching computer science.

“CSEd is important because access to high-quality computer science education is an issue of equity. Since practically all work is on computers, and so many decisions are being made by algorithms, every person has a need to understand how computers work, how algorithms and computer programs are made,” said Tiffany Barnes, Distinguished Professor and faculty member in the Center for Educational Informatics.



Tiffany Barnes



Sarah Heckman

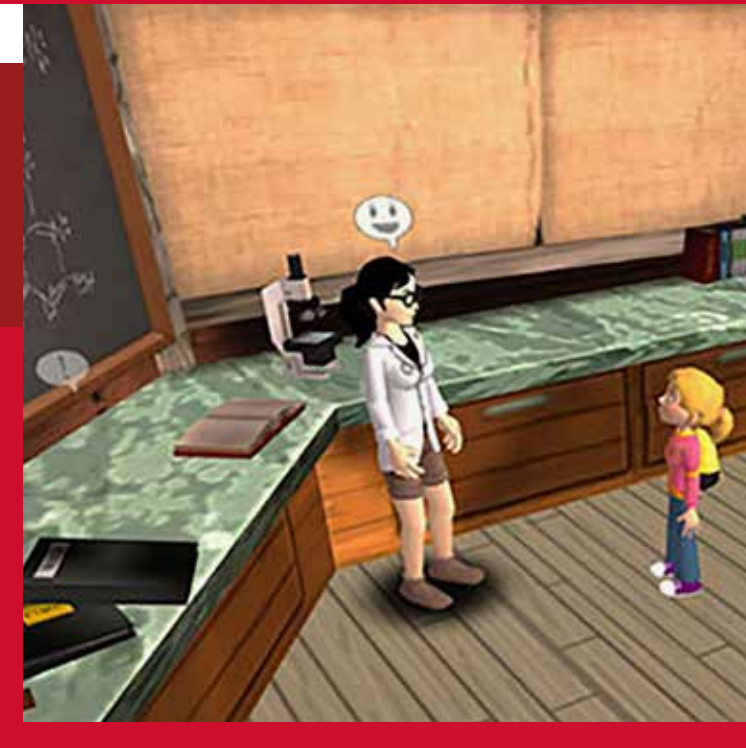
Sarah Heckman, Alumni Distinguished Undergraduate Teaching Professor and director of undergraduate programs, recognizes the importance of CSEd research. “Research in computing education is needed to better understand how to educate computer scientists and software engineers to maintain, create and improve the software systems we use today and need for tomorrow while protecting the security and privacy of the users.” She adds that everyone needs some education in computing to

understand how their data might be used and to establish digital literacy to work and thrive in our modern world.

The faculty of the Department of Computer Science at NC State is working on several noteworthy CSEd research projects. For instance, Collin Lynch, associate professor and faculty member in the Center for Educational Informatics, is currently working on research that “... cuts across areas of study habits, practice and collaboration.” His research studies how students learn through their study habits, seeking help, collaborating with others and evaluating their progress. He adds that his team is also working on a dynamic platform for deliberate practice in CSC courses designed to support students in problem-solving training.

Barnes is also working on a number of CSEd research projects, “We are creating a new class called CS Frontiers that is designed for high school girls to access education about cutting-edge CS concepts including distributed computing, internet of things, machine learning / artificial intelligence and software engineering / games.” She adds that her lab is also working on research to automatically determine when a student may require assistance with a programming assignment and building an adaptive, immediate feedback system to provide students with their progress on their programming assignments.

The paper presented at the 2021 SIGCSE Technical Symposium on Computer Science Education, “Where is Computer Science Education Research Happening?”, analyzed 1,099 publications from 2015 to 2020 that were collected from the Innovation and Technology in Computer Science Education (ITiCSE) and ACM International Computing Education Research (ICER) conferences, and from the ACM Transactions on



Computing Education (TOCE) journal. ITiCSE and ICER are two major international conferences, and TOCE is a leading journal in CSEd. However, the ITiCSE and ACM ICER conferences are not the only conferences where the department’s faculty members publish. They publish papers in many other noteworthy conferences and publications.

From this analysis, researchers found that NC State produced the greatest count of publications, generating 73 CSEd research publications between 2015 and 2020 coming from 32 unique authors. Additionally, NC State was tied for having the second-highest student participation in doctoral consortiums worldwide.

Although the paper was presented at the SIGCSE Technical Symposium, the symposium was not included in the analysis. However, the authors of the paper suggest including it in future research. Notably, NC State has had the most attendees of any institution for the past two years of in-person SIGCSE Technical Symposia. This year, NC State is currently ranked third in attendance at the 2021 SIGCSE Technical Symposium.

“This distinction reflects the dedication of NC State faculty to high-quality computer science education that is driven by data, empirical evidence and research, and our long-standing focus on broadening participation and CS education as valid research areas for computer scientists,” said Barnes. She adds that the faculty at NC State uses innovative methods to effectively teach computer science, improve courses and improve education for teachers and learners.

CENTER PLAYS MAJOR ROLE



James Lester

Some of the faculty members from NC State engaged in CSEd research are members of the Center for Educational Informatics (CEI). CEI consists of 21 total faculty and staff members, as well as 14 affiliated faculty members (across campus) and 45 graduate students in computer science, with additional students across disciplines like art and design. The CEI is a university-wide center that is internationally recognized as a research hub for AI-augmented learning technologies. CEI research spans virtual tutors for learning and teaching, affective computing for interactive learning, intelligent game-based learning environments and more.

James Lester, Distinguished University Professor of Computer Science and director of CEI said, “We are proud of CEI’s role

in computer science education and are delighted to see the impact that we are having at both the national and international levels. Many CEI faculty members are leaders in computer science education research and are at the forefront of efforts to both understand how students learn computer science and how to help K-12 teachers and university faculty members more effectively teach computer science.”

“We apply advanced computing technology to understand how to teach and how students learn. We are a uniquely talented group of people who apply the unique skills of data analysis and system development. CEI is also the largest group of CS faculty members working on computer science for education including CSEd,” said Noboru Matsuda, associate professor and CEI faculty member.

However, it is important to recognize the faculty members who are not members of the CEI, but who are contributing to many of the articles that gave NC State the number one ranking. Heckman is working on innovative CSEd research to identify the most effective ways to help students. “My work is currently focused on help-seeking and how to support interactions between students and teaching assistants ... I’m interested in utilizing data to identify productive and unproductive patterns for completing programming projects. If we can identify unproductive patterns, we might be able to develop interventions to get students the right help at the right time to maximize learning.”

NEXT STEPS

As a growing discipline, new developments are being made globally to better prepare future researchers and teachers in CSEd. Most recently, at NC State, there have been plans to create a K-12 computer science education certification program, promote research-based tools and practices in classrooms and generate identification and intervention efforts for struggling students. Additional plans include broadening participation and diversity and inclusion efforts in CSEd, establishing efforts for teacher preparation and creating cross-institutional working groups.

Barnes acknowledges the significance of the partnerships that NC State maintains. “We would not be able to do all of this without strong partnerships with North Carolina schools and collaboration with the Friday Institute for Educational Innovation. NC State has demonstrated a strong commitment to computer science education and related research through its Digital Transformation of Education cluster within the Chancellor’s Faculty Excellence Program, and through funding the Game-Changing Research and Innovation Program that supported NC State researchers in expanding our efforts to broaden access to computer science education in K-12 in North Carolina.” ■

New course helps Ph.D. students achieve academic vibrancy

The journey toward a Ph.D. in computer science can be a difficult one, full of twists and turns that can be challenging and disheartening even for the most gifted students. Laurie Williams, Distinguished University Professor of Computer Science, observed that the challenges were exacerbated by the COVID-19 crisis, and she decided to take action.

A new CSC course entitled Academic Vibrancy, created and taught by Williams during the fall 2020 semester, is being offered for Ph.D. students. The primary objective of the course is to have students “feel more joy, happiness and peace — so they can be vibrant academics.”

This course is incredibly unique in its nature for the CSC department, but its existence is essential amidst the pandemic. COVID-19 has shown our society the value of science and how important it is to support scientists.

“This fall, I could see my own students really suffering from COVID-19 isolation. I felt like part of my job this fall was to lift them up out of their negative feelings. I assumed they were representative of the students in general. So, one day, I just decided to do something about it,”

Williams said. She proposed the new course to George Rouskas, professor and director of computer science graduate programs, and he said yes. “It was that easy,” said Williams. “I feel blessed to be able to help the students with no hassle to start the class up.”

Academic Vibrancy has 14 scheduled class sessions in which students will meet to discuss topics such as energy, movement and exercise; sleep and daily / circadian rhythms; preventing burnout; and visioning and goal setting. Each of these sessions will include a presentation, a smaller breakout room discussion and a general open discussion with the entire group.

Williams is most excited about being able to help her students. “I love the technical aspects of my job a lot. But, what I really like about my job is to be able to touch people’s lives. I really feel this course has the potential to do just that,” she said. “I feel like COVID-19 has exaggerated the situation, but depression (and even suicide) is higher among Ph.D. students. I am open to keep teaching this class every year if students find it helpful. I am also planning to make a general website to make the information

available more generally outside of just the class.”

Each class will be taught with the course objectives of students having strategies for finding more joy and happiness in their lives, strategies for self-care and strategies for boosting productivity and brain power — practices that Williams herself uses.

“I have long been a student of a lot of the practices I will teach in the class — reading books, going to seminars, listening to podcasts, going on retreats, being part of coaching programs,” said Williams.

The COVID-19 pandemic has created an unprecedented learning experience for all, yet classes such as Academic Vibrancy are a reminder of how important it is to work together.

“(T)he course offers us a way to talk to each other, share our concerns, express how we are managing ourselves in these difficult times — it gives us the opportunity to understand and learn from one another.”

Md Rayhanur Rahman

“Ph.D. students have lots of unique pressures in the best of times. The isolation brought about by COVID-19 has only exacerbated these challenges. I strongly feel that by coming together as a community, our Ph.D. students can learn new personal skills that will help them thrive during these times and beyond,” said Williams.

Md Rayhanur Rahman, a Ph.D. student in the department, is taking the course as a way to connect with other students.

“We are devoid of socialization, sharing, compassion and active involvement with peers ... I took this course to mitigate these adverse effects. As the course offers us a way to talk to each other, share our concerns, express how we are managing ourselves in these difficult times — it gives us the opportunity to understand and learn from one another.”

Another Ph.D. student, Rezvan Mahdavi Hezaveh, has high hopes for this course, “I hope that this course helps me to learn techniques for recovering and maintaining my mental health during this pandemic.”

After their first class meeting, second year Ph.D. student Nusrat Zahan reflected on her positive experience.

“Starting my Ph.D. life as an international student during COVID-19 was hard. In our first class, I shared my challenges with my peers without any particular purpose. Indeed, it was refreshing. From this course, I want to learn how to keep smiling while dealing with my stresses and stay productive.” ■



Labcorp sponsors Leadership in Technology Speaker Series

The Department of Computer Science is pleased to announce that Labcorp has made a multi-year commitment to serve as the sole named sponsor of the department’s popular Leadership in Technology Speaker Series.

The series, sidelined for the last year due to the COVID-19 pandemic, has relaunched for its 14th year as the Labcorp Leadership in Technology Speaker Series in the fall of 2021. The three-year sponsorship commitment runs through the end of the 2023-24 academic year and is expected to feature five to six high-profile technology leaders each year.

Lance Berberian, executive vice president and chief information and technology officer at Labcorp, said, “Labcorp is pleased to support the Leadership in Technology Speaker Series to help promote education and prepare students for careers in technology.”

Gregg Rothermel, professor and head of the Department of Computer Science, commented, “Our world is in a constant and relentless state of technology-driven change, and our graduates are producing technology solutions that are disrupting, revolutionizing and transforming how we

live, work and play. Surviving and thriving in a technology-driven landscape requires a special set of leadership skills, and the speakers in this series supplement what is taught in the classroom, providing depth and richness to the overall academic experience.”

Rothermel added, “Over the years, this series has grown into one of NC State’s premier speaker series, allowing us to give students from all disciplines insight into the unique world of technology leadership. We are so grateful to Labcorp for their generous gift and commitment to helping us reach a new generation of students through this series.”

Speakers for the fall included Mona-Lisa Pinkney, senior director, cybersecurity governance, risk, compliance, engagement and geos at Nike, and Drew Banks, serial entrepreneur, business author, technology blogger and novelist.

The series will take place in room 1231 in Engineering Building II, the home of the Department of Computer Science, on Centennial Campus. Sessions will be free and open to the public. ■

More details about dates, times and speakers will be released at www.csc.ncsu.edu.

Cisco Systems makes major gift in support of department's cybersecurity initiative



Global technology leader Cisco Systems and the Department of Computer Science have enjoyed a deep and sustained partnership over the decades.

The partnership took a giant step forward in 2020 as Cisco made a \$250,000 unrestricted lead gift via the Silicon Valley Community Foundation in support of Laurie Williams and the Secure Computing Institute at NC State. In particular, the unrestricted gift provides foundational funding to support the department's mission to increase its role as a national leader in cybersecurity education and research, which has been forged by Williams, Distinguished University Professor in the department, and fellow CSC faculty members Will Enck, Douglas Reeves and Sarah Heckman.

The Secure Computing Institute (SCI) was founded at NC State in 2019 and is co-led by Williams and Enck, a professor in the department. The goal of the SCI, a key component of the department's overall cybersecurity strategy, is to enhance the security and privacy of computing systems through basic and applied research and advancing and delivering cybersecurity education.

"Our goal with this investment is to ensure that when NC State engineering graduates join the global workforce that cybersecurity is a part of their DNA," said Anthony Grieco, vice president and trust strategy officer for Cisco. "We are honored to help accelerate this important program at NC State, ensuring that the next generation of engineering talent has cybersecurity expertise and is a priority for all engineers."

Williams said the Cisco partnership and the significant support the company has provided are helping bootstrap the department's efforts to make some very strategic hires.

"The funding allows us to move forward with hiring the core talent to help us launch a new undergraduate cybersecurity concentration, develop an extensive community of practice, and establish a comprehensive, self-sustaining financial model for the future," Williams said. "We are so very thankful to Cisco for their ongoing partnership and in particular, their commitment to helping us strengthen our position of leadership in the cybersecurity space."

As a tangible result of the support, the department recently hired Thierry Wandji Ketchiozo as its first director of cybersecurity education. Ketchiozo, a cybersecurity pioneer with more than 15

years of front-line national security experience, now leads the department's efforts to train the next generation of engineers and computer scientists who will continue the work protecting critical systems from dangerous attacks. The department is currently in the process of hiring a director of cybersecurity practice.

Cisco's partnership will help the department continue its efforts in recent years to build off a strong foundation in cybersecurity education and research and to become a global leader in the space.

The SCI has pulled together much of the work and funding already in place within the department and other parts of the University, Enck said. "Our Science of Security Label has brought in more than \$19 million in research since it was established in 2012," he added. "We established a master's track in security in 2017 and an undergraduate track in 2019, and we launched a new undergraduate concentration in spring 2021." The department plans to soon propose to University officials a master's degree in cybersecurity.

In 2019, Reeves, professor emeritus, and Heckman, Alumni Distinguished Undergraduate Professor, helped secure a \$2.75 million award from the National Science Foundation to launch a CyberCorps Scholarships for Service program. Five scholarships will be awarded annually to graduate and undergraduate students specializing in cybersecurity. In addition to full tuition, the two-year scholarships provide a generous stipend, health insurance and an allowance for other professional expenses. In return, students agree to work after graduation with a federal, executive-branch government agency for an equal period of time.

Ken Tate, director of engagement and external relations, said that the Cisco gift is another example of the department's strong commitment to partnering with industry. "As a founding Super ePartner with the department, Cisco has played a key role over the years in helping provide not only financial support, but incredible industry perspective and guidance that has helped shape and evolve our educational curriculum," he said. "We owe a huge debt of gratitude to Cisco for the historical impact they have had on our department, our faculty and staff, and our students." ■

For more information on partnering with the department on this or other initiatives, contact **Ken Tate** at kmtate2@ncsu.edu.

Community and computer science: coming together during COVID-19

All around the world, there are inspirational stories of people supporting each other during a tough period dealing with the COVID-19 pandemic. One such story is the success of high school student interns and researchers from NC State who came together during summer 2020 to create lessons for middle school and high school teachers during the Game2Learn Computer Science High School Intern Program.

The Game2Learn Computer Science High School Internship is a relatively new internship program that connects high school students from around the country with an interest in computer science with researchers in the NC State Game2Learn Lab and teachers from North Carolina, Tennessee and South Carolina. The program is run by Veronica Cateté, research scientist at NC State, and graduate student Amy Isvik.

In summer 2020, Game2Learn had 30 interns, and 75 percent of them were girls. Alongside Game2Learn researchers from NC State, these students worked on coding software projects for teachers that creatively combined programming and academic lessons into fun and interactive projects. For example, two interns programmed a game that provides students with an engaging way to practice their fundamental mathematical concepts. Another intern created a project that allows students to learn more about planets in the solar system through interacting with 3-D representations of the planets. Be sure to check out the Snap! project repository which includes most of the projects that the interns made during the program: go.ncsu.edu/2020internsnapprojects.

Through their internship experience, these 30 student interns were able to further develop their understanding of computer science while gaining extra technical software engineering skills as they built over 90 computing infused lessons. They were given the opportunity to work with members of the CSC department and researchers and collaborative partners from other states. Additionally, the interns also worked collaboratively with the 162 teachers attending the virtual Infusing Computing PD (infusingcomputing.com) as both teaching assistants during the Coding boot camps and as developer support during the Create sessions, aiding teachers in creating their own custom assignments.

"Our internship program is really great, not just because it helps our own team support ongoing projects, but because

"Our internship program is really great, not just because it helps our own team support ongoing projects, but because it provides something really valuable to the interns, to teachers and our community."

VERONICA CATETÉ

it provides something really valuable to the interns, to teachers and our community," said Cateté.

Because of COVID-19, many school systems decided that instruction would be held remotely for much of 2020-21 school year. This new, online format of schooling has proven to be quite difficult. Without in-person contact, it's not always easy to keep students engaged and to ensure that they do not fall behind. However, with the help of the interactive lessons created by these interns, hundreds of teachers will be able to use them as a resource to teach their students in a fun and engaging way.

The impact and success of the Game2Learn Computer Science High School Internship program represents the importance of working together as a community and advancing underrepresented groups in computer science.

According to Cateté, "Research has shown that women prefer to work in careers that are perceived as being helpful to people and society — computer science often gets a bad rap because not many people know what it actually entails. Our program specifically focuses on the socially relevant applications of computing such as education and science. Interns get to make really cool projects that go directly into the hands of teachers and classrooms. We've created a sustainable model for educational engagement within a community between students and teachers that can spur more computing being introduced into K-12 classrooms increasing the number of students entering and being retained in the pipeline. Furthermore, our program specifically encourages juniors and seniors to apply, as that is when they are making decisions about which colleges to attend.

"Thanks to our program, several of our female alumni have made the decision to join the College of Engineering (computer science intended) and are now participating in student organizations like STARS and WiCS, which aim to help support broadening participation in computing." ■

Robots in the air and on the water could improve shellfish farming



Aquaculture is the world's fastest-growing animal-protein production sector, and the use of robots in many industries is growing quickly. At NC State, researchers are building on these trends to increase marine aquaculture yields, ensure food safety and decrease the pressure to harvest wild seafood.

It's a step that could help North Carolina on its way to a proposed goal of growing shellfish farming into a \$100-million-a-year industry by 2030.

The researchers plan to use small fleets of unmanned vehicles on the water and in the air to work together to monitor water quality in areas difficult to access, helping improve oyster production near the state's coastline.

Sierra Young, an assistant professor in the Department of Biological and Agricultural Engineering (BAE), is the project's principal investigator. Collaborators include BAE's Steven Hall, Natalie Nelson and Celso Castro-Bolinaga, as well as John-Paul Ore from the Department of Computer Science.

The four-year project was funded by a \$1 million grant from the U.S. Department of Agriculture's National Institute for Food and Agriculture through the multiagency National Robotics Initiative 2.0.

The team is focusing on water quality because it has important implications for the safety of consumers' food and for producers' profitability.

Bacteria and other pollutants carried by storm water into the ocean can cause nearshore producers to halt their harvests until the bacteria reach safe levels. These closures are estimated to cost producers 25 percent of their average annual income.

As Young explained, "We hope to automate water testing and sample collection by creating a data-driven process that makes the window (of closure) as small as it needs to be."

The researchers plan to develop computer models that let

them know which areas of an operation are most likely to become bacterial hotspots.

Within those hotspots, the robots will use sensor probes to measure conditions, and they'll take samples that can be returned for laboratory analysis.

"We're looking to not just have robots that autonomously monitor the same area over and over," Young said, "but we are integrating that water quality modeling with robot path planning to direct the robots to the most important and informative areas within a shellfish growing area.

"The idea is to get the most value out of a single deployment, especially when the number of water samples the robots can take is limited," she said.

The researchers will also be looking at ways they can have unmanned surface vehicles (USVs) moving along the water communicate and work with unmanned aerial vehicles (UAVs), or drones. UAVs could scout areas and let the USVs know where conditions might be unsafe to enter, and the USVs could be used as landing and docking stations for the UAVs to expand the survey area.

The researchers plan to initially test their system in local lakes and ponds, at NC State and at the university's Marine Aquaculture Research Center in Carteret County. Full-scale testing will also occur in commercial oyster-growing areas.

"We're designing our autonomous robot fleet to generate water quality data not only to inform management decisions in real-time but also to improve bacteria load forecasts and predictions," Young said. "Our long-term goal is to get this information — and ultimately these robotic tools — in the hands of growers to help mitigate production and income loss due to shellfish mortality and unanticipated closures." ■

Four new members named to Strategic Advisory Board

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

- **Dave Gill:** Executive director, global information security officer at PRA Health Sciences
- **Steve Grobman*:** Senior vice president and chief technology officer at McAfee
- **Beth Smith*:** GM, IBM Watson AI at IBM
- **Kamala Subramaniam*:** Engineering leader at Google

**NC State alumni*

The SAB, a group of industry executives and academic leaders who provide the foundation for the department's strategic planning efforts, meets annually on campus and acts as a virtual working team through member involvement on subcommittees, executive panels and other engagement opportunities. Each term with the SAB is three years in length, and membership may be renewed for a second term.

"Even during a global pandemic, and perhaps especially during this period, we find ourselves facing strategic decisions that will impact the department for decades to come," said Gregg Rothermel, professor and department head. "We depend greatly on our SAB to provide industry-specific guidance and direction that helps us ensure that our strategic plans are well aligned with industry needs, and ensures that we can continue to play a significant role in providing the talent and research that fuels the economy of North Carolina and beyond. These new additions to the board bring tremendous experience and wisdom that will benefit us greatly on our journey."

The SAB is currently chaired by Tracy Doaks, who was recently appointed president and CEO of MCNC. Kim Calhoun, founder and CEO of Guardianator and senior executive producer of MoneyMasters.TV, is the current vice chairperson. ■

Machine learning predicts how long museum visitors will engage with exhibits

In a proof-of-concept study, researchers have demonstrated the use of a machine-learning model to predict how long individual museum visitors will engage with a given exhibit. The finding opens the door to a host of new work on improving user engagement with informal learning tools.

"The amount of time people spend engaging with an exhibit is used as a proxy for engagement and helps us assess the quality of learning experiences in a museum setting," said Jonathan Rowe, co-author of the study and a research scientist in NC State's Center for Educational Informatics (CEI).

"If we can determine how long people will spend at an exhibit, or when an exhibit begins to lose their attention, we can use that information to develop and implement adaptive exhibits that respond to user behavior in order to keep visitors engaged," said Andrew Emerson, first author of the study and a Ph.D. student at NC State.

"We could also feed relevant data to museum staff on what is working and what people aren't responding to," Rowe said.

To determine how machine-learning programs might be able to predict user interaction times, the researchers collected data — facial expressions, posture, where they looked on the exhibit's



screen and which parts of the screen they touched — from 85 museum visitors as they engaged with an interactive exhibit on environmental science.

The data were fed into five different machine-learning models to determine which combinations of data and models resulted in the most accurate predictions.

"We found that a particular machine-learning method called 'random forests' worked quite well, even using only posture and facial expression data," Emerson said.

The paper was co-authored by Nathan Henderson, a Ph.D. student at NC State; Wookhee Min and Seung Lee, research scientists in CEI; James Minogue, an associate professor of teacher education and learning sciences at NC State; and James Lester, Distinguished University Professor of Computer Science and the director of CEI.

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

The Legend of the Silver Bullet Award

Stories of the legendary Silver Bullet Award have circulated within the walls of the Department of Computer Science at NC State for many years. But like Bigfoot, leprechauns and other mythical creatures, we have been left to wonder if the legend was real. Until now.

For decades, retired professor and department icon Tom Honeycutt has quietly recognized exceptional students, alumni and colleagues with this unique symbol of his ultimate respect.

Honeycutt commissioned a local jeweler to create the custom silver bullet jewelry piece almost three decades ago. The mold sits patiently until he orders up a new silver bullet, finely crafted as a unique symbol of excellence.

Why a silver bullet? Honeycutt said it is partly a tip of the hat to the Lone Ranger (whom he called the 'Long Ranger' as a small boy), who used silver bullets as his calling card and a symbol of justice. And silver bullets are thought to fly straighter and are more accurate. He also noted that the 'silver bullet' idiom refers to something that provides an immediate solution to an extremely difficult problem. But the concept for the award was inspired by a software engineering paper entitled "No Silver Bullet — Essence and Accident in Software Engineering" written by Turing Award winner Fred Brooks. In the paper, Brooks argues that all software development is made up of essential and accidental tasks, with most of the huge productivity gains coming from the removal of artificial barriers that have made accidental tasks inordinately difficult. He argues more focus should be placed on essential tasks, and identifying and developing the great conceptual designers of the future.

"The Silver Bullet Award is only given to those who exemplify acuity for quality management in their personal lives," Honeycutt said. The standard is captured in a quote by influential British-American architect and design theorist, Christopher Alexander.

"There is a central quality which is the root of life and spirit in a man, a town, a building, or a wilderness. This quality is objective and precise, but it cannot be named. The search which we make for this Quality, in our own lives is the central search for any person, and the crux of any individual person's story."

So far, Honeycutt has given out 21 awards, which he pays for out of his own pocket. The initial award was given in the mid-90s and cost approximately \$50 to craft, while the most recent ones have run in excess of \$200 each.



Joyce Hatch, now retired from her role as director of undergraduate advising for the department, was the first recipient. This department icon is widely revered for having taken in over 30 computer science students over the years to live with her and her husband when they had nowhere else to go. She remains as humbled by the award today as when it was given to her over 25 years ago. "Tom Honeycutt gave me the undergraduate academic advising job, which was truly the best job I ever had," said Hatch. "He's still one of my best friends after all these years. We talk by phone several times a week."

Not all of the winners are from the CSC department. John Baines, assistant director of the security & compliance unit in NC State's Office of IT, was the fifth recipient. He worked with Honeycutt to convert his Knowledge Information Management (KIM) concepts into a commercial venture. "I wrote a chapter for Tom's KEO book about the validity of KIM in these times of exponential changes. This was about the time of the dot-com bubble burst. Although that crisis should have given more credence to the use of KIM in business, the resulting stock market crash left us all breathless. I still believe in the validity of Tom's approach to KIM. I was surprised, but gratified by my Silver Bullet Award," Baines explained.

Number 11 on the list is Beatrice Le Pechoux, who was given a Silver Bullet after working with Honeycutt on his KEO book, during a period that was almost a blur as she was also working on her Ph.D. She recalled countless early morning conversations over coffee at the Cup A Joe on Hillsborough Street. Le Pechoux said, "He was able to get a lot out of us, in a good way. He certainly knows how to fan the flames of creativity through dialogue and exchange of ideas."

Former student and recipient number 14, Kanchana Padmanabhan, said, "Dr. Tom loves out-of-the-box thinking and encourages students to find their own way to interpret things. He is also always kind and helpful to everyone. For me, getting an award from him meant that I had in some way checked one or more of these boxes."

Other known recipients of the award include Rebecca Soper, Bill Waters, Doug Champion, Marshall Brain, Tommy Vitolo, Brian Patrick Donovan, Gary Williams, Jesse Johnson, Jim Bender, Tony Barr, Paul Bigelow, Myra Frank, Moncef Slaoui and Robert Benjamin.

Will he continue the tradition, now that he is retired? "Absolutely," Honeycutt said. "When I see a deserving person, I will recognize them." In fact, he recently notified Ken Tate, the department's director of engagement and external relations (and

author of this story), that he would be receiving Silver Bullet number 19. "Ken, you have earned it. Your efforts for CSC are well beyond all expectations, and you did it all with a clear heart. You are the invisible hand that made our department shine with honesty and integrity beyond the call of duty without personal gain."

Tate said, "I am sure that I speak for every recipient of a Silver Bullet Award when I say I am truly humbled and honored to be recognized by Dr. Honeycutt, an admired and beloved department icon."

So, the hunt for Bigfoot, leprechauns and fire-breathing dragons may continue, but we now know that the legend of the Silver Bullet Award is true. Congratulations to all the recipients and a special thank you to Honeycutt for his efforts to quietly and selflessly recognize excellence in this world. ■

Software spots and fixes hang bugs in seconds, rather than weeks

Hang bugs — when software gets stuck, but doesn't crash — can frustrate both users and programmers, taking weeks for companies to identify and fix. Now researchers from CSC have developed software that can spot and fix the problems in seconds.

"Many of us have experience with hang bugs — think of a time when you were on website and the wheel just kept spinning and spinning," said Helen Gu, co-author of a paper on the work and a professor of computer science at NC State. "Because these bugs don't crash the program, they're hard to detect. But they can frustrate or drive away customers and hurt a company's bottom line."

With that in mind, Gu and her collaborators developed an automated program, called HangFix, that can detect hang bugs, diagnose the relevant problem and apply a patch that corrects the root cause of the error. Video of Gu discussing the program can be viewed at bit.ly/3tcxUqq.

The researchers tested a prototype of HangFix against 42 real-world hang bugs in 10 commonly used cloud server applications. The bugs were drawn from a database of hang bugs that programmers discovered affecting various websites. HangFix fixed 40 of the bugs in seconds.



"The remaining two bugs were identified and partially fixed, but required additional input from programmers who had relevant domain knowledge of the application," Gu said.

For comparison, it took weeks or months to detect, diagnose and fix those hang bugs when they were first discovered.

"We're optimistic that this tool will make hang bugs less common — and websites less frustrating for many users," Gu said. "We are working to integrate Hangfix into InsightFinder." InsightFinder is the AI-based IT operations and analytics startup founded by Gu.

The paper was co-authored by Jingzhu He, who recently graduated with her Ph.D. from NC State; Ting Dai, a Ph.D. graduate of NC State who is now at IBM Research; and Guoliang Jin, an assistant professor of computer science at NC State. The work was done with support from the National Science Foundation. ■



Study reveals extent of privacy vulnerabilities with Amazon's Alexa

A recent study outlines a range of privacy concerns related to the programs that users interact with when using

Amazon's voice-activated assistant, Alexa. Issues range from misleading privacy policies to the ability of third-parties to change the code of their programs after receiving Amazon approval.

"When people use Alexa to play games or seek information, they often think they're interacting only with Amazon," said Anupam Das, co-author of the paper and an assistant professor of computer science at NC State. "But a lot of the applications they are interacting with were created by third parties, and we've identified several flaws in the current vetting process that could allow those third parties to gain access to users' personal or private information."

At issue are the programs that run on Alexa, allowing users to do everything from listen to music to order groceries. These programs, which are roughly equivalent to the apps on a smartphone, are called skills. Amazon has sold at least 100 million Alexa devices (and possibly twice that many), and there are more than 100,000 skills for users to choose from. Because the majority of these skills are created by third-party developers, and Alexa is used in homes, researchers wanted to learn more about potential security and privacy concerns.

With that goal in mind, the researchers used an automated program to collect 90,194 unique skills found in seven different skill stores. The research team also developed an automated review process that provided a detailed analysis of each skill.

One problem the researchers noted was that the skill stores display the developer responsible for publishing the skill. This is a problem because Amazon does not verify that the name is correct. In other words, a developer can claim to be anyone. This would make it easy for an attacker to register under the name of a more trustworthy organization. That, in turn, could fool users into thinking the skill was published by the trustworthy organization, facilitating phishing attacks.

The researchers also found that Amazon allows multiple skills to use the same invocation phrase.

"This is problematic because, if you think you are activating one skill, but are actually activating another, this creates the risk that you will share information with a developer that you did not intend to share information with," Das said. "For example, some skills require linking to a third-party account, such as an email, banking, or social media account. This could pose a significant privacy or security risk to users."

In addition, the researchers demonstrated that developers can change the code on the back end of skills after the skill has been placed in stores. Specifically, the researchers published a skill and then modified the code to request additional information from users after the skill was approved by Amazon.

"We were not engaged in malicious behavior, but our demonstration shows that there aren't enough controls in place to prevent this vulnerability from being abused," Das said.

Amazon does have some privacy protections in place, including explicit requirements related to eight types of personal data — including location data, full names and phone numbers. One of those requirements is that any skills requesting this data must have a publicly available privacy policy in place explaining why the skill wants that data and how the skill will use the data.

But the researchers found that 23.3 percent of 1,146 skills that requested access to privacy-sensitive data either didn't have privacy policies or their privacy policies were misleading or incomplete. For example, some requested private information even though their privacy policies stated they were not requesting private information.

The researchers also outline a host of recommendations for how to make Alexa more secure and empower users to make more informed decisions about their privacy. For example, the researchers encourage Amazon to validate the identity of skill developers and to use visual or audio cues to let users know when they are using skills that were not developed by Amazon itself.

The paper was co-authored by Sheel Jayesh Shah, who received his M.S. in 2021 from NC State, and William Enck, an associate professor in the department. The work was done with support from the National Science Foundation, and from the German state of North Rhine-Westphalia. ■



Without question, COVID-19 has changed many aspects of our personal and professional lives in dramatic ways. And now that many fears, norms and misconceptions have been shattered, the new normal that we return to in the future may look quite different for many of us.

The process that employers use to identify and recruit talent is no exception.

While the traditional student recruitment process has certainly taken advantage of technology enhancements over the years, many employers continued to rely heavily on 'in person' student engagements at career fairs and special recruiting events in order to identify potential candidates to meet their hiring needs. The department's annual ePartners Career Connection event is a great example of a traditional job fair with expo-style booths, recruiters, hundreds of students and some very long lines. Plans for this traditional in-person recruiting event were in place for September 14, 2020.

COVID-19 stopped those plans in their tracks.

Despite the initial plans to bring students back on campus in fall 2020, the department made the decision over the summer to shift from an "in person" career fair to a virtual ePartners Career Connection. In conjunction with several other groups on campus and after a thorough review of options, the decision was made to host all virtual career fairs at NC State on the new Career Fair Plus technology platform.

A total of 29 companies participated in the virtual 2020 ePartners Career Connection event on September 14, conducting 1,552 interviews during a four-hour period. Most employers chose standardized 10-minute interview slots, and students could select open slots with specific recruiters for select roles, if they met all of the applicant requirements. Approximately 700 CSC students participated in the event, filling 75 percent of the available interview slots.

Feedback from recruiters and students has been overwhelmingly positive.

According to Leslie Rand-Pickett, director of graduate career services for the department and key organizer of the event,

companies touted a number of positive aspects related to the virtual event. "Recruiters enjoyed the focus and attention they were able to give students during interviews, something that is very difficult in a loud environment when there are other students packed around waiting their turn."

In addition to the obvious benefits of reduced travel expenses, Rand-Pickett said the structure of the event made it easy for more hiring managers to participate, and even pop in and out of the event based on their work schedule, something that is typically not practical during a traditional job fair.

"Despite a few firewall- and VPN-related issues that we quickly worked through, companies found the technology underlying the event to be easy and intuitive to use," she said. Rand-Pickett added that most of the companies responding to the survey said they found the virtual events to be every bit as effective as in-person events, and they'd continue to participate in them in the future.

Students were just as complimentary, and most strongly preferred the virtual career fair to in-person events.

CSC junior Manali Shirsekar noted that the virtual event was far less stressful than the normal career fair. "Last year, I skipped a couple classes to attend, stood in line for at least three hours, and the rooms were incredibly hot, humid and loud," she said. "It was much easier to collect my thoughts and prepare myself to speak with a recruiter at home both physically and mentally."

Drew Hughlett, also a CSC junior, liked the flexibility provided by the virtual format. "More than once, I have had to cut my time short at in-person career fairs because of classes, exams or assignments," Hughlett said. "With the ability to select 10-minute slots ahead of time, I was able to balance my academic requirements and still be able to meet with the companies that I wanted to."

Will virtual career fairs completely replace traditional in-person events? Time will tell. But based on corporate and student feedback, it is highly likely that virtual career events will become a part of the new normal in a post-COVID-19 world. ■

Five inducted into the 2020 CSC Alumni Hall of Fame



Kevin Clark



Loren Harrell



Nachiappan Nagappan



Beth Smith



Tommy Vitolo

Five outstanding new members have been added to the NC State Computer Science Alumni Hall of Fame.

The CSC Alumni Hall of Fame was established in 2017 to celebrate and recognize the exemplary contributions that the department's 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 47.

Award winners are presented 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 by visiting ncsucsc.touchpros.com.

The 2020 inductees into the NC State Computer Science Alumni Hall of Fame include:

- **Kevin Clark** (B.S. '89, M.S. '91) – Professor and director of the Center for Digital Media Innovation and Diversity, George Mason University, and director – Original Animation, Preschool at Netflix
- **Loren Harrell** (B.S. '72) – Co-founder, MemberHub, Inc.
- **Nachiappan Nagappan** (M.S. '02, Ph.D. '05) – Software engineer, Facebook
- **Beth Smith** (B.S. '87) – General manager, Watson AI, IBM
- **Tommy Vitolo** (B.S. '99) – Senior associate, Synapse Energy Economics and state representative in the Massachusetts House of Representatives

Gregg Rothermel, CSC department head and professor, extended his congratulations to the latest group of inductees. Rothermel said, "It is most unfortunate that COVID-19 has robbed us of the pleasure of celebrating in person this fall with this outstanding group of computer science alumni. But celebrate, we will, when we can gather safely. This impressive group serves as an inspiration for us all — faculty members, staff and students."

Ken Tate, director of engagement and external relations, said, "This group truly represents a broad spectrum of achievement, from entrepreneurs to executive leadership to researchers to a politician, this is yet another group of NC State computer science alumni who have left their mark on this world in a socially relevant way."

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

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

CSC graduate awarded Marshall Scholarship

Colton Botta, a 2019 computer science B.S. graduate, has been awarded the 2021 Marshall Scholarship.

Botta was one of only 46 winners selected from an applicant pool of more than 1,190 to receive this scholarship. Founded in 1953, the Marshall Scholarship Program began as a gesture of gratitude for the assistance provided by the United States to the UK under the Marshall Plan. Since its founding, there have been more than 2,100 scholarships awarded. Former Marshall Scholars include Academy Award nominees, Pulitzer Prize winners, Supreme Court justices, a Nobel laureate and a NASA astronaut.

This renowned program is funded by the British government and allows American students to pursue graduate study of their academic subject of choice at a top university in the UK for up to three years. Winners are selected based on criteria of academic merit, leadership potential and ambassadorial potential.

Botta plans to pursue a master's in cognitive science at the University of Edinburgh in fall 2021, then pursue a master's in education and technology at the University College London in fall 2022.

Botta majored in computer science with a minor in business entrepreneurship at NC State, where he was involved in the University Honors Program, undergraduate research, the Computer Science Student Ambassadors program and graduated as a class valedictorian. He is credited as the second author of the paper, entitled "Here We Go Again: Why Is It Difficult for Developers to Learn Another Programming Language?" that was published at the 2020 International Conference on Software Engineering. Botta also spent four semesters as a teaching assistant in the department, which sparked his passion for education and a lifelong love of teaching. After his time in the UK, he plans to pursue a Ph.D. in computer science education before seeking a faculty role at a research institution.

Dame Karen Pierce, British ambassador to the United States, said the class of 2021 Marshall Scholars is "one of the most diverse and inclusive in the programme's history." Additionally, Christopher Fisher, chair of the Marshall Commission, said



Colton Botta

"I am going to use the Marshall Scholarship to push the boundaries of what technology can do for education. I will examine two key areas: how students learn and how technology can model, influence and even supplement this learning process."

COLTON BOTTA

this class consists of "scholars continuing to search for a better understanding of today's world and how best to meet tomorrow's challenges."

"I am going to use the Marshall Scholarship to push the boundaries of what technology can do for education," said Botta. "I will examine two key areas: how students learn and how technology can model, influence and even supplement this learning process. My dream is to lead a research group that investigates how artificial intelligence can individualize how we learn, allowing every student to learn in a way that suits their own needs." ■

Department honors two alumni with 2020 Rising Star Award



Angie Jones



Ravi MuthuKrishnan

The department selected Angie Jones and Ravi MuthuKrishnan as recipients of its Rising Star Award for 2020.

The CSC Alumni Rising Star Award (previously known as the CSC Outstanding Young Alumni Award) was established in 2017 as part of the department's 50th Year Celebrations to celebrate and recognize the exemplary contributions our outstanding graduates have made to their profession, their community and the world at large. In particular, the Rising Star Award recognizes alumni within 10 years of graduation, an honor reserved to recognize alumni for early-stage career accomplishments. To date, the department has recognized a total of 13 "Rising Stars."

Honorees 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 2020 CSC alumni Rising Star winners are:

Angie Jones — Jones is a 2010 M.S. graduate of the department and currently serves as a senior developer advocate with Applitools, where she specializes in test automation strategies and techniques.

She shares her wealth of knowledge around the world as an international keynote speaker who has spoken at more than 150 software development conferences in 18 countries. She is a certified Java programmer and teaches free online software development courses for engineers via the online learning platform Test Automation University.

Recognized as a "Master Inventor" while working at IBM early in her career, Jones is known for her innovative and out-of-the-box thinking style, which has resulted in more than 25 patented inventions in the U.S. and China in the areas of collaboration software, social networking, virtual worlds, smarter

planet and software development processes. While working as a software engineer, she also served as an adjunct professor in the Department of Computer Science at Durham Technical Community College teaching the next generation of software engineers.

Jones was featured in *Ebony* magazine as one of the country's "30 Young Leaders Under the Age of 30," by *Women of Color* magazine as a "Technology Rising Star," by *Triangle Times* as a "Mover and Shaker in the IBM Corporation," and by *Spectacular* magazine as the "Future of Tech in the Triangle." In 2020, she was named a Java Champion — one of only about 300 in the world, and the first Black woman to be so honored.

Jones is committed to mentoring young women and exposing them to technology. In her spare time, she runs an online community, Diva Chix, where teenage girls and women learn to excel in technological areas as well as learn other key life lessons such as running a business and working as a team, all within the realm of a game. She also volunteers with Black Girls Code to teach coding workshops to young girls in an effort to attract more women and minorities to tech.

Jones is frequently featured in online publications, podcasts and magazines. Learn more by visiting angiejones.tech/featured.

Ravi MuthuKrishnan — MuthuKrishnan is a 2011 M.S. graduate of the department and currently serves as the product security lead at Visa, Inc., where he leads security architecture for Visa Digital Products and Emerging Technologies. Previously, he has worked in the CTO office at IBM Security and at e-commerce companies such as eBay, PayPal and HP.

MuthuKrishnan is a master innovator with more than 35 information and payment security patents and more than a

dozen publications to his credit, research published with more than 150 citations (with an h-index of 6, i-10 index of 4), and one of the youngest internal patent review board members judging patent submissions at IBM.

He is a recognized expert and leading voice in product and application security, cloud security and risk management. He has been an invited speaker at major security industry conferences around the world, including RSA Asia Pacific, OWASP LasCon USA, European Identity and Cloud Conference, IDG Security World South Korea and more.

MuthuKrishnan has been named a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and Information Systems Security Association (ISSA), which only 10 percent of members achieve, reflecting professional accomplishment and maturity.

He serves as an editorial advisory board member and judge for a number of top journals and awards such as The Journal of Cybersecurity and Mobility, The International Systems Security Association Journal, The Journal of Information System Security and conference program and Cloud Security Alliance SECtember 2020.

He holds a number of special awards including the Visa Go Beyond Award, the IBM Fifth Plateau Invention Achievement Award, the IBM Security App Exchange Contest — Eminence and Excellence Award and the IBM Technical Rock Star for Cloud Award.

CSC Department Head and Professor Gregg Rothermel offered his congratulations to the honorees, saying, "Angie and Ravi are excellent examples of the incredible early career impact our graduates are capable of making when they apply their degrees with a passion. They can truly change the world."

Ken Tate, director of engagement and external relations, said, "It gets harder and harder to make these selections each year as the accomplishments are so incredible. Angie and Ravi are truly outstanding examples of achievement and I know they will serve as an inspiration to our current students."

To nominate someone for future consideration as a member of the CSC Alumni Hall of Fame or for the Rising Star Award, please visit the CSC Alumni Hall of Fame page at www.csc.ncsu.edu/alumni/hall-of-fame.php. ■

Alumnus' paper wins Blue Sky Award at AAMAS 2020

A paper written by team of researchers from NC State and the Delft University of Technology has won the Blue Sky Award in the Blue Sky Track of the 19th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2020) held in Auckland, New Zealand in 2020.

The paper's authors are NC State computer science Ph.D. graduate Pradeep Murukannaiah (currently an assistant professor at the Delft University of Technology in the Netherlands); Nirav Ajmeri, a postdoctoral research scholar in the department; Catholijn Jonker, a professor at Delft University of Technology; and Munindar Singh, Alumni Distinguished Graduate Professor of Computer Science at NC State.

The award was sponsored by the Computing Community Consortium (CCC), a part of the Computing Research Association. The CCC's mission is to catalyze the computing research community, enabling the pursuit of innovative, high-impact research.

The winning paper is "New Foundations of Ethical Multiagent Systems." The abstract follows:

"Ethics is inherently a multiagent concern. However, research on AI ethics today is dominated by work on individual agents: (1) how an autonomous robot or car may harm or (differentially)

benefit people in hypothetical situations (the so-called trolley problems) and (2) how a machine learning algorithm may produce biased decisions or recommendations. The societal framework is largely omitted. To develop new foundations for ethics in AI, we adopt a sociotechnical stance in which agents (as technical entities) help autonomous social entities or principals (people and organizations). This multiagent conception of a sociotechnical system (STS) captures how ethical concerns arise in the mutual interactions of multiple stakeholders. These foundations would enable us to realize ethical STSs that incorporate social and technical controls to respect stated ethical postures of the agents in the STSs. The envisioned foundations require new thinking, along two broad themes, on how to realize (1) an STS that reflects its stakeholders' values and (2) individual agents that function effectively in such an STS."

To read the winning paper, visit bit.ly/3jT0pmd.

AAMAS is the leading scientific conference for research in autonomous agents and multi-agent systems. The Blue Sky track emphasizes visionary ideas, long-term challenges, new research opportunities and controversial debate. It serves as an incubator for innovative, risky and provocative ideas. ■



Alexandros Kapravelos



Christopher Parnin



Ruozhou Yu

THREE FACULTY MEMBERS WIN NATIONAL SCIENCE FOUNDATION CAREER AWARDS

Alexandros Kapravelos, Christopher Parnin and Ruozhou Yu, all assistant professors in the Department of Computer Science at NC State, have each received a Faculty Early Career Development award, also known as the CAREER Award, from the National Science Foundation (NSF). The award is one of the highest honors given by NSF to young faculty members in science and engineering.

Kapravelos will receive \$561,188 for his project, “Web Evolution and Emerging Threats.” His research objective is to build the fundamental blocks for studying the increasingly complex web by developing a new approach to monitoring modern web browsers and assessing current and emerging web attack threats.

As part of the project, he will build abstract models that characterize the behavior of modern web applications and then use those models to identify current and emerging threats to the privacy and security of web users. Kapravelos’ project will also include an interactive and publicly available portal that any researcher, web developer or web user can use to understand what browser features are used when they visit a website.

Kapravelos received his Ph.D. in computer science from University of California, Santa Barbara in 2015. His research interests include systems and software security and internet privacy.

NSF will provide Parnin \$555,882 for his project, “Understanding and Supporting Programmer Cognition.” His goal

is to first better understand programmer cognition, and then to develop tools that more effectively support programmers who are working with complex code and acquiring expertise.

Parnin will develop a methodology to conduct a series of brain-imaging studies to obtain brain-activation contrasts between an experimental comprehension task and a control task, as well as to identify brain regions associated with programmer expertise. The results from this study will help explain the neural mechanics of cognition in programming and lead to better strategies and training techniques. A better understanding of programmer cognition will also help reduce frustration for people just starting to learn programming, as well as develop unique support for neuro-diverse people.

Parnin earned his Ph.D. in computer science from Georgia Institute of Technology in 2014. His research interests include using empirical, hci and cognitive neuroscience perspectives to study software engineering, as well as crowd programming alternative coding interfaces, brains and bio-sensing and dev ops.

Yu will receive \$505,702 for his project, “WolfPack: An Application-Network Co-Design Framework for Performance-Guaranteed Real-time Applications at the Network Edge.” The project aims to co-design the provisioning of both computing and network resources in edge computing, to provide end-to-end performance guarantee for a wide range of applications and edge network scenarios under a general optimization framework named the WolfPack.

The overall results from the project will help improve and empower life-changing real-time applications, including

autonomous driving, smart city and connected industry. The research will contribute to core knowledge of edge resource management and performance guarantee, as well as packing/covering optimization, truthful mechanism design and optimization-based system design. Yu also aims to integrate the research with undergraduate and graduate education, the promotion of STEM research for K-12 students and increased involvement of women and underrepresented students in STEM.

Yu received his Ph.D. in computer science in 2019 from Arizona State University. His research interests include algorithms and theory of computation, cloud computing, cybersecurity, embedded and real-time systems, networking and performance evaluation and parallel and distributed systems.



Lina Battestilli

BATTESTILLI RECEIVES NUMEROUS DEPARTMENT, UNIVERSITY AWARDS

Lina Battestilli, teaching associate professor, received multiple awards from the CSC department and NC State in 2020 and 2021, recognizing her outstanding work as a professor, researcher and women’s equity advocate.

Battestilli completed her undergraduate education at Kettering University, where she received her B.S. in electrical engineering with a minor in applied mathematics in 1999. She then went on to further her education at NC State where she received her master’s in computer networking in 2002 and her Ph.D. in computer science in 2005. Shortly after receiving her Ph.D., she was selected by the NC State Graduate School as the winner of the 2006 Nancy G. Pollock Dissertation Award for her outstanding research in computer science, making her one of the first graduate students from computer science to receive this award.

Since she began her career at NC State as a teaching associate professor in 2012, Battestilli has been involved at NC State in a variety of other roles, including faculty adviser for Women in Computer Science (WICS), member of the Academic Committee of the Grace Hopper Celebration, member of the Diversity in Admissions and Matriculation committee within the department, panelist on Technology and Bias at Honors and Scholars Village, leader in College of Engineering high school

summer camps and a 2020 NC State Distance Education and Learning Technology Applications (DELTA) faculty fellow.

She teaches Intro to Computing and Network elective courses and serves as part of the Computer Science Senior Design Center.

DEPARTMENT’S PERSON OF EXCEPTIONAL PERFORMANCE

The department presented the 2020-21 Person of Exceptional Performance (PEP) Award to Battestilli.

Battestilli has dedicated much of her efforts to creating and supporting a diverse environment within the department, as well as increasing diversity and participation within the technology and computer science majors. Her passion is seen through her research interests, which include: the innovation of computer science education, effective ways of teaching computer science to non-majors and increasing the diversity of computer science students. Along with her research, Battestilli is co-principal investigator on a National Science Foundation-funded project “Analysis of a Simple, Low-cost Intervention’s Impact on Retention of Women in Computer Science.” The goal of this project is to improve the retention of women within computer science. She also has a publication based on this work in the 2020 Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT) conference.

“There is no doubt that we need more women in tech innovation. Companies and teams perform better when there is diversity,” said Battestilli. “Women need to be part of solving the world’s problems and technology is a powerful tool to accomplish just that.”

For her dedication to her teaching and research, and for her passion and commitment to establishing and maintaining a diverse computer science community at NC State, the department is honored to recognize Battestilli with the 2020-21 Person of Exceptional Performance Award.

Battestilli is also being recognized as the Most Awesome Teaching Associate Professor because of her outstanding work performance as a teacher and a researcher (*more details on pages 27-28*).

DELTA 2020-21 FACULTY FELLOW

Battestilli was one of five new faculty fellows for the 2020-21 academic year named by NC State’s Digital Education and Learning Technology Applications (DELTA) program. DELTA’s group of faculty fellows is committed to sharing their knowledge of teaching with technology through leading workshops, presenting at conferences and writing articles.

Each faculty fellow has specific skills and experiences to offer in their partnership with DELTA, and they plan to use these skills to the advantage of NC State faculty and students. Their individual knowledge of technology best practices in education allow them to positively impact the NC State community.

The faculty fellows grant began in 2015 and has grown each year, becoming an esteemed program in the NC State community. In the program's fifth year, the main goal remains to promote excellence in teaching with technology by fostering the exchange of ideas and interdisciplinary partnerships.

2021 EQUITY FOR WOMEN AWARD NOMINEE

Battestilli was nominated for the 2021 Equity for Women Awards at the annual Sisterhood Celebration hosted by the NC State Council on the Status of Women. She was nominated in recognition of her efforts in increasing women's representation and participation in technology and computer science, as well as for her involvement in the diversity efforts of the CSC department.

According to the National Center for Women & Information Technology, women only hold 26 percent of professional computing occupations. Thus, Battestilli's work is guided by the mission of increasing female representation in the field of computer science and other technology fields.

The Sisterhood Dinner, hosted by the Council on the Status of Women and the Women's Center on Feb. 22, 2021, "celebrates the contributions and accomplishments of NC State women." The theme for the 36th annual Sisterhood Dinner was "Normal Never Was" to acknowledge and celebrate the hard work and achievements amidst the difficulties of the past year.

Battestilli was one of the faculty nominees for the 2021 Equity for Women Award, which recognizes "... outstanding leadership in establishing equity for women at NC State." Nominees were selected based on their demonstrated excellence in leadership, service and scholarship. Battestilli said it was an enjoyable time and "... it really made me proud to be part of NC State and to see everyone's efforts to bring equity for women."

BARNES NAMED DISTINGUISHED MEMBER OF THE ACM

Tiffany Barnes, Distinguished Professor in the department, was named a 2020 distinguished member of the Association for Computing Machinery (ACM) for her outstanding educational contributions to computing.

The ACM has named 64 distinguished members for their outstanding contributions to the field of computing. All 2020 inductees are longstanding ACM members and were selected by their peers for a range of accomplishments that move the computing field forward.



Tiffany Barnes

The 2020 ACM distinguished members work at leading universities, corporations and research institutions in Australia, Canada, China, India, Qatar, Singapore, Spain, Sweden, Taiwan, the United Kingdom and the United States. These innovators have made contributions in a wide range of technical

areas including data science, mobile and pervasive computing, artificial intelligence, computer science education, computer engineering, graphics, cybersecurity and networking among many other areas.

The ACM distinguished member program recognizes up to 10 percent of ACM worldwide membership based on professional experience as well as significant achievements in the computing field. To be nominated, a candidate must have at least 15 years of professional experience in the computing field, five years of professional ACM membership in the last 10 years and have achieved a significant level of accomplishment, or made a significant impact in the field of computing, computer science and/or information technology. In addition, it is expected that a distinguished member serves as a mentor and role model, guiding technical career development and contributing to the field beyond the norm.

CATETÉ RECEIVES 2020 ERSKINE B. BOWLES STAFF SERVICE AWARD

The UNC Staff Assembly presented the 2020 Erskine B. Bowles Staff Service Award to Veronica Cateté, a research scientist in the department.

Since becoming a research scientist in 2018, Cateté has continued to go above and beyond in service to NC State and the global community. She serves as the co-advisor for the STARS student organization, a service club that provides weekly workshops in computer science for K-12 students. She has mentored 50 high school, 10 undergraduate and five graduate researchers, and an incredible number of protégés. In addition, Cateté's groundbreaking research has led the way in establishing evaluation support for novice K-12 teachers new to computer science.

"Dr. Cateté invests the time to know each student individually, understanding what motivates them, what aspects of research they are successful at, and how they can collaborate with other students in the lab to create studies and projects



Veronica Cateté

that maximize their potential," said UNC Staff Assembly Chair Garrett Killian, who made the announcement at the May 2021 meeting of the UNC Board of Governors.

As the department's second Latina Ph.D. graduate, Cateté has made it her personal mission to help foster a sense of belonging and curiosity toward computing in young women and minorities to help give them the knowledge and opportunities to make informed decisions on career pathways.

During the COVID-19 pandemic, Cateté took steps to help students adjust. She shifted her office hours to meet regularly with students in other time zones. In addition, Cateté sponsored virtual game time and social activities for students to feel connected with their peers.

"Her character makes our culture better and her actions and initiatives make our department better," said Tiffany Barnes, professor at NC State. "I am confident that she helps NC State grow relationships while providing additional cultural, professional and educational exposure for our students."

The Erskine B. Bowles Staff Service Award was established in 2010 by the UNC Staff Assembly to recognize employees whose accomplishments are consistent with the goals of the University and the University's public service mission. Recipients must exemplify excellence in their professional interactions and customer service within their university employment; provide extraordinary service to their campus and the UNC System outside their job description; and provide exemplary service to their surrounding community.

CATETÉ HONORED WITH COLLEGE OF ENGINEERING'S 2021 AWARD FOR EXCELLENCE

Two outstanding staff members from the department were recognized as nominees for the annual College of Engineering Awards for Excellence at a virtual ceremony held on April 28, 2021. Dean Louis Martin-Vega recognized nominees Veronica Cateté, research scholar, and Donna Richards, university program specialist in the Contracts and Grants office.

The department is pleased to announce that Veronica Cateté was named one of two EHRA Awards for Excellence recipients.

Cateté was nominated in the Spirit of North Carolina category. Per her nomination, "Dr. Cateté promotes STEM and computer science education in the state of NC and beyond ... She helps the Infusing Computing Project, which has prepared and empowered 450 NC and SC teachers to integrate computational thinking into their classrooms ... an incredible service in NC which just adopted computer learning standards for all K-12 students in 2020... Dr. Cateté is involved in task forces to improve diversity and promote anti-racism ... she has also worked to bring STEM to rural areas in Rwanda. Dr. Cateté truly exemplifies the state motto, 'To be, rather than to seem' by mentoring others in the pursuit of excellence and serving as an ambassador for the state of North Carolina."

Richards was nominated in the Customer Service category. Per her nomination, "She is very positive, supportive and knowledgeable. Donna always tries to help and has a positive outlook. She finds solutions for all questions and scenarios. Donna is definitely a key player on the CSC team!"

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

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



William Enck

ENCK'S PAPER WINS 2020 SIGOPS HALL OF FAME AWARD

William Enck, associate professor in the department, along with fellow researchers Peter Gilbert (Oasis Labs), Byung-Gon Chun (Seoul National University), Landon P. Cox (Microsoft Research), Jaeyeon Jung (Samsung), Patrick McDaniel (The

Pennsylvania State University) and Anmol N. Sheth (A9), won the 2020 ACM Special Interest Group in Operating Systems (SIGOPS) Hall of Fame Award.

The winning paper is "TaintDroid: An Information-Flow Tracking System for Realtime Privacy Monitoring on Smartphones." The paper appeared in OSDI '10: Proceedings of the 9th USENIX Conference on Operating Systems Design and Implementation.

According to the selection committee, "This paper was instrumental in demonstrating that taint tracking could be made both efficient and fine-grained. For unmodified smartphone applications, with minimal monitoring overhead, the authors found dozens of potential leaks of sensitive and private information. This work sparked an important research agenda on smartphone privacy that continues to this day."

The abstract follows:

"Today's smartphone operating systems frequently fail to provide users with adequate control over and visibility into how third-party applications use their private data. We address these shortcomings with TaintDroid, an efficient, system-wide dynamic taint tracking and analysis system capable of simultaneously tracking multiple sources of sensitive data. TaintDroid provides

realtime analysis by leveraging Android's virtualized execution environment. TaintDroid incurs only 14 percent performance overhead on a CPU-bound micro-benchmark and imposes negligible overhead on interactive third-party applications. Using TaintDroid to monitor the behavior of 30 popular third-party Android applications, we found 68 instances of potential misuse of users' private information across 20 applications. Monitoring sensitive data with TaintDroid provides informed use of third-party applications for phone users and valuable input for smartphone security service firms seeking to identify misbehaving applications."



Xiaohui (Helen) Gu

GU WINS 10-YEAR BEST PAPER AWARD

The ACM Symposium on Cloud Computing 2020 (SoCC '20) awarded Xiaohui (Helen) Gu and co-authors, Zhiming Shen (Exotanium, Inc.), Sethuraman Subbiah (Amazon) and John Wilkes (Google), the 10-Year Best Paper Award for their paper "CloudScale: Elastic Resource Scaling for Multi-

Tenant Cloud Systems." This paper focuses on the CloudScale system and how it addresses challenges in prediction-driven elastic resource scaling with solutions including adaptive padding, fast under-estimation error correction, predictive migration and integration with DVFS.

CloudScale was part of a larger project created 14 years ago at NC State with the goal of developing a new system management framework that would help operators move toward proactive intelligence system management. This project is funded by the National Science Foundation (NSF), the Army Research Office (ARO), Google, IBM and Credit Suisse.

The 10-Year Best Paper Award was established in 2019 when the Symposium on Cloud Computing turned 10 years old. This award "recognizes the paper that has stood the test of time with its technical contribution." Gu's paper stood out as a breakthrough paper on cloud elasticity having over 630 citations, demonstrating its relevance and impact.

Gu is a professor in the department, and the founder and CTO of InsightFinder, Inc. She has filed nine patents and has published more than 80 research papers in international journals and major peer-reviewed conference proceedings. Gu is a recipient of the NSF CAREER Award, four IBM Faculty Awards (2008, 2009, 2010, 2011), and two Google Research Awards

(2009, 2011). She has received best paper awards from ICDCS 2012 and CNSM 2010 and an NC State Faculty Research and Professional Development Award. Her research areas include autonomic computing, cloud computing and accountable distributed systems.



Todd Gardner

DEPARTMENT NAMES 2020 PRIDE OF THE WOLFPACK AWARD WINNERS

Two staff members in the Department of Computer Science were recently recognized with Pride of the Wolfpack Awards. Veronica Cateté, research scholar, and Todd Gardner, director of operations, are the most

recent recipients of the award.

The awards are designed to recognize NC State employees for a special or unique contribution to their college/unit or the University. Criteria for the award include: leadership on the job, customer focus and quality of service.

Veronica Cateté, who received two nominations, is a two-time graduate of the department (BS '10), (Ph.D. '18). She joined the department as a research scientist in 2018. Cateté has shared her passion for computing through many different outreach efforts. Per her nomination: "Veronica is a tremendous leader and representative of the CS department. She has ... been at large part responsible for the sharp increase in publications coming out of the Game2Learn Lab and does this while creating and maintaining CS outreach initiatives for K-12 students such as her new high school internship program and her long-established work with STARS."

Her second nominator added: "Dr. Cateté has made it her personal mission to help foster a sense of belonging and interest in computing for young women and students of color ... Her dedication to mentorship, recruitment and diversity initiatives make her contributions to the CSC department and NC State uniquely her own ... Dr. Cateté's contributions to NC State, the College of Engineering and CSC department go above and beyond what is expected of her position as a research scientist."

The CSC department's second winner is Todd Gardner, who joined NC State in 2013 as director of operations. He was previously recognized with a Pride of the Wolfpack Award in 2016, and was the department's nominee for the College of Engineering 2016 Awards for Excellence. Per his nomination, "Todd has done an outstanding job of keeping the department

and our building operational during the COVID-19 crisis. While the rest of us have been able to work remotely, Todd's role has required him to go to work in Engineering Building II (almost) every day. With safety being at the forefront, Todd has kept our department, our faculty/staff and our students equipped, prepared and safe. Surely, keeping the department and our building "operational" is the main part of Todd's job. He has done that since the beginning of the pandemic, when there were so many unknowns, putting himself at potential risk. I appreciate his dedication to the safety and well-being of our faculty, staff and students."



ToniAnn Marini

DEPARTMENT NAMES CARLA SAVAGE AWARDS WINNERS

ToniAnn Marini and Barbara Jasmine Adams have been named the winners of The Carla Savage Award in the Administrative Staff category. Lina Battestilli won the award in the Teaching Professor category. George Rouskas, professor and director of graduate programs, and William Enck, associate professor, were the October 2020 winners of The Carla Savage Award.



Barbara Jasmine Adams

A new intra-departmental initiative, The Carla Savage Awards were created to recognize outstanding achievement and special people within the department, in the spirit of the incomparable department icon Carla Savage.



George Rouskas

Each month, nominations for The Carla Savage Awards will focus on one of the following groups: Ph.D. students, administrative staff, research professors, teaching professors, assistant professors,

associate professors and professors. The 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. Voting is open to everyone in department. Two awards will be given each month, with a maximum of 14 winners (one person cannot win more than once every six months). No awards will be given in January, June, July, August or December.

Marini is the assistant director of undergraduate advising and a lecturer. Her job is to help students maneuver through some of the most challenging advising aspects of the department. In her role, she is the magician who knows all the tricks about how to pull rabbits out of hats, and how to pull answers out of students. Through it all, she somehow manages to remain (outwardly) calm and patient through each advising and scheduling season. Marini is a two-time graduate of NC State (B.S., M.Ed.). She started working for the department in 2005 as an undergraduate lab instructor and then became the undergraduate lab coordinator and a lecturer in 2010. She has been working in advising since 2013, in scheduling since 2018 and taught E115 for a record 10 years. She co-advises approximately 1,300 major and prospective students and about 200 minor students.

Adams, who earned her Ph.D. in psychology from the City University of New York in 1996, is the director of undergraduate advising and a lecturer. She joined the department in 2004, and is legendary in the department for being able to read minds. Somehow, she knows how to get things done, and she knows who to call when there's trouble in the neighborhood. Always listening, and always giving top-notch advice, Adams is the first line of defense, and every instructor (and the whole department) owes her a huge debt of gratitude.

Battestilli was recognized as the Most Awesome Teaching Associate Professor. She dedicates herself to teaching, research and the cause of increasing women's representation and participation in technology and computer science. Her NSF-funded research, "Analysis of a Simple, Low-cost Intervention's Impact on Retention of Women in Computer Science," studies intervention designed to improve the retention of women in computer science.

Rouskas, who was recognized for his funding record and his collegial and even-tempered approach to all his work, is the recipient of many awards and recognitions, including the Institute of Electrical and Electronics Engineers (IEEE) ONTC Outstanding Service Award in 2019. He was named an NC State Alumni Association Distinguished Graduate Professor in 2018, and he is also a member of the NC State Academy of Outstanding Teachers. In 2012, he was named an IEEE Fellow, and in 2010

and 2011 he was an IEEE Communications Society Distinguished Lecturer. As of 2020, 25 Ph.D. students and 12 master's thesis students have graduated under his supervision. Rouskas, whose research interests are in the broad field of computer networking, earned his Ph.D. (1994) and his M.S. (1991) from the Georgia Institute of Technology, and his B.S. (1989) from the National Technical University of Athens, Greece. Per his nomination: "Dr. Rouskas is the most complete faculty member I've had the pleasure to know in our department. 'Complete' as in 'excellent in all dimensions.' His research credentials and reputation and impact are excellent. He's been very active in professional service. He has a very respectable funding record. His skill in mentoring students has been excellent. He is a highly rated instructor, and his course materials are excellent. He has been an excellent DGP."

Enck is an associate professor in the department and co-director of the Secure Computing Institute (SCI) and director of the Wolfpack Security and Privacy Research (WSPR) laboratory. Enck, whose research interests are in cybersecurity, earned his Ph.D. (2011), M.S. (2006) and B.S. (2004) from the Pennsylvania State University. Enck was recognized for his efforts that led to the highly successful SCI, as well as the more recent Cybersecurity Initiative and Undergraduate Cybersecurity Concentration. He was also praised for his inspiring teaching and lectures. Per his nomination: "I nominate Dr. Will Enck for his tireless and inspiring leadership (along with Dr. Laurie Williams) in the establishment of the highly successful Secure Computing Institute, and most recently in his efforts to launch the associated Cybersecurity Initiative here at NC State. ... Collectively, these efforts have resulted in NC State's rise in the rankings as a leader in cybersecurity, as we recently ranked fourth on Cyber Degrees EDU's list of 'Top 50 Colleges for Cyber Security Master's Degrees in the U.S.'"



Munindar Singh

SINGH RECEIVES INTERNATIONAL, UNIVERSITY HONORS

Munindar Singh, Alumni Distinguished Graduate Professor, received multiple awards and honors from institutions around the world and from NC State for his outstanding research contributions and mentorship.

His research areas include artificial intelligence

and intelligent agents, computer and video games, cybersecurity, health care information technology and information and knowledge management. Currently, his research emphasizes sociotechnical systems as a computational basis for modeling and realizing software to support collaborations of autonomous stakeholders, as arise in application domains such as finance, healthcare, manufacturing and the Internet of Things.

Singh is a Fellow of the Association for the Advancement of Artificial Intelligence (AAAI) and of the IEEE. He has won NC State's Outstanding Research Achievement Award and is a member of the NC State's Research Leadership Academy. He has graduated 27 Ph.D. students.

ELECTED FOREIGN MEMBER OF ACADEMIA EUROPAEA

Singh was named as NC State's first elected foreign member of Academia Europaea.

Academia Europaea is the Pan-European Academy of Sciences, Humanities and Letters and was established in 1988 with encouragement from the European Ministers of Science. The object of Academia Europaea is the advancement and propagation of excellence in scholarship in the humanities; law; the economic, social and political sciences; mathematics; medicine; and all branches of natural and technological sciences anywhere in the world for the public benefit and for the advancement of the education of the public of all ages.

Academia Europaea's more than 4,500 members include leading experts from the physical sciences and technology, biological sciences and medicine, mathematics, the letters and humanities, social and cognitive sciences, economics and the law. Becoming a member of the academy is by invitation only and follows a rigorous peer review selection process by each relevant section. The Academia Europaea wishes to elect into membership scientists and scholars of international distinction, irrespective of nationality, citizenship, gender, location or discipline. The primary criterion for membership is "sustained academic excellence in the candidate's field."

Singh was elected a member of the Informatics section for his distinguished contributions to computer science, especially in decentralized AI, multiagent systems and service-oriented computing.

ELECTED AAAS FELLOW

Singh was elected a Fellow of the American Association for the Advancement of Science (AAAS), an honor bestowed upon AAAS members by their peers.

Singh was elected as an AAAS Fellow for his distinguished contributions to the field of computer science, particularly to foundations of multiagent systems and their applications

in service-oriented computing, sociotechnical systems and governance.

The 489 members awarded this honor by AAAS in 2021 were honored during a virtual Fellows Forum — an induction ceremony for the new Fellows — in February.

AAAS was founded in 1848 and includes more than 250 affiliated societies and academies of science, serving 10 million individuals. The nonprofit AAAS is open to all and fulfills its mission to "advance science and serve society" through initiatives in science policy, international programs, science education, public engagement and more.

RECOGNIZED FOR RESEARCH INNOVATION BY IEEE

The Institute of Electrical and Electronics Engineers (IEEE) Computer Society awarded Singh the IEEE TCSVC Research Innovation Award for his contributions to services research and engineering systems of autonomous and heterogeneous parties via computational abstractions for business protocols, contracts, trust and reputation.

For more than 70 years, the IEEE Computer Society has existed to empower leaders in technology and innovation. The IEEE TCSVC Research Innovation Award recognizes "... outstanding technical innovations in the field of services computing have had a lasting impact in advancing the theory and practice in the field. The contributions must have significantly influenced the direction of research and development of the field or transferred to practice in significant and innovative ways and/or enabled the development of commercial systems/products..."

NAMED 2020 OUTSTANDING GRADUATE FACULTY MENTOR

Finally, Singh received the NC State Outstanding Graduate Faculty Mentor Award in the area of mathematical sciences, physical sciences and engineering.

Singh received this award in recognition of his excellence in mentorship based on nominations from graduate students and his truly exemplary track record of outstanding mentorship. A committee of graduate faculty with demonstrated success in mentoring selected him for this honor. Only one award is made every two years in this category.

The award is designed to honor those outstanding mentors who are clearly devoted to helping their graduate students flourish and assisting them to create a pathway to successful careers. In addition to providing discipline-specific guidance related to research, teaching coursework and other curricular requirements and enduring the transparency of the graduate educational process, outstanding mentors provide their mentees with other types of significant support.



Laurie Williams

LAURIE WILLIAMS EARNS UNIVERSITY, NATIONAL HONORS

Laurie Williams, Distinguished University Professor, was honored with a number of awards in the last year in recognition of her groundbreaking research and dedication to student success.

Williams is co-director of the NC State Science of Security Labet, and she is the chief cybersecurity technologist of the SecureAmerica Institute. At NC State, she leads the Software Engineering Realsearch research group.

In 2018, she was named an NC State Distinguished Professor of Computer Science and an IEEE Fellow. She received an NC State Alumni Association Outstanding Research Award in 2016, and was named to the NC State Research Leadership Academy, also in 2016. Additionally, she was named an IEEE Senior Member in 2015, an NC State Faculty Scholar in 2013 and an ACM Distinguished Scientist in 2011. In 2009, she won the ACM Special Interest Group on Software Engineering (SIGSOFT) Influential Educator Award and in 2004 she won a National Science Foundation (NSF) Faculty Early Career Development Award (CAREER) Award.

Williams joined the NC State faculty in 2000. In addition to teaching responsibilities, she has served in several leadership roles in the department including acting department head from 2014-15; associate department head from 2015-16; and interim department head from 2017-18. She received her B.S. in industrial engineering from Lehigh University in 1984, her MBA from Duke University in 1990 and her Ph.D. in computer science from the University of Utah in 2000. She worked for IBM Corporation in various technical and managerial capacities for nine years before returning to academia.

NAMED DISTINGUISHED UNIVERSITY PROFESSOR

Williams was named a Distinguished University Professor in the CSC department.

Williams' research focuses on software security; agile software development practices and processes, including continuous deployment; and software reliability, software testing and analysis. Her research has emphasized the importance of having practical relevance in software security and software engineering research and providing research solutions to solve the problems faced in day-to-day software development. With her students in the Software Engineering Realsearch group, she has been involved in working collaboratively

with high tech industries like ABB Corporation, Cisco, IBM Corporation, Merck, Microsoft, Nortel Networks, Red Hat, Sabre Airline Solutions, SAS, Tekelec and healthcare IT organizations and on open source software. The Realsearch team works on research activities ranging from security issues in healthcare IT applications to software process to applying failure-prediction in-process and vulnerability-prediction in-process during development to impact programmer productivity and ensure the development of high quality, reliable, and secure applications. The research collaborations have resulted in significant publications in the primary conferences in her research area maintaining a balance between research and practice in software security and software engineering. Williams has more than 240 refereed publications.

Williams is one of the foremost researchers in the security of healthcare IT applications and of agile software development. Her work has had wide ranging impact on the research community ranging from the collection of empirical evidence on agile software development to the evaluation of specific practices in isolation to gauge their efficacy to be adapted in different contexts. She is the main author of the book *Pair Programming Illuminated* and a co-author of *Extreme Programming Perspectives*, both published by Addison-Wesley. In January 2009, her 2000 IEEE Software paper "Strengthening the Case for Pair Programming" was chosen as an IEEE Software 25th Anniversary Top Pick Paper and was on the list of the Most Cited IEEE Software Articles for a 25-year period, and was chosen by the Association for Computing Machinery's Special Interest Group on Computer Science Education as the #2 SIGCSE Top Ten Symposium Papers of All Time.

Williams is strongly committed to software engineering and security education through her mix of teaching, professional and

research activities. She redesigned the software engineering course at NC State to include an innovative laboratory component that enhances communication, coordination skills and provides practical software development team experience to students. She has designed two new graduate level courses on Software Reliability and Testing and on Software Security at NC State. Her involvement in education research activities has included her role as lead investigator in National Science Foundation grants to improve the retention of women and minorities in computer science using various educational practices like agile software development and pair programming.

Williams becomes the fifth Distinguished Professor in the department, joining Donald Bitzer, Jon Doyle, James Lester and Mladen Vouk.

NAMED 2020 ACM FELLOW

Williams was named a 2020 Association for Computing Machinery (ACM) Fellow for her contributions to empirical research on agile software development, software security and software engineering education. She is the second ACM Fellow in the department, joining Frank Mueller, who became a Fellow in 2018.

In 2020, ACM named 95 members Fellows for wide-ranging and fundamental contributions in areas including artificial intelligence, cloud computing, computer graphics, computational biology, data science, human-computer interaction, software engineering, theoretical computer science and virtual reality, among other areas.

The ACM Fellows 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.

Nachiappan Nagappan, a two-time graduate of the department (M.S. 2002, Ph.D. 2005) was also named a 2020 ACM Fellow, and was Williams' first Ph.D. student at NC State. Nagappan, formerly a partner researcher at Microsoft Research, was recognized as an ACM Fellow for his contributions to empirical software engineering and data-driven software development. He was inducted into the NC State Computer Science Alumni Hall of Fame in 2020.

WILLIAMS AND COLLABORATORS WIN THE MOST INFLUENTIAL PAPER AWARD

Williams, alongside fellow researchers Thomas Zimmermann and Nachiappan Nagappan, won the Most Influential Paper Award at the 13th IEEE International Conference on Software Testing (ICST), Validation and Verification.

Williams is an influential leader in the development of

vulnerability prediction models (VPM) that are used to predict the location of vulnerable code which can be used in the prioritization of which areas of the code to spend additional time for vulnerability detection. Her research has used the following as predictors: social networking metrics, complexity, unfiltered static analysis alerts, source code metrics and stack traces from crash dumps. Her papers have influenced many other researchers to study this topic and remain the most cited in VPM. The influence was recognized in 2020 by an ICST Test of Time award for her 2010 paper on VPM with Microsoft.

Zimmermann, a senior principal researcher at Microsoft Research, is a long-time collaborator with Williams. Nagappan received the 2020 Harlan D. Mills Award for his "outstanding contributions to empirical software engineering and data-driven software development."

For over 70 years, the IEEE Computer Society has existed to empower leaders in technology and innovation. The IEEE International Conference on Software Testing, Verification and Validation 2020 provided a common forum for researchers around the world to present their ideas and findings in the area of software testing, verification and validation. All papers were peer reviewed, and their acceptance was based on their originality, quality and relevance.

The winning paper is "Searching for a Needle in a Haystack: Predicting Security Vulnerabilities for Windows Vista." The abstract follows:

"Many factors are believed to increase the vulnerability of software system; for example, the more widely deployed or popular is a software system the more likely it is to be attacked. Early identification of defects has been a widely investigated topic in software engineering research. Early identification of software vulnerabilities can help mitigate these attacks to a large degree by focusing better security verification efforts in these components. Predicting vulnerabilities is complicated by the fact that vulnerabilities are, most often, few in number and introduce significant bias by creating a sparse dataset in the population. As a result, vulnerability prediction can be thought of us preverbally 'searching for a needle in a haystack.' In this paper, we present a large-scale empirical study on Windows Vista, where we empirically evaluate the efficacy of classical metrics like complexity, churn, coverage, dependency measures, and organizational structure of the company to predict vulnerabilities and assess how well these software measures correlate with vulnerabilities. We observed in our experiments that classical software measures predict vulnerabilities with a high precision but low recall values. The actual dependencies, however, predict vulnerabilities with a lower precision but substantially higher recall." ■



Sean Mealin

FIRST BLIND PH.D. STUDENT GRADUATES FROM THE DEPARTMENT OF COMPUTER SCIENCE

When Sean Mealin received his Ph.D. from the Department of Computer Science in May, his research partner was right by his side. Of course, when you're a Labrador retriever, where else would you want to be?

Mealin, who is the first blind Ph.D. student to graduate from the department, found inspiration for his research from his guide dog, Simba, who he received between his undergraduate and graduate studies at NC State. He hopes his research, which is focused on using computers to enhance communication between humans and dogs, will help service dog training programs become more efficient.

Mealin started research as an undergraduate student, when he worked with Suzanne Balik, CSC teaching assistant professor, to develop a publicly accessible tool that helps blind people work with graphs or node-link diagrams, a common structure in computer science that is often inaccessible to people with visual impairments.

After graduating summa cum laude in 2013, he joined the Canine Instruction with Instrumented Gadgets Administering Rewards (CIIGAR) lab led by David Roberts, an associate professor of computer science who is also interested in dog training and agility. Mealin embarked on an independent study focused on using technology to better train and evaluate guide dogs. In 2014, he received a National Science Foundation Graduate Research Fellowship for his work.

"It's not too far from robotics, except that all the hard problems are taken care of. If you tell a dog to go through an environment, the dog will automatically path-find, the dog will preserve its own safety, the dog will do all of these things that are still outstanding problems in the world of robotics," he explained.

Mealin and Roberts formed a partnership with Guiding Eyes for the Blind in New York, one of 11 accredited schools in the U.S. for training guide dogs. Guiding Eyes restructured some of its early training programs to incorporate Mealin's technology and hardware.

"We focused on how we can use computers and data collected by a custom system that we built to better evaluate guide dogs at seven-and-a-half weeks old and see if they're likely to successfully make it through the program," Mealin said. "Will this dog one day be a good guide dog or it is not likely to succeed?"

It's a difficult question to answer. Of the dogs in program, 62.5 percent failed. It costs \$50,000 to train a guide dog, so early evaluation of a guide dog's likely completion of the program could save the school considerable resources.

Mealin and Roberts worked on the project with the College of Veterinary Medicine and the Department of Electrical and Computer Engineering, as well as with IBM, which allowed Mealin to use IBM Watson to run his analysis.

"One of the standout things I really enjoyed was the collaboration," Mealin said. "We were basically coming up with how to collect data on these dogs that are seven-and-a-half

weeks old...how do we get a computer small enough to put on them to detect their heart rate, their movement, and where they are?"

When asked what he found the most challenging, Mealin cited the technical content and diagrams that are so prevalent in engineering courses and often not crafted with consideration for accessibility.

"I always had professors who would work with me and find alternative ways for me to perform assignments or tasks," he said. "But having to invent the tools that I use to try and learn the material and keep up with the rest of the class, there's a bit of a bootstrap paradox going on."

Mealin now works at SAS as a full-time software developer, and he continues his game-changing work on service dogs, staying on with the lab to conduct research and mentor incoming Ph.D. students.

And in his free time? Applying machine learning to brewing beer. "The idea of bringing technology and beer together sounds fun."

HUI GUO NAMED WINNER OF THE CARLA SAVAGE AWARD FOR PH.D. STUDENTS

Hui Guo, a Ph.D. student advised by faculty member Munindar Singh, has been named a winner of The Carla Savage Award in the Ph.D. student category.

In their text nominating him for this award, Guo's fellow students were effusive in their praise: "He has served as an excellent sounding board for anyone who is stuck in their thinking ..." "He provides students constructive criticism on their presentations and drafts, testing out and challenging their hidden assumptions, and offering suggestions on how they should refine their problems and perform their evaluations..." "Hui unhesitatingly spends time and effort teaching others about techniques and technologies that improve the quality of their work and their productivity ... More than once, he has developed software and worked on manuscripts, contributing on par with others but opting to be a second author to let them have a more prominent position..."

Guo received his master's in computer science in 2012 from East Carolina University and two bachelor's degrees in automation engineering and economics in 2009 from Tsinghua University in Beijing, China. Guo's research interests include natural language processing, data and text mining, multiagent systems and social computing. He has worked as a research assistant supported by the National Security Agency Science of Security Lablet, conducting research related to software security,

requirement engineering and HIPAA compliance of software systems. He has published numerous research papers in both intelligence and software engineering at top-tiered venues such as ICSE, AAMAS, IJCAI, the EMSE journal and IEEE Internet Computing. He also won the department's Outstanding Teaching Assistant (TA) Award in 2017 and Outstanding Research Award in 2020.



Zachary Parks

TWO CSC GRAD STUDENTS RECEIVE PRESTIGIOUS NSF GRADUATE RESEARCH FELLOWSHIPS

The department is pleased to announce that two Ph.D. students, Zachary Parks and James Skripchuk, have been chosen to receive prestigious and highly competitive National Science Foundation (NSF) Graduate Research Fellowships.



James Skripchuk

Parks, a second-year Ph.D. student, is currently a research assistant in Patrick Dreher's research group. Dreher is a research professor in the department and is the chief research scientist for the IBM

Quantum Hub at NC State. NC State's hub was established in 2018 as the first university-based IBM quantum computing hub worldwide.

Parks' research interests include quantum computing applications and investigating ways to maximize the performance of these nascent quantum computational devices through novel algorithms, robust software and noise and error mitigation techniques.

"One of the more pressing challenges facing quantum information researchers is obtaining reliable results from these quantum processors," Parks said. "I am interested in being a part of the solution to these challenges."

As an NSF Graduate Research Fellow, Parks' proposed research will focus on investigating, developing and deploying pulse-level noise characterization and error mitigation methods and

techniques for quantum computing. “These techniques involve programming the quantum computers more closely to the actual physical system, using microwave pulse schedules to manipulate the device’s quantum state instead of programming the devices using the quantum circuit abstraction,” said Parks.

Skripchuk is a first-year Ph.D. student studying computer science education. His research focuses on how to use data-driven methods to make learning computer science more accessible and authentic. During his undergraduate career at the University of Delaware, he co-designed a course that allowed non-STEM majors to use statistical methods and computer science skills to compose a song in the style of their favorite artist. Currently, he is working at the HINTS Lab under Assistant Professor Thomas Price and using techniques from artificial intelligence and machine learning to create intelligent tutoring systems that help programming learners when they are “stuck.”

Skripchuk’s research proposal for the NSF Graduate Research Fellowship involves studying student search behaviors. “I’m going to collect data from students’ programming environments and their internet browsers and see if we can use that data to pick up on some common trends. Are there specific ways that novice programmers phrase their questions? How many web pages does a student visit before they fix their problem? Do they just copy and paste code directly from the internet into their editor? I hope to use the answers to those questions in order to develop educational theories and intelligent tutors that help novice programmers learn ‘how to learn’ using the help of the internet,” he explained.

The National Science Foundation Graduate Research Fellowship Program (GRFP) is the oldest graduate fellowship of its kind and supports outstanding graduate students who have demonstrated potential for significant achievements in their research. The GRFP provides three years of funding for research-focused degrees in the STEM fields, an annual stipend of \$34,000 and a cost-of-education allowance of \$12,000 to the recipient’s institution.

Since 1952, the NSF has funded well over 46,500 Graduate Research Fellowships. In 2020, NSF awarded the GRFP to approximately 2,000 individuals from among 13,000 applicants. Parks and Skripchuk join the ranks of Nobel Laureates and members of the National Academies.

The NSF Graduate Research Fellowship will allow both Skripchuk and Parks to grow professionally and personally as they pursue their research interests. “A source of funding such as the NSF Fellowship will grant me a level of freedom I did not have before that enables me to fully explore and investigate my research interests. Receiving this fellowship will open up many doors and opportunities for my research career in quantum computing, and I am looking forward to making good use of it,” said Parks.

TWO CSC STUDENTS AWARDED NC STATE’S 3RD AND 4TH CHURCHILL SCHOLARSHIPS

Ana Sofia Uzsoy and Nikhil Milind — two recent alumni who both majored in computer science — were awarded the prestigious Churchill Scholarship for the 2021-22 academic year, the third and fourth NC State students to ever receive the honor.

The two are among 17 recipients of the Churchill Scholarship selected from an incredibly competitive applicant pool. In 2021, there were 125 nominations from over 80 different institutions across the country, which are some of the highest numbers that the scholarship program has ever seen. NC State was one of only two schools in the country to be awarded two scholarships.

The Churchill Scholarship program was established in 1963 as part of the founding of Churchill College. It was established in fulfillment of Sir Winston Churchill’s vision of deepening the United States-United Kingdom partnership to advance science and technology in both countries. Churchill College was established in 1960 as a predominantly science and technology college and the National and Commonwealth memorial to Sir Winston Churchill.

Winners of this scholarship are selected based on criteria of outstanding academic achievement, proven talent in research and outstanding personal qualities. This program provides full funding to students from the United States to pursue a one-year master’s degree at the University of Cambridge, based at Churchill College in the United Kingdom. The scholarship is valued at around \$60,000 and covers full tuition, travel costs and a stipend.

UZSOY TO STUDY MACHINE LEARNING AND INTELLIGENCE

Uzsoy plans to pursue an MPhil in machine learning and machine intelligence during her time at the University of Cambridge.

While working on a double-major in physics and computer science with minors in math and oboe performance, Uzsoy was also a Park Scholar, a College of Sciences ambassador and the president of Women in Physics. Before the pandemic, she played with the NC State Woodwind Quintet and even had the chance to open for the NC Symphony and play at the Gregg Museum located in Raleigh.

Uzsoy is heavily invested in research. She is currently working with Mary Elting of the NC State Physics Department on creating computational tools to automatically track yeast cells as they divide. She is also working on another project with a professor at the University of Chicago studying exoplanets, which are planets that orbit stars other than the sun. Uzsoy has interned with NASA and Google and was a 2019 recipient of the Goldwater Scholarship.

Uzsoy is excited and grateful for this experience. “I am so incredibly honored to receive a Churchill Scholarship. When I was applying, I never thought I would actually get it — I was so



Ana Sofia Uzsoy



Nikhil Milind

shocked when I got the email,” she said. “I’m very excited to move to the UK and start my studies at Cambridge ... I think you can learn a lot from being in new environments, so I’m excited about the opportunity to experience a different country and meet people from all over the world while learning and doing research in an exciting field.”

She is also thankful for those who have supported her along the way.

“I am so grateful to all of my faculty mentors, the Fellowships Office, both the computer science and physics departments, the counseling center, my friends and family and everyone who has supported me throughout the process of applying to the Churchill Scholarship program, and just over the course of my four years at NC State,” she said. “Many people have invested significant amounts of their time into helping me succeed, and I don’t think I can accurately express how much I appreciate it.”

MILIND TO EXPAND STUDIES ON GENETICS

Milind, who studied genetics in addition to computer science, will continue research into connections between human genetics and

diseases and aims to earn a master’s degree in biological sciences.

The Churchill Scholarship was an unexpected turn in Milind’s academic path. He had already moved to California to attend grad school at Stanford University when he learned he had been selected. He decided to defer his admission to Stanford to take advantage of the opportunity.

Milind will work with a primary investigator in the field of functional immunogenomics, which examines why immune systems respond differently to diseases.

The research builds on work Milind did at NC State. Under David Aylor, a professor whose specialties include epigenetic modification and reproductive biology, Milind examined data from experiments with mice to see if there were underlying genetic causes for their immune systems’ responses to influenza and asthmatic allergens.

Milind’s primary project will be to study messenger RNA and protein molecules in the blood to identify potential genetic biomarkers of dangerous sepsis responses. Biomarkers are especially important because they would inform medical professionals of patients who need help before they even display any symptoms of

sepsis.

He called it “a deep dive into genomic data I’ve never touched before” that could shed light on why some patients recover with antibiotics and others get rushed to the intensive care unit.

Beyond his academic studies, Milind is looking forward to meeting new people and traveling abroad.

“It’s all these different people doing completely different things, and we’ve been brought together in one program. I think the discussions will be lively,” Milind said.

That’s not all that will be lively; he is packing his ukulele. He’s been playing for a few years now and says it’s a great instrument for socializing.

When he returns to the United States next year, he’ll pursue a doctoral degree in genetics at Stanford with funding from a National Science Foundation fellowship that he was also able to defer a year.

“I know that without the university, I had no chance to make it as far as I have,” he said. “Thank you to everyone, including professors at NC State, my family and friends — everyone who has supported me.”



Neill Robson

MEET NEILL ROBSON

Application Developer, Software Engineer and Two-Time College Of Engineering Graduate

Neill Robson is a curious and determined application developer and software engineer. Fascinated by technologies that minimize the gap between the developer and the end user, he strives to transform impersonal computer behaviors into accessible, emotional experiences for the consumer. Robson will put his engineering skills and knowledge to practice in his role as an associate software engineer at Pendo.

Robson earned both bachelor's and master's degrees in computer science from NC State. He reflected on his time at NC State and how it's given him the tools he needs in order to succeed in life after college.

Besides thriving as an engineering student, Robson was also heavily involved in the entrepreneurial ecosystem at NC State. Having lived five years at the Albright Entrepreneurs Village, a living and learning community for student entrepreneurs, Robson had the opportunity to tour startup businesses in both Silicon Valley and New York City, as well as work with fellow alumnus Nick Sisco on prototypes for his business, Trashr. He also worked as the Entrepreneurship Garage's graduate assistant, overseeing the prototyping lab's equipment and mentoring students interested in using the many tools the Garage offers.

During his undergraduate time at NC State, Robson spent six weeks studying abroad in Hangzhou, China, and also served as a senior Goodnight Scholar mentor, introducing incoming college freshmen to NC State and the Goodnight Scholars program. "Through these experiences, NC State has taught me how to bring my full self to the table when serving others. Intellect is important, but I've also grown a lot in terms of empathy and creativity — owing in great part to these opportunities given during my time here," Neill shared.

We asked Robson about what he's learned and his future plans.

What are your plans after graduation?

I'm joining the excellent team at Pendo as an associate software engineer, helping businesses understand their customers and improve user experience within their software!

What is your favorite thing about the NC State Entrepreneurship community?

The breadth and depth of passions within the students, staff and faculty. I'm always learning or discovering something

new when interacting with folks in the program. The community is a beautiful reflection of how entrepreneurial thinking can enrich all areas of life, from technology to the arts, to physical, mental and social health.

What is your advice to those looking to explore entrepreneurship?

Don't be concerned about not having a "business plan" or "profitable" idea when getting started. Start by creating: building a prototype that you believe could improve your life or the community's well-being. Economics are important, but that knowledge is readily available: ideas and creativity are the scarcest resources and most valuable contribution you can provide.

What are you most proud of achieving during your time at State?

Over spring break in 2020, I led a group of peers on a trip to the Appalachia Service Project in rural Virginia to serve the community through housing repairs and renovations. The trip was a culmination of several months doing both logistical planning and team building to form a well-equipped and passionate group. We were able to insulate an elderly woman's mobile home to keep AC/heating costs down through the different seasons. Although this activity may not seem directly related to my academic/professional pursuits as a computer scientist, I cherished this experience as a unique and wonderful blessing. There will be many times in the future to develop exciting software tools or applications, but leading this service trip was truly a once-in-a-lifetime experience.

Anything else you want to add?

My sincerest gratitude goes out to the entire NC State Entrepreneurship staff, who have tirelessly and passionately created a world of opportunities for us students and coached us toward making our communities a better place. ■

Q&A

QUESTIONS FOR DR. JAMES LESTER

Dr. James Lester is a Distinguished University Professor in the Department of Computer Science and director of NC State's Center for Educational Informatics (CEI). This year's pandemic has increased demand for the kind of educational technology tools that are CEI's specialty.

Tell us a little bit about CEI.

CEI creates innovative next-generation learning technologies. With a focus on technologies that leverage artificial intelligence, we design, develop and field learning software for a wide variety of student populations ranging from elementary school to college. Much of this work centers on intelligent learning software for K-12 STEM education. Our faculty conducts research on intelligent game-based learning environments, multimodal learning analytics, intelligent tutoring systems, collaborative learning environments and natural language technologies for education.

Does CEI work beyond the boundaries of K-12?

We also conduct research on learning technologies to support training for the defense and first-responder communities, as well as healthcare. For example, we're working on a project for the U.S. Army Futures Command to investigate technologies to support team training, including using natural language processing to assess team communication and performance. We're also working with the Washington, D.C. Metro to investigate virtual reality-based training environments with intelligent user interfaces to support firefighters. In healthcare, with the support of the National Science Foundation and the National Institutes of Health, we're partnering with the UC San Francisco medical school to create health behavior change environments for adolescents.

This COVID-19 pandemic has shone a spotlight on virtual learning tools like never before. What do they do well?

Traditional educational software can work for some students in some subject matters to some degree. For example, there are some success stories for introductory literacy and math — but certainly not across the board.

And what parts of learning in a classroom can they not provide?

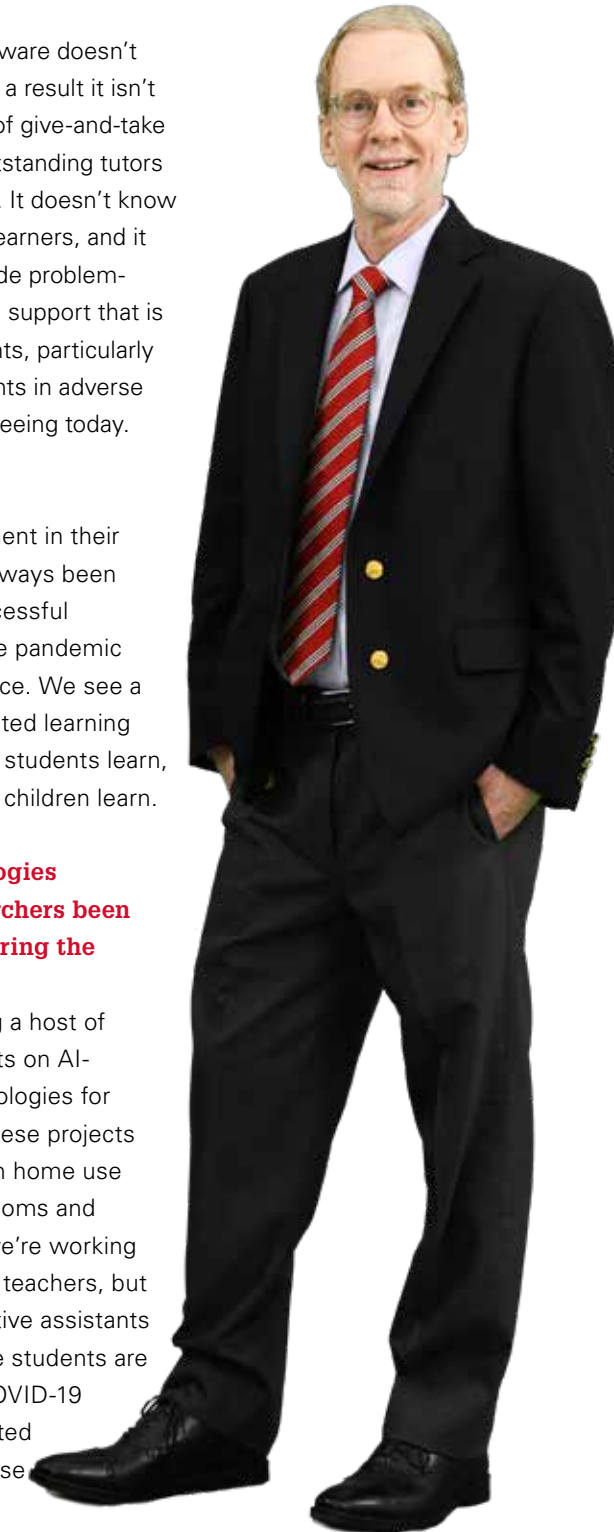
Traditional educational software doesn't "understand" students. As a result it isn't able to engage in the kind of give-and-take that teachers do or that outstanding tutors can in one-on-one learning. It doesn't know what motivates particular learners, and it doesn't know how to provide problem-solving advice or emotional support that is tailored to individual students, particularly for underperforming students in adverse circumstances, like we're seeing today.

How can parents help?

Parents' in-depth involvement in their children's education has always been a major contributor to successful learning outcomes, and the pandemic is highlighting its importance. We see a future in which AI-augmented learning technologies not only help students learn, but help parents help their children learn.

Have any of the technologies developed by CEI researchers been utilized by educators during the pandemic?

CEI currently is conducting a host of federally supported projects on AI-augmented learning technologies for K-12 education. None of these projects were originally centered on home use — they were all for classrooms and museums. For example, we're working on cognitive assistants for teachers, but now we need these cognitive assistants to support teachers whose students are working remotely. With COVID-19 developments, we've pivoted and are excited to pilot these technologies in home use. Stay tuned! ■



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