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CSC NEWS

DEPARTMENT OF COMPUTER SCIENCE | FALL 2017

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50 years of computer science

DEPARTMENT MARKS 50 YEARS OF EXCELLENCE

LETTER FROM THE DEPARTMENT HEAD LAURIE WILLIAMS

Dr. Laurie Williams

Welcome to our newly redesigned Department of Computer Science magazine. We are combining our *Impact* and *Connected* newsletters to streamline how we share information about the department with our alumni, corporate partners and friends. It is a pleasure to update you on the happenings in Computer Science.

As many of you know, I assumed the role of interim department head in January when our department head, Dr. Mladen Vouk, stepped down from the role he's held for the last 11 years. He will continue to serve NC State University in the very important role of associate vice chancellor for research development and administration, director of the NC State Data Science Initiative, and as a computer science faculty member. The plan going forward is to carry out a national search for a new computer science department head during the 2017-18 academic year with the intent of having a new department head in place by the fall of 2018.

This is a red-letter year for the NC State Department of Computer Science. I am very excited about the plans for the Department's 50th year anniversary celebrations this fall. A highlight will be the induction of the inaugural class of the Computer Science Alumni Hall of Fame. Details about all the 50th Year events are shared elsewhere in this newsletter, or you can find more information online at **csc.ncsu.edu/50-year-celebration**.

We have experienced much success over the past year with the Department, our students and faculty receiving numerous awards and honors. However, there are a few highlights that deserve special notice:
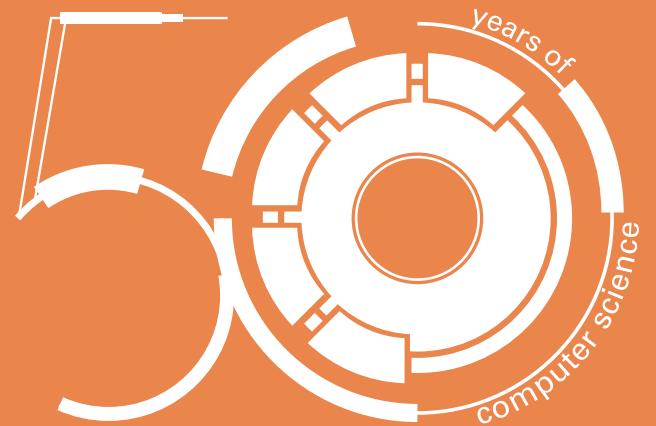
- According to the latest data from the American Society for Engineering Education (ASEE), NC State ranks first in the nation in number of female tenure-track/tenured faculty members in departments of computer science in colleges of engineering. The department currently has 20 female faculty members and several other female adjuncts.
- Dr. Min Chi is the department's most recent recipient of an NSF CAREER Award. She becomes the 28th NSF CAREER Award winner in the NC State Department of Computer Science (25 currently on faculty), one of the highest concentrations of any department in the nation.
- Dr. Frank Mueller has been named an IEEE Fellow for his contributions to real time, embedded systems, and timing analysis research. He is now the seventh IEEE Fellow in the department.
- The Game Design Program at NC State has been recognized as one of the "Top 50 Undergraduate Schools to Study Game Design for 2017" on the *Princeton Review*'s annual list that salutes the best schools in the U.S. and Canada. NC State ranked seventh on the list of public universities, and 38th overall.

As we celebrate our first 50 years, it's easy to see the tremendous impact the Department of Computer Science has had. The Research Triangle Park was built on the talent produced by this department. About 70 percent of our 9,000 alumni have remained in the area. It has been estimated that every dollar invested in our department by the North Carolina General Assembly has yielded a return of $8-12. However, more than 10 percent of our alumni base is in the Silicon Valley and Seattle areas, with mission-critical software engineering jobs on products and services we use every day. From your iPhone to Google Maps, from an Amazon order to your Pinterest page, NC State computer science alumni are helping shape the experience.

We hope to see you on campus this fall as we celebrate 50 years of success, while we look toward an exciting future.

Laurie Williams

Dr. Laurie Williams
Interim department head and professor

CELEBRATING
50 YEARS
OF COMPUTER SCIENCE AT NC STATE

From its humble beginnings in the basement of Patterson Hall 50 years ago, to its modern and expansive footprint on Centennial Campus, NC State's Department of Computer Science has emerged as one of the nation's leading producers of computer science talent and cutting-edge research. To commemorate this auspicious milestone in our department's history, a number of special events and activities are planned including:
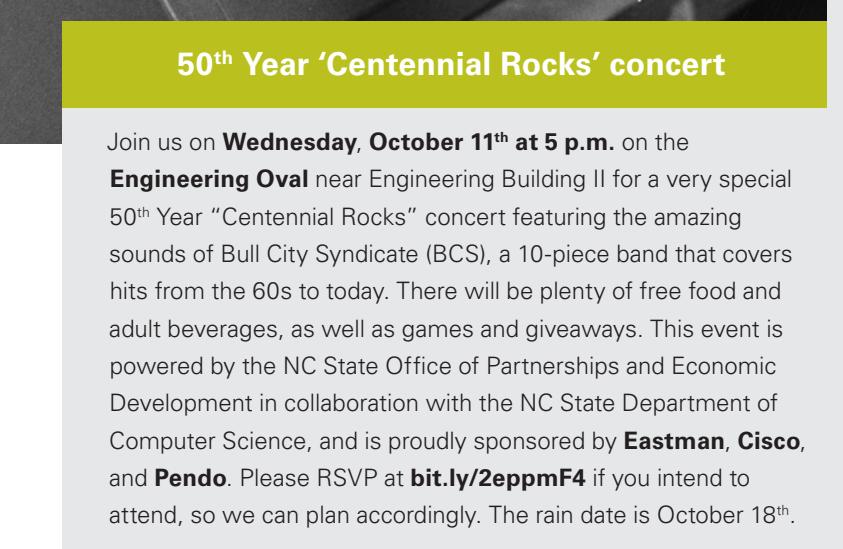
Department history update

Thanks to retired faculty member Carol Miller (and her accomplice Carol Lee), many interviews with faculty members, alumni and students were conducted over the last year, resulting in an update to the department's history over the last 10 years. Check out the 2007-17 history update (**csc.ncsu.edu/department/publications/50_Years_07-17.pdf**) as well as all the department's history documents (**csc.ncsu.edu/department/history/index.php**).

Louisville vs NC State game sponsorship

On **Thursday**, **October 5th**, the eyes of the nation will be on Carter Finley Stadium as NC State hosts Louisville on ESPN in a game sure to have huge ACC Championship implications. If you will be among the 60,000 in attendance or among those watching on TV or listening on the radio, be on the lookout as the Department of Computer Science will be one of the prime sponsors of this game, leveraging the national exposure to promote our 50th Year. Co-sponsoring the game with us are ePartners **IBM** and **Fidelity Investments**.

50th Year 'Movie on the Oval'

There is nothing quite like enjoying a great movie outside under the stars! Bring a blanket or lawn chairs and join us out on the Engineering Oval on the evening of **Friday, October 20th** for a special viewing of '*The Imitation Game*' on a giant outdoor screen. Guests are invited to arrive between **6 and 6:30 p.m.**, and enjoy free pizza, Howling Cow ice cream, popcorn and sodas. The movie will begin by **6:45 p.m.** as the sun sets. In case of inclement weather, everything will shift to the James B. Hunt Jr. Library Auditorium. This special event will be co-hosted by our CSC Ambassadors and the ACM/AITP and WiCS student organizations, and is sponsored by **Capital One** and **VMware**.
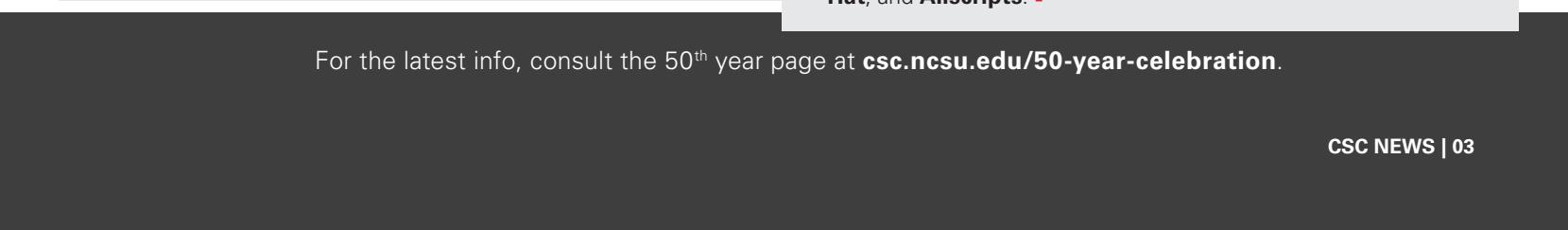
Share a memory

Computer science alumni are invited to share a short story or memory from their time in the department to be referenced during the 50th Year celebrations. All memories are welcomed as well as associated files, photos and videos. This can be accessed using the following link: **bit.ly/2xCWsK0**.

50th Year Technical Symposium and Reception

Join us on **Friday**, **October 13th**, for a very special day-long celebration at the James B. Hunt Jr. Library. In the morning, we will enjoy a walk down memory lane, with faculty and alumni panel discussions that provide a retrospective look at the department's history. During a catered meal of traditional North Carolina BBQ and fried chicken, guests will have an opportunity for guided tours of the James B. Hunt Jr. Library and Engineering Building II. We shift gears in the afternoon session, hearing from a variety of futurists who will challenge us with a vision of the future, and how computer science will need to evolve over the next 50 years. Following the Tech Symposium, guests will be invited to join us for a very special 50th Year Reception, where we will enjoy comments from university leaders and dignitaries, special entertainment, and an array of heavy hors d'oeuvres and adult beverages. This special day will be possible thanks to the generous sponsorship of **Capital One**, **BCBS of NC**, **LexisNexis**, **Dell EMC**, **Fidelity Investments**, **LabCorp**, **Merck**, **NetApp**, **Oracle**, **Premier**, **Red Hat**, and **Allscripts**.

Computer Science Alumni Hall of Fame

On **Thursday, October 12th**, at a special 'invitation only' event at the Park Alumni Center, we will celebrate the induction of the inaugural class of the CSC Alumni Hall of Fame. We will also recognize a select group of Young Alumni Award winners. The new Hall of Fame was established to celebrate and recognize the exemplary contributions our outstanding graduates have made to their profession, their community and to the world at large. This special awards ceremony is proudly sponsored by **SAS** and **Dude Solutions**. For more information and/or to nominate someone for future consideration, go to **csc.ncsu.edu/alumni/hall-of-fame.php**.

50th Year 'Centennial Rocks' concert

Join us on **Wednesday**, **October 11th at 5 p.m.** on the **Engineering Oval** near Engineering Building II for a very special 50th Year "Centennial Rocks" concert featuring the amazing sounds of Bull City Syndicate (BCS), a 10-piece band that covers hits from the 60s to today. There will be plenty of free food and adult beverages, as well as games and giveaways. This event is powered by the NC State Office of Partnerships and Economic Development in collaboration with the NC State Department of Computer Science, and is proudly sponsored by **Eastman**, **Cisco**, and **Pendo**. Please RSVP at **bit.ly/2eppmF4** if you intend to attend, so we can plan accordingly. The rain date is October 18th.

For the latest info, consult the 50th year page at **csc.ncsu.edu/50-year-celebration**.

NC State ranks first in the nation in CSC female faculty members

According to the data from the American Society for Engineering Education (ASEE), NC State ranked first in the nation in number of female tenure-track/tenured faculty in departments of computer science in colleges of engineering in 2014-15*. The department currently has 20 female faculty members and several other female adjuncts (*14 represented in the picture above*).

Former department head Dr. Mladen Vouk, noted "We are thrilled to be in this position of leadership. Our number one priority is always to find the very best faculty candidates available to meet our needs."

In a field traditionally dominated by men, the women of NC State's Department of Computer Science truly flourish both in number and achievement.

NC State computer science is particularly well positioned with some of the nation's leading authorities in the field including Dr. Laurie Williams, one of the foremost researchers in agile software development and in the security of healthcare IT applications; Dr. Carla D. Savage, a world renowned

mathematician who now serves as the secretary of the American Mathematical Society; Dr. Nagiza Samatova, a data analytics expert who has conducted impactful climate change research; and Dr. Helen Gu, whose research recently led to the launch of InsightFinder.com, a cloud monitoring and system analytics startup.

In recent years, the department has been on a mission to add high-quality teaching professors to the faculty, Ph.D.s whose primary focus is teaching rather than research. Dr. Sarah Heckman was the first to be hired. Now, four of the six teaching professors are women. These high-quality teaching professors provide a strong educational foundation for all computer science undergraduates.

Williams, interim department head, maintains that a strong female faculty presence, both from a teaching and research perspective, is key to successful women pursuing degrees in computer science. "It's very natural, and I think it has a very positive effect on the student body."▪

2014-15 ASEE Tenure-Track/Tenure Faculty Demographics

Department launches Faces of Computer Science display

Upon entering Engineering Building II on NC State's Centennial Campus, the passion for computer science from students and faculty members is hard to miss. A new display located in the main classroom hallway in the east wing of the building entitled Faces of Computer Science makes by-passing this passion nearly impossible.
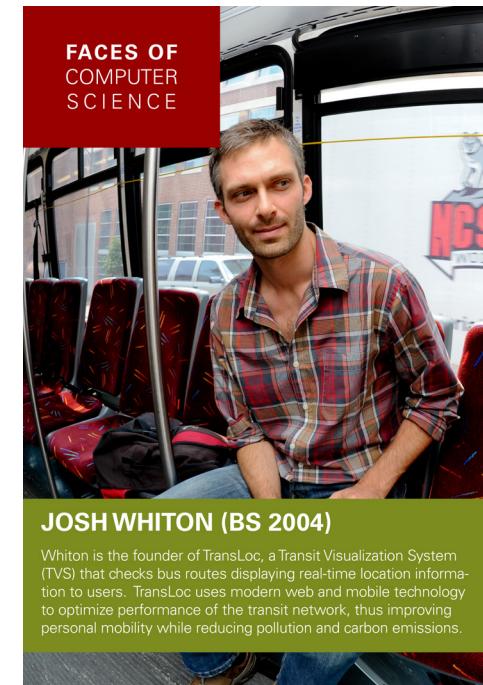
The display highlights more than a dozen current or former students who are using their computer science degrees, many combined with a life passion, to make a real impact on the world. Diversity of gender and ethnicity, as well as diversity of thought and career interests, are a common thread in the display that includes entrepreneurs, game developers, scientists, a weatherman and an aspiring astronaut.

Central to the powerful message in the display, according to Ken Tate, director of engagement and external relations, is that you can do anything with a degree in computer science. "I tell students all the time that a degree in computer science is a 'magic ticket.' Combine this degree with a passion for anything and you can change the world."

According to Tate, the display is an extension of the department's comprehensive outreach campaign designed to help shape a more realistic understanding and perception of what computer scientists do in their careers. "Computer science is not coding and programming, rather it is a technology enabler that allows for creative and innovative problem solving," says Tate.

The picture of each current or former student featured in the display is presented on colorful 24 by 36 high gloss metal prints along with their major accomplishments in computer science.

FACES OF COMPUTER SCIENCE

JOSH WHITON (BS 2004)
Whiton is the founder of TransLoc, a Transit Visualization System (TVS) that checks bus routes displaying real-time location information to users. TransLoc uses modern web and mobile technology to optimize performance of the transit network, thus improving personal mobility while reducing pollution and carbon emissions.
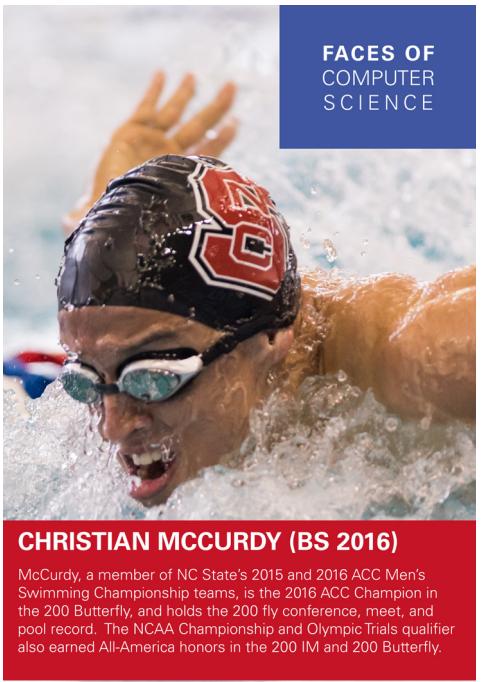

FACES OF COMPUTER SCIENCE

KHALIA BRASWELL (BS 2013)
Braswell is a user experience engineer at Apple where she helps design experiences for enterprise applications. In 2014, she founded the INTech Foundation, a nonprofit organization whose mission is to inform and inspire girls to innovate in the technology industry. To date, INTech has reached over 400 minority girls across North and South Carolina, through hosting one-day camps, mini-camps and summer camps.

FACES OF COMPUTER SCIENCE

BUSHRA ANJUM (PHD 2012)
Anjum is a tech lead at Amazon for the Amazon Prime program, a data science and performance evaluation researcher, and an advocate for improving diversity in STEM.

FACES OF COMPUTER SCIENCE

CHRISTIAN MCCURDY (BS 2016)
McCurdy, a member of NC State's 2015 and 2016 ACC Men's Swimming Championship teams, is the 2016 ACC Champion in the 200 Butterfly, and holds the 200 fly conference, meet, and pool record. The NCAA Championship and Olympic Trials qualifier also earned All-America honors in the 200 IM and 200 Butterfly.

Tate says, "The display is arranged like a gallery, and we expect this to be a very popular tour stop for prospective students visiting campus."

All images currently up in display can be viewed online at flickr.com/photos/cscncsu/sets/72157675411061186. ▪

Sit With Me: NC State, Eastman hold "Red Chair" event to increase women in IT

The number of women who choose careers in information technology has declined dramatically. Last fall, NC State and Eastman co-hosted an event at Talley Student Union designed to bring about change.

Sit With Me, which drew students, NC State faculty members and Eastman professionals to Talley Student Union, offered all participants the chance to sit in the iconic Sit With Me "Red Chair" to express thoughts of encouragement or empowerment to women. Sit With Me is a nationwide initiative created by the National Center for Women and Information Technology (NCWIT).

Meryl Streep has sat in the Red Chair; Shaquille O'Neal, too. So has Facebook executive and "Lean In" author Sheryl Sandberg, in order to get the word out that women can find promising careers and make a difference in IT.

And you can be sure that NC State's Dr. Lina Battestilli has something to say about women in IT, too. Battestilli, a teaching assistant professor in the Department of Computer Science, is the faculty sponsor of Women in Computer Science at NC State.

"Sit With Me brings together students, faculty, and industry to showcase the many exciting opportunities in computer science today," Battestilli said. "We hope to generate discussion, share experiences, answer questions and break stereotypes on what computer scientists look like. We especially want to reach out to undecided female freshmen and encourage them to consider a computer science degree."

The approximately 200 students who attended Sit With Me were able to speak to Eastman IT professionals and NC State faculty members — from the Department of Computer Science and the College of Engineering — about the wide spectrum of careers available in tech innovation.

Those students were also made aware of the stark numbers of women in IT.

Women held 57 percent of the U.S. professional occupation positions in 2014, but only 26 percent of the professional computing jobs. In 2013, only 18 percent of bachelor's degree recipients in computer and information science were women. In 1985, that number was 37 percent.

Eastman vice president Keith Sturgill, the company's chief information officer, was a keynote speaker along with Terry Morreale, chief technology officer for NCWIT.

Sturgill said it's essential for Eastman to be involved with Sit With Me because of the educational component and the potential for empowering women. The two institutions have close ties, as NC State is one of the primary pipelines for recruiting talented computer science graduates, and Eastman maintains the Eastman Innovation Center on Centennial Campus.

"We're a global company, a Fortune 500 company, and we are constantly competing with other companies to hire the best and brightest people in the world to fill positions in information technology," Sturgill said. "We need to change the trend because women represent half or more of our available talent pool, and there's little doubt that many women who could be excellent IT professionals don't consider it for a career.

"We're making a concerted effort to turn that tide." ▪

New system makes it harder to track Bitcoin

Researchers from NC State, Boston University and George Mason University have developed a Bitcoin-compatible system that could make it significantly more difficult for observers to identify or track the parties involved in any given Bitcoin transaction.

Bitcoin was initially conceived as a way for people to exchange money anonymously. But then it was discovered that anyone could track all Bitcoin transactions and often identify the parties involved.

Bitcoin operates by giving each user a unique public key, which is a string of numbers. Users can transmit money in the form of digital Bitcoins from one public key to another. This is made possible by a system that ensures a user has enough Bitcoins in his or her account to make the transfer. The use of the public keys gave users a sense of anonymity, even though all of the transactions were visible on the public Bitcoin blockchain which lists all transactions. Over time, experts and private companies have developed highly effective methods of de-anonymizing those public keys.

Now researchers have developed a system called TumbleBit, which is a computer protocol that runs on top of Bitcoin.

TumbleBit takes advantage of an existing concept called "mixing service." The idea works like this: instead of Party A paying Party B directly, many different Parties A pay an intermediary "tumbler," which then pays the Parties B. The more parties are involved, the harder it is to determine which Party A paid which Party B.

"However, this still has a security flaw," says Alessandra Scafuro, an assistant professor of computer science at NC State and co-author of a paper describing TumbleBit. "Namely, if an outside observer can compromise the tumbler, it could figure out who was paying whom."

To address this, TumbleBit takes a three-phased approach.

In the first phase, called escrow, the Parties A notify the tumbler that they would like to make a payment, and the Parties B notify the tumbler that they would like to be paid. This is all done on the public blockchain.

For the second phase, the researchers have put cryptographic tools into place that allow the tumbler to pay the correct parties without actually knowing which parties are involved. Phase two does not appear on the blockchain.

In the third phase, called cashout, all of the transactions are conducted simultaneously, making it more difficult to identify which parties are involved in any specific transaction. Phase three does appear in the public blockchain.

"We tested TumbleBit with 800 Bitcoin users, and found that the second phase only took seconds to complete," Scafuro says.

"One limitation of TumbleBit is that, right now, the system is designed to work with a fixed denomination – so paying amounts larger than that denomination require making multiple payments," Scafuro says. "That's something we're working on." ▪

There is nothing like dancing after all, it is one of the first refinements of polished societies.

NOT SO SILENT MOVIE

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"Not So Silent" film project a success for NC State's Visual Narrative Cluster

Visitors walking through the second floor entrance of James B. Hunt Jr. Library are greeted by the iPearl Immersion Theatre that shows a wide variety of exhibits provided at NC State. One of the newest additions to the theatre is a collaborative exhibit that combines art, design, and computer science — the Not So Silent film project. Professors, students, and faculty members worked together to create the progressive exhibit.

Everyone using the exhibit begins with the same content: clips of black and white American Western films, and "Pride and Prejudice" title cards. After considering the clips, visitors are able to assemble them any way they want to create their own story. Once these sequences of clips are gathered from visitors, analysis is done to eventually train algorithms that could combine small units of narrative to create richer stories.

Arnav Jhala, co-director of the Visual Narrative Cluster and associate professor of computer science, explains the original idea behind the exhibit:

"We wanted to create a system that would simultaneously allow us to gather data on how people create many types of stories from a small set of visual units in the form of an engaging and enjoyable experience."

Keeping true to the exhibit's collaborative roots, many different individuals played a part in its creation. Hope Hutman, artist-in-residence for the Visual Narrative Cluster, contributed to the artistic design and direction of the project. Film curation
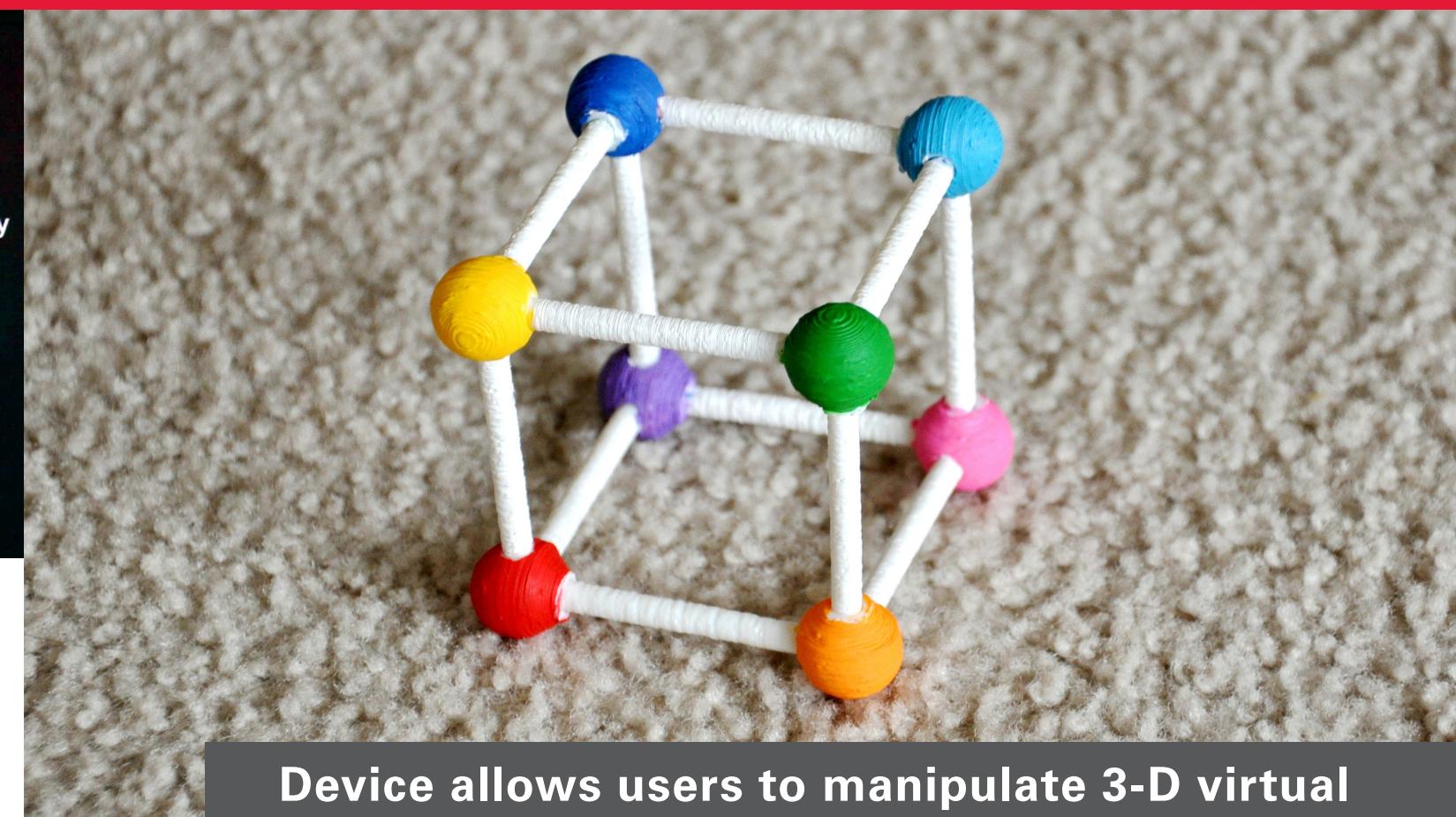
and editing help came from Harrison Smith, an NC State design student. Fellow NC State students Daxit Agarwal and Matthew Scott Riegel also played vital roles in the project. Agarwal worked with UI Design, and Riegel took on the role of lead developer. Together, the team of faculty members and students was able to piece together the interdisciplinary exhibit that wouldn't have been possible without the University's Visual Narrative Cluster.

Agarwal, who was introduced to the project through an extra credit opportunity, is thankful for the chance to work with not only a team of professionals, but also older students in the same field of study.

"Having someone like Riegel who has much more experience, and getting to collaborate with another developer in a team setting, was a huge thing for me."

After just nine months of the cluster's creation, Jhala credits the Visual Narrative Cluster for the project's success. "It wouldn't have been possible without all of the support from several different departments, from English to history, from the College of Design to computer science and electrical engineering."

The clips, title cards, and movie-making aspect of the project take on an artistic approach, while the algorithms and data collection gathered take a more mathematical viewpoint of the exhibit. Together, both disciplines bring a better understanding of each topic while building possibilities for future projects. ▪

Device allows users to manipulate 3-D virtual objects more quickly

Researchers in the department have developed a user-friendly, inexpensive controller for manipulating virtual objects in a computer program in three dimensions. The device allows users to manipulate objects more quickly — with less lag time — than existing technologies.

The device, called CAPTIVE, offers six degrees of freedom (6DoF) for users — with applications ranging from video gaming to medical diagnostics to design tools. CAPTIVE makes use of only three components: a simple cube, the webcam already found on most smartphones and laptops, and custom software.

The cube is plastic, with differently colored balls at each corner. It resembles a Tinkertoy, but is made using a 3-D printer. When users manipulate the cube, the image is captured by the webcam. Video recognition software tracks the movement of the cube in three dimensions by tracking how each of the colored balls moves in relation to the others. Video demonstrating CAPTIVE can be seen at **https://youtu.be/gRN5bYtYe3M**.

"The primary advantage of CAPTIVE is that it is efficient," says Zeyuan Chen, lead author of a paper on the work and a Ph.D.

student in the department. "There are a number of tools on the market that can be used to manipulate 3-D virtual objects, but CAPTIVE allows users to perform these tasks much more quickly."

To test CAPTIVE's efficiency, researchers performed a suite of standard experiments designed to determine how quickly users can complete a series of tasks.

The researchers found, for example, that CAPTIVE allowed users to rotate objects in three dimensions almost twice as fast as what is possible with competing technologies.

"Basically, there's no latency; no detectable lag time between what the user is doing and what they see on screen," Chen says.

CAPTIVE is also inexpensive compared to other 6DoF input devices.

"There are no electronic components in the system that aren't already on your smartphone, tablet or laptop, and 3-D printing the cube is not costly," Chen says. "That really leaves only the cost of our software." ▪

LexisNexis and NC State open user experience lab

Three years after moving into the former Red Hat building on NC State University's Centennial Campus, LexisNexis has launched an initiative that site lead Mike Lipps hopes will improve how humans and technology interact.

The legal software firm has opened a user experience lab, dubbed the LexisNexis Experience Innovation Studio, part of $3 million in recent renovations. The 1,500-square-foot lab is the product of a partnership between LexisNexis and the University. NC State donated equipment to the effort and LexisNexis funneled in the cash. Lipps says the two are working together to innovate user experiences.

"I think it's consistently demonstrated that companies that deliver outstanding user experiences tend to do much better financially from a shareholder standpoint," he says. "We've declared Raleigh to be the technology center for LexisNexis … and we want to be known locally as a leader in the field of user experience and user design."

Lipps says he'd been pushing for a lab like this since signing on with Centennial Campus. While the space's physical creation started in September, he'd had something similar in mind since working at Intuit in Silicon Valley — which also hosted a user experience lab.

By basing the facility on the first floor, LexisNexis is creating an "experience studio" students can walk through easily, he says.

Both LexisNexis and NC State are jointly operating the lab, which is available to employees building project engagement sessions and university students working on their own ideas and projects. The goal is to create new solutions to problems that haven't yet been explored. Lipps envisions teams from multiple departments — from engineering to social sciences — collaborating with LexisNexis staff on new innovations.

"For us in the legal industry, we think this is pretty unique," he says. "Clearly, the most unique part of it is doing this in concert with one of the best technical universities anywhere in the country."

LexisNexis CEO Mike Walsh called the collaboration "the next milestone in our company's innovation journey."

"It gives LexisNexis the ability to serve our customers in a new way — researching, testing and refining the latest thinking in user experience," he stated. "At the same time it gives students meaningful real-world experiences that tackle technology challenges and help advance the rule of law around the world."

LexisNexis has more than 600 employees in the Triangle and is the largest employer at Centennial Campus. ▪

New tech to help companies detect and respond to cloud computing performance bugs

Dr. Helen Gu

In late 2012, Dr. Helen Gu presented a research paper on a new tool designed to prevent disruptions in cloud computing. Less than four years later, she has launched a start-up to help companies that use cloud computing to improve the user experience for their customers.

"The technology I developed has evolved significantly since 2012," says Gu, an associate professor of computer science. "What was then a proof-of-concept is now a technology that works seamlessly with real-world cloud systems, like Amazon Web Services, with a click of a button."

Gu's technology allows companies that use cloud computing to gain insight into user and program behavior in order to diagnose potential problems in their code, so that it can be corrected quickly. The technology can also prevent performance disruptions in cloud-hosted applications by automatically identifying and responding to potential anomalies before they can develop into disastrous service outages.

"What we're doing is important, because services like Spotify and Snapchat are constantly deploying updates to their code," Gu explains. "Our technology can help these companies prevent or detect problems in the updated code and, ultimately, improve the user experience.

"I launched my start-up, InsightFinder Inc., to make this technology available to companies – like Snapchat or Netflix – that use the cloud to deliver their services."

In 2013, NC State's Office of Technology Transfer filed for a patent on the technology. Gu started InsightFinder in November 2015.

The start-up was made possible by a highly competitive National Science Foundation Small Business Innovation Research grant that Gu is using to develop, test and fine-tune prototypes.

InsightFinder's three services are: a basic cloud-monitoring service; a premium smart monitoring service, which she says is more powerful and accurate than existing products on the market based on real-world application testing with a pilot customer; and a batch data analysis service that allows customers to upload historical data to get insights on what caused a performance problem in the past. ▪

Department creates Graduate Certificate in Data Science Foundations

The Department of Computer Science and the Department of Statistics at NC State have created a Graduate Certificate in Data Science Foundations (DSF).

This online/on-campus program is primarily intended for working professionals who have some formal training in computer science and/or statistics and wish to acquire a basic understanding of data science to improve their on-the-job experience and career prospects.

Students must meet at least one of the following requirements for admission into the DSF Graduate Certificate Program: (1) Have a B.S. in computer science from an accredited four-year college or university, and have an overall (or major) GPA of at least 3.0 on a 4-point scale; (2) Have a B.S. in statistics from an accredited four-year college or university, and have an overall (or major) GPA of at least 3.0 on a 4-point scale; (3) Have a B.S. degree in the sciences or engineering from an accredited four-year college or university with an overall (or major) GPA of at least 3.0 on a 4-point scale, and relevant experience in computer science and/or statistics; (4) Be a degree-seeking student in good standing in an NC State graduate program in the sciences or engineering.

Dr. George Rouskas, professor and director of graduate programs, says, "This data sciences certificate program will provide students with a solid foundation in both computer science and statistics. Core and elective courses are designed to provide our students a basic understanding of data science to improve their current and future career prospects."

For more information on the Graduate Certificate in Data Science Foundations and its curriculum requirements, please visit **csc.ncsu.edu/academics/graduate/degrees/dsf.php**. ▪

Onorio's Walk West changing the way companies do business

Digital-first marketing agency has many success stories.

Brittany Johnson is empowering young females to pursue computer science

Ph.D. grad challenges traditional notion of who a computer scientist is.

LONG AGO, a newspaper columnist wrote "Go West Young Man, Go West" and the phrase captured the attention of many Americans looking for new beginnings. It also rang true for NC State computer science alum Brian Onorio (CSC BS '04) during his venture into the working world.

Onorio blended his knowledge of computer science with marketing to create the digital-first marketing agency, Walk West. A new age version of "Mad Men," Walk West is an innovative and groundbreaking company leading the way for digital issue advocacy.

The company's name communicates its willingness to push boundaries and explore the unknown.

"The movement west has always been bravery, the courage to do something different," said Onorio.

In a world that places such emphasis on technology, Onorio believes this technology has completely transformed marketing.

"You can't really market effectively without some kind of technology," he said.

His agency works to build infrastructure that supports various types of marketing, ranging from web design to social media marketing to content creation. A recent merger with a public and government affairs firm run by Onorio's wife, Laurie, resulted in a fresh digital approach to issue advocacy.

Among the success stories to their credit, Onorio points to North Hills in Raleigh, NC. An upscale collection of boutiques and restaurants, the digital presence of North Hills was redesigned by Walk West to better match the experience a customer receives. Walk West personalized the online experience using web design and WordPress technologies. The new website works like an app and reduces number of clicks to get to a destination within the site. These changes resulted in a 40 percent increase in pages per session and 8 percent decrease in bounce rate.

The Rex Women's Center of Raleigh, NC also employed the company to create a fun and entertaining video showing mothers why they should choose Rex Health Center to deliver their babies. The video used real nurses and doctors while relaying real information in an interesting way.

A company centered around progress, Onorio compares Walk West to English settlers traveling West in search of a new world.

"We're not afraid to do things differently. Above convention, above the standard, above the normal, we really want to think and go beyond what that means."

Walk West specializes in helping companies campaign and lobby online, and gain awareness and support for their issues. Specifically, Walk West brings this service to the digital forefront offering a virtually one-of-a-kind service. The "pioneers" of Walk West strive to do things differently, bringing a new approach to digital issue advocacy and digital marketing.

Based in Raleigh on NC State's Centennial Campus, Onorio credits close ties to the University with the relationships he made as a student. "I really loved the people that I surround myself with at NC State. I've got a soft spot in my heart for the school. It's a place I love being back."

Like so many of his fellow computer science alums who have taken life's entrepreneurial path, Onorio found a way to leverage his computer science degree with a passion for marketing to launch a company that is disrupting the space in a new and pioneering way.

"NC State prepared me very, very well for the world. NC State certainly gave me a lot and any chance I have to give back to the community, specifically to the department of computer science, it's always rewarding." ▪

> ## "We're not afraid to do things differently."
> - Brian Onorio

BRITTANY JOHNSON has a passion. As an NSF Graduate Research Fellow and Ph.D. student in computer science, she pursued research on improving developer productivity. But while she strives to improve workplace efficiency, she works just as passionately on recruiting young women and diverse student populations into the field of computer science. Because to her, therein lies an untapped market.

"Women and diverse populations are desperately under explored in the field of computer science," said Johnson, who completed her Ph.D. in the department in 2017 and is now a post-doctoral researcher at the University of Massachusetts, Amherst. "I'm so curious about what keeps them from exploring the field and how to reach them so they won't dismiss it without knowing all about the program."

It could be a lot of things, she speculates.

"Maybe they think it is a lot of math, maybe they feel out of place as the minority, maybe they just don't feel the love from their professors and fellow students," she said. "But it could be much more minor than that, like they really can't imagine doing anything else in computer science other than coding and sitting at a desk all day."

She is quick to dispel that notion herself.

"I'm very social and I don't want to be at a desk all day either," she said. "The stereotypical image of a white male who is one dimensional is not what computer science is about. It is about creative problem-solving."

Her first exposure to the field is a perfect example, as she was a high school student editing MySpace pages when her creativity and skill set were noticed by her teacher.

"I had a female teacher that noticed that I had a knack for it," she remembered. "I took a programming class in high school and it was sort of my 'aha' moment regarding considering the field as a career path."

When putting together the puzzle of why women and minorities seem to miss out on computer science careers, Johnson does identify one specific missing piece.

"I think a lot of what is missing in recruiting for computer science is in academia," she said. "I think that basic education about the field is missing in the classroom, particularly in the younger grades and that is what I am working to improve upon."

To broaden the message to the groups she hopes to reach, she is an active advocate in many forums. As a Ph.D. student at NC State, she volunteered with Hi-Tech Teens, an afterschool program available at the Wade Edwards Learning Lab in downtown Raleigh, where students learn about coding and participate in interactive projects. She has also led engineering camps for middle school girls and served as judge for the Louis Stokes Alliance for Minority Participation program.

For all that she does to provide outreach, Johnson holds firm to her ideals of providing more opportunities for students to connect with the computer science field in the classroom. Her plans are to stay in academia and become the same type of catalyst as the educators who helped her along the way.

"I plan to follow my passion for research, spreading knowledge and inspiring others like me to pursue a degree and career in technology," she said.

And with her infectious enthusiasm for her field, she most certainly will. ▪

> ## "Women and diverse populations are desperately under explored in the field of computer science"
> - Brittany Johnson

Student project evolves into new tool for the biotech industry

RiboWiz bacteria benefit everything from biofuels to antibiotics.

Outgoing graduate designs her own destiny

Journey from India to NC State leads to position with Microsoft

WHEN SCOTT VU started working on a computer science research project as a teenager, he didn't realize it would lead him down a path to earning a Ph.D. in biomedical engineering and launching a company designed to help the biotechnology industry operate more efficiently.

But Vu's story has been anything but typical.

At the age of 4, he and his family were smuggled out of Vietnam on a boat. "Escaping," Vu says. At the age of 15, he enrolled at NC State as a full-time student, working toward a triple major in computer science, computer engineering and electrical engineering.

As an undergraduate, Vu began working with his mentor, Dr. Donald Bitzer, on a project aimed at creating a computer-based biophysical model to understand how to manipulate genes in bacteria to get those bacteria to produce specific proteins that they would not normally produce. The idea was that these bacteria would offer an easier, less expensive way to create proteins for use in manufacturing everything from biofuels to antibiotics.

Vu's undergraduate project grew into a Ph.D. dissertation as he pursued a doctorate in the joint biomedical engineering program at NC State and UNC-Chapel Hill. In graduate school, Vu learned myriad life science techniques he needed to test the model in vivo, conducting the necessary experiments in the lab of NC State microbiologist Eric Miller with the help of undergraduate research assistants Adriano Bellotti, Chris Gabriel and Hayden Brochu.

Incorporating techniques from computer science, biophysics, molecular biology and microbiology, Vu was ultimately able to not only fine-tune his model, but to use the model to "optimize" genes in bacteria so that they would produce many desired proteins quickly and accurately.

Creating individual proteins is important to biotech companies because proteins are used across a broad range of industrial applications. For example, proteins can be used in wastewater treatment, laundry detergent, winemaking, and to develop drugs for treating diseases like diabetes and cancer.

In late 2012, in the midst of his research on protein synthesis, Vu was inspired by a talk with Dr. Mladen Vouk, one of his Ph.D. committee advisers, to launch a venture and pursue a patent for the biophysical model he had developed. Thus began the lengthy process of learning what he needed to know about the business world.

Vu began working with NC State's Office of Technology Transfer and took two courses that he credits with setting him on the right track. One was a class with Dr. Steve Markham in NC State's Poole College of Management, where he met fellow students William Glauser and Joseph Thomas, who would become co-founders of his company, RiboWiz Scientific. The other course was the "FastTrac" entrepreneurial training program with the Council for Entrepreneurial Development.

"These courses taught me what I needed to know about bringing an idea to the market – doing market research, estimating costs and profits, developing a business plan, pitching ideas to investors," Vu says. "It was eye-opening."

Ultimately, Vu created RiboScan™, a web-based tool based on the model he started developing as an undergraduate. A patent was submitted on Vu's technology before he completed his Ph.D., and he has already incorporated his company. RiboWiz is now seeking industry partners to commercialize the technology.

"We only incorporated RiboWiz in October 2015, but we are already able to work with customers," Vu says. "We are looking forward to using our technology to help industry partners produce proteins they've been unable to make in the past. And we're also planning to file Small Business Innovation Research grant proposals, which would support future research to improve our model. We plan on expanding the model to predict and maximize protein production in eukaryotes and addressing issues related to protein aggregation caused by the misfolding of proteins during synthesis.

"I'm ready to go to work." ▪

IN 2010, Vidya Srinivasan canceled Christmas. A computer science graduate student at NC State by way of Chennai, India, she had scored an unexpected internship interview with Microsoft in Seattle.

"I canceled my vacation," she said. "I reached out to all the Microsoft connections I could possibly find. I spent my Christmas with books, because I really wanted to nail that interview."

And she did. Three years into her career in tech, Vidya is now a program manager for OneDrive-SharePoint, still on the same team she interned with in 2011.

Vidya, who could outtalk a roomful of teenage girls on Red Bull, is petite and bubbly. She is also the type of person who works insanely hard for extreme goals, and doesn't necessarily see rescheduling the occasional holiday as a sacrifice. Originally from Hyderabad, India — Microsoft CEO Satya Nadella's hometown — Vidya is an only child born to banker parents who raised her to be highly independent. By age 3, she was training to be a classical singer, a career path she kept open in case computer science didn't work out. Throughout college, Vidya performed on four Indian television shows, appearing alongside some of the country's musical superstars. Last year, when her Microsoft Hackathon team, Ability Eye Gaze, appeared to be reaching the finals, she realized her planned trip to Alaska might interfere with presenting the project to Nadella if they won. So she canceled the trip. (And good thing, because they won.)

That's not to say she's never had a crisis of confidence. As a new arrival to NC State, she almost turned around and went home. "I called my mom, and I'm like, 'Mom, I think I've made a mistake,'" she said. Her fellow graduate students had several years of work experience, had already met with professors, and knew what they wanted to achieve with their degrees.

"They were asking, 'Do you know this, do you know that?'" she recalled. "I said, 'No.' 'Do you have experience?' 'No. I graduated three months ago.' People said, 'If you don't have these skills, you'll never get a job.'" The cultural shift scared her, too. "When I was an undergraduate, the coursework is prescribed. In grad school, you design your own destiny."

By the time the first career fair came around in October, Vidya knew she needed to land an internship to get ahead. "I couldn't sleep the night before," she said.

She approached a few companies and received some polite rejections. "Then I spoke to a Microsoft rep, and decided that I would tell them whatever was on my mind," she said. "The one thing I'm good at is talking."

She rattled on about all about her projects and interests and the work she was doing on campus with the Indian community. "To my surprise, I got an invitation to come interview at Microsoft for an internship within the first three months of starting graduate school," she said. "I was like, this is so unexpected."

In a Burger King, she got the news she'd been awarded the internship. "That's when I gained so much confidence," she said. "If I can do this, I can do anything."
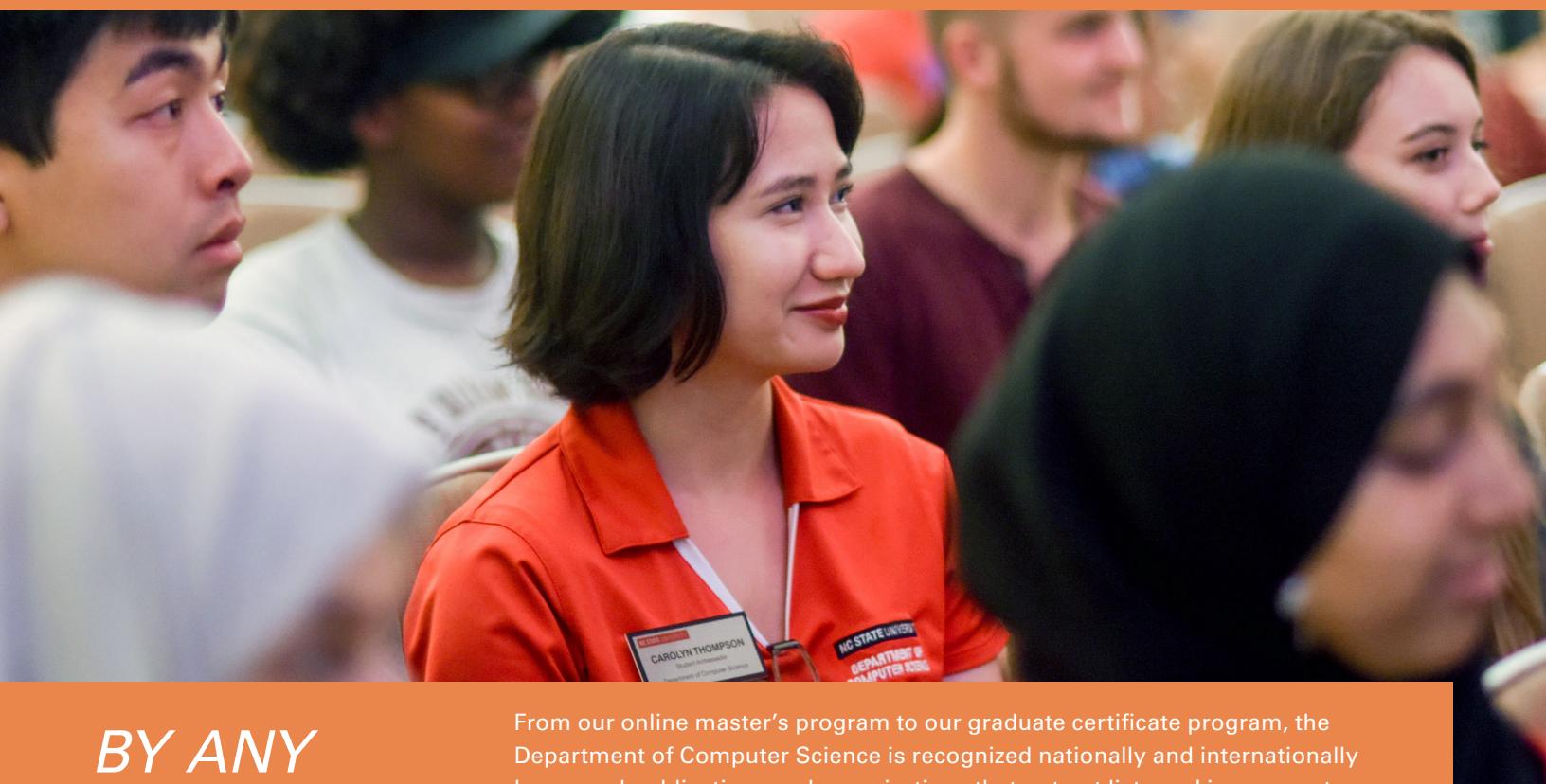
As a technical program manager at OneDrive-SharePoint, one of Microsoft's cloud-based business solutions, Vidya translates what she calls "random ideas" into action, and she's happiest designing user experiences while listening to her favorite music. As an intern, Vidya created an asset library for SharePoint, a solution she felt was calling out to be developed. She's still essentially doing the same thing now: visualizing abstract concepts, identifying gaps, assessing problems, and building solutions for the market. And while she considers herself an engineer, she's most interested in the human experience and the thrill of creating a product that will positively affect millions of customers.

Vidya opens the Wunderlist app on her phone, where she keeps two lists: her career plus-plus list, and her bucket list. Both have about a million items.

"My mom says, 'If you're doing something, be good at it,'" she said. "There's no limit on dreaming. There are a lot of things I still really want to do." ▪

BY ANY MEASURE

From our online master's program to our graduate certificate program, the Department of Computer Science is recognized nationally and internationally by several publications and organizations that put out lists ranking computer science programs. An NC State computer science degree offers a first-class education at a great price, and people are noticing.

NC STATE'S ONLINE COMPUTER SCIENCE AND NETWORKING PROGRAMS RANK IN TOP TEN

The Engineering Online computer science and networking programs at NC State have moved up to being ranked sixth nationally in the *U.S. News & World Report*'s 2017 list of the Best Online Graduate Computer Information Technology Programs.

Additionally, Engineering Online at NC State has been recognized as one of the top ten online engineering programs in the United States, coming in 9th nationally on the magazine's list of Best Online Graduate Engineering Programs.

For the 2017 edition of Best Online Graduate Information Technology Programs and Engineering Online rankings, *U.S. News* ranked schools based on five general categories:

Student engagement (25 percent) – Quality online information technology programs promote participation in courses, allowing students opportunities to readily interact with their instructors and classmates, as is possible in a campus-based setting. In turn, instructors are not only accessible and responsive, but they are also tasked with helping to create an experience rewarding enough that students stay enrolled and complete their degrees in a reasonable amount of time.

Faculty credentials and training (25 percent) – Strong online programs employ instructors with academic credentials that mirror those of instructors for campus-based programs, and they have the resources to train these instructors on how to teach distance learners.

Peer reputation (25 percent) – A survey of high-ranking academic officials in information technology helps account for intangible factors affecting program quality that are not captured by statistics. Also, degrees from programs that are well respected by academics may be held in higher regard among employers.

Student services and technology (12.5 percent) – Programs that incorporate diverse online learning technologies allow greater flexibility for students to take classes and labs from a distance. Outside of classes, strong support structures provide learning assistance, career guidance and financial aid resources commensurate with quality campus-based programs.

Admissions selectivity (12.5 percent) – Student bodies entering with proven aptitudes, ambitions and accomplishments can handle the demands of rigorous coursework. Furthermore, online degrees that schools award judiciously will have greater legitimacy in the job market.

GAME DESIGN PROGRAM RANKS IN TOP 50 AGAIN

The Game Design Program at NC State has been recognized as one of the "Top 50 Undergraduate Schools to Study Game Design for 2017" on the *Princeton Review*'s annual list, which salutes the best schools in the U.S. and Canada. NC State ranked seventh on the list of public universities, and 38th overall.

The *Princeton Review* selected the schools based on a survey it conducted in 2016 of 150 institutions in the U.S., Canada and abroad offering video game design coursework and/or degrees. The company's 40-question survey asked schools to report on everything from their academic offerings and faculty credentials to their graduates' starting salaries and employment experience. Among criteria the *Princeton Review* weighed to make its selections: the school's academics, facilities, career services and technology.

Dr. Arnav Jhala, associate professor of computer science and co-director of the Digital Games Research Initiative, said, "We are very happy to have our program recognized on this year's top 50 list. NC State's unique program includes courses taught in the top engineering and design colleges. Students in our gaming concentration have a solid foundation in the computer science curriculum, but their electives are focused on specific courses directly related to game design and development like computer graphics, artificial intelligence, and human-computer interaction." For more information on the Department of Computer Science's undergraduate concentration in game development, visit **csc.ncsu.edu/academics/undergrad/bs-csc-gdc.php**.

DEPARTMENT ACHIEVES TOP 25 US RANK

One of academia's fastest-moving disciplines — computer science — is thriving at NC State, recently receiving high accolades from an international education trade publication.

Times Higher Education, a weekly magazine based in London, released its "World University Rankings" for 2016-17, ranking the NC State computer science program 21st in the United States and 84th internationally.

The magazine evaluated each institution on five core missions: teaching, research, citations, international outlook and industry income. In order to keep the integrity of the ranking, PricewaterhouseCooper independently audited the rankings' calculations.

The number of times a university's work is published makes up the basis for citation scores. Scoring in the 90th percentile for citations, NC State's computer science program stands out for spreading knowledge globally.

International outlook is another standard used to determine ranking. Ranking in the 56.3 percentile, NC State prospers because of the program's ability to attract students and teachers on a global scale.

ONLINE MASTER'S DEGREE RATED ONE OF BEST IN THE COUNTRY

The NC State Computer Science Online Master's Degree program has been recognized as one of the top five by Go Grad, an online platform where aspiring graduate students of all ages, backgrounds, and specialties can get the information they need to make knowledgeable decisions about their education. NC State came in fifth on Go Grad's 2015-16 List of Best Master's Programs in Computer Science.

Schools were evaluated based on the number of online graduate degrees available in related subject area; graduate tuition; availability of academic and career counseling services; availability of job placement services; and the GoGrad Peer-Based Value.

The online NC State Master of Computer Science program is a terminal professional degree program designed primarily to meet the needs of working professionals. The degree is based on coursework only; no thesis or comprehensive examination is required. Courses are provided in streaming video form over the Internet through Engineering Online. Full details of the Master of Computer Science degree can be found at **csc.ncsu.edu/academics/graduate/degrees/mcs.php**.

DEPARTMENT RECOGNIZED FOR VALUE, AFFORDABILITY

The department has been recognized as one of the top programs in the country by *College Choice*, an independent online publication dedicated to helping students and their families find the right college.

NC State was recognized for offering one of the top 10 Most Affordable Online Master's in Computer Science Degrees. According to *College Choice*, those with a master's degree in the field make as much as $20,000 more than their peers with an undergraduate degree. *Forbes* has even named computer science as the second-best field in which to earn a master's degree. For those hoping to improve their value and employability while spending the least in tuition, NC State and the others on the list rank highest in affordability.

College Choice also recognized NC State as one of the top 50 Best Schools for a Computer Science Degree. ▪

SINGH HONORED AS MEMBER OF RESEARCH LEADERSHIP ACADEMY

Dr. Munindar Singh

Dr. Munindar Singh, Alumni Distinguished Professor of Computer Science, is one of 12 faculty members to be selected for the University's Research Leadership Academy, and the 2016-17 Alumni Association Outstanding Research Award.

The academy promotes a culture of research leadership at NC State and operates as the faculty-driven epicenter for the development and implementation of best practices in the empowerment of research faculty at all levels of the university.

Membership in the academy is lifetime as long as the member is associated with NC State. Members are expected to take an active role in promoting the research enterprise across campus for a minimum of three years.

Singh joined the department in 1995. He is a Fellow of the Association for the Advancement of Artificial Intelligence (AAAI) and of the Institute of Electrical and Electronics Engineers (IEEE). His research areas of interest include artificial intelligence, intelligent agents, cyber security and social computing with applications in health care information technology and service-oriented systems.

BARNES RECEIVES NCWIT UNDERGRADUATE RESEARCH MENTORING AWARD

Dr. Tiffany Barnes, associate professor of computer science, received the National Center for Women and Information Technology (NCWIT) Undergraduate Research Mentoring Award.

The award is one of four awarded by NCWIT annually, and is the only one awarded in the Senior Faculty member (professor or associate) category.

Barnes was recognized for her outstanding mentorship, high-quality research opportunities, recruitment of women and minority students and efforts to encourage and advance undergraduates in computing-related fields. Per her NCWIT citation: "Dr. Barnes encourages students to apply for awards,

Dr. Tiffany Barnes

Dr. Rudra Dutta

honors, fellowships, and attend graduate school, scaffolding that experience with talks on how to write applications in addition to offering in-lab reviews for applications. Barnes has mentored 83 students with 73 percent of her students belonging to minority groups in computing. Fifty-five percent of her mentored students have gone on to graduate school."

DUTTA NAMED DISTINGUISHED ENGINEER OF THE ACM

Dr. Rudra Dutta, professor in the department, was named a 2016 Distinguished Engineer of the Association for Computing Machinery (ACM).

The ACM named 45 Distinguished Members in 2016 for their contributions to the field of computing. Only nine of the 45 are Distinguished Engineers, and Dutta is the only Distinguished Engineer who is a university researcher; the other eight work in industry. Dutta is only the third professor in the department to reach this level of recognition. He joins Drs. Frank Mueller and Laurie Williams as Distinguished Members of the ACM.

Achievements of the Distinguished Members have advanced science, engineering and education of computing, and highlight the growing role of computing in the major technological advances shaping society today.

The 2016 ACM Distinguished Members work at leading universities, corporations and research institutions around the world, including in Austria, Brazil, Canada, China, Hong Kong, India, Italy, Korea, Japan, the Netherlands, Singapore, Spain, the United Kingdom and the United States. These trailblazers have made contributions in a wide range of technical areas including computer science education, data privacy, security, computer networking, machine learning, distributed systems, multimedia computing, human-computer interaction, programming languages, mobile and wireless networks, database management, information retrieval, computational biology, molecular computing, and software engineering, among others.

Dr. Christopher Healey

HEALEY NAMED DISTINGUISHED PROFESSOR

The North Carolina State Institute for Advanced Analytics has appointed Dr. Christopher Healey to the Goodnight Distinguished Professorship in Advanced Analytics. Healey is a noted scholar in the field of data visualization and visual analytics — specifically, the development of methods for visualizing large, multidimensional datasets to support rapid and accurate exploration, analysis, validation, and discovery. A member of the faculty in the Department of Computer Science, Healey has been actively involved in the Master of Science in Analytics (MSA) degree program since the Institute's inception in 2006.
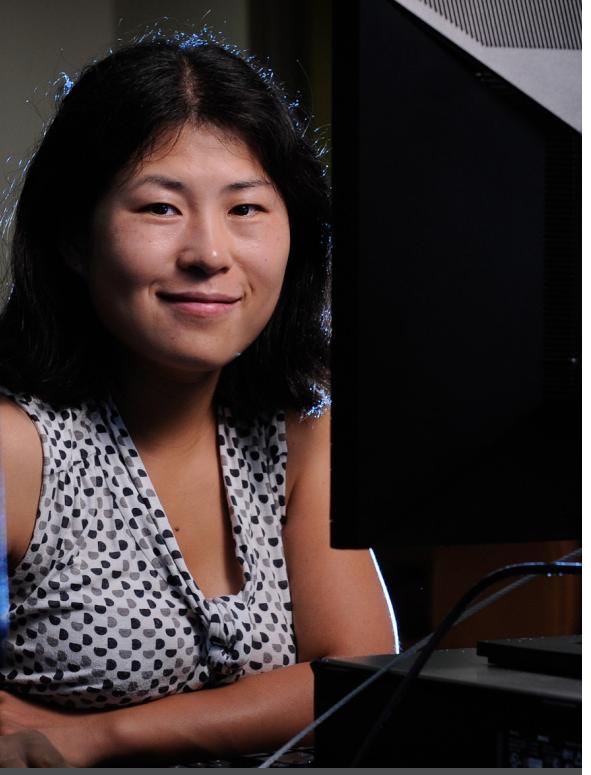
"Dr. Healey is a first rate scholar, gifted teacher and valued colleague," said the Institute's director, Dr. Michael Rappa. "His appointment as the Goodnight Distinguished Professor is a tribute to Dr. Healey's talent and dedication to creating and sharing knowledge with students. We're fortunate to have him participate full time as a member of the Institute's community."

Healey's appointment comes as the second of three endowed faculty positions at the Institute named in honor of the University's distinguished alumnus and prominent business leader Dr. James Goodnight. The Institute's founding director and Distinguished University Professor, Dr. Michael Rappa, was named to the Goodnight Directorship of the Institute for Advanced Analytics in January 2015.

Dr. James Lester

LESTER WINS 2017 IFAAMAS INFLUENTIAL PAPER AWARD

IFAAMAS (The International Foundation for Autonomous Agents and Multiagent Systems) has selected an article co-authored by Dr. James Lester of NC State,

CHI WINS NSF CAREER AWARD

Dr. Min Chi, assistant professor of computer science, has received a Faculty Early Career Development award from the National Science Foundation (NSF). The award, known as the NSF CAREER Award, is one of the highest honors given by NSF to young faculty in science and engineering.

NSF will provide $547,810 in funding over five years to support her project, "Improving Adaptive Decision Making in Interactive Learning Environments." This research is supported by NSF's Cyber-Human Systems and Robust Intelligence programs in the Division of Information and Intelligent Systems.

Chi's project aims to improve decision-making skills of students in interactive learning environments (ILEs) to better prepare them for long-term problem-solving. Using advanced machine-learning techniques, she will analyze data to develop an integrated research and education program with the goal of preparing students to make efficient, independent decisions in situations for which they do not instantly know how to act.

Improving ILEs will enable students in STEM domains to make erudite decisions and enhance teachers' and domain experts' understanding of the process of these decisions from the system. ▪

Dr. Lewis Johnson of Alelo, and the late Dr. Jeff Rickel of the University of Southern California as a recipient of the 2017 Influential Paper Award. The article, entitled "Animated pedagogical agents: Face-to-face interaction in interactive learning environments," laid the groundwork for a wide range of educational products incorporating animated agent technology.

The award recognizes publications that have made an influential and long-lasting contribution to the field. Candidate award publications must have been published at least a decade prior to the year of award, and the judging panel seeks nominations each year from the community. The award was formally presented at this year's AAMAS (Autonomous Agents and Multi-Agent Systems) conference in São Paulo, Brazil.

The article introduced and surveyed a new paradigm for interactive learning environments: animated pedagogical agents. The article argued for combining animated interface agent technologies with intelligent learning environments, yielding intelligent systems that can interact with learners in natural, human-like ways to achieve better learning outcomes. The concept has become an essential element of engaging, effective learning experiences. For example, the first Marine battalion that returned from Iraq without any combat fatalities learned Arabic language and culture in an immersive Alelo game that was populated with pedagogical agents.

Dr. Timothy Menzies

MENZIES EARNS INTERNATIONAL ACCOLADES

Dr. Timothy Menzies, professor in the department, has been recognized for his major contributions in the field of mining software repositories with the inaugural Mining Software Repositories Foundational Contribution Award. Menzies is the curator of the PROMISE repository, storage for Software Engineering project data.

Menzies' "PROMISE project" first began in 2005, when he and his students couldn't get the data they needed for their work. Seeing this issue, the team went out to search for the data they needed. This undertaking that Menzies and his team first began in their spare time quickly developed into an internationally recognized project, challenging the status quo of data collection. Menzies explains just how much

data collection has changed in this recent past, and holds onto the idea that sharing information leads to future successes in any field.

"In this age of connected information it may be a surprise to learn that there was a time where people just didn't share data. Our thought process was: If you have anything, give it away."

The project is composed of two parts: a repository to store data from papers from the conference, and an annual conference called "PROMISE" that's currently co-located with ESEM (Empirical Software Engineering and Measurement). Both parts have created hundreds of papers, using dozens of students, resulting in some of the most cited papers within the field of software engineering.

Menzies received his award as part of the May 2017 International Conference on Software Engineering. For more details, see **menzies.us/msraward17**.

REEVES PROMOTED TO ASSOCIATE DEAN FOR COLLEGE OF ENGINEERING GRADUATE PROGRAMS

Dr. Douglas S. Reeves

Dr. Douglas S. Reeves, professor in the department and assistant dean for graduate programs in the College of Engineering, has been promoted to associate dean for graduate programs in the College.

Reeves has served as assistant dean since fall 2013. As assistant dean, he has helped departments recruit a record number of high-quality students, particularly at the Ph.D. level, with the highest levels of support ever from the College and the Office of the Provost. He has represented the College on the COE Graduate Studies Committee, the Administrative Board of the Graduate School and the Graduate Operations Council of the University. He also assists the College with international partnerships, and his office works closely with the Graduate School. The associate dean position is part time, and Reeves has continued with his many duties in the Department of Computer Science.

Reeves was the director of graduate programs in the department from May 2010 until December 2013, during which time graduate enrollment reached more than 600 students (including 180 Ph.D. students).

MICROSOFT RESEARCH NAMES WILLIAMS OUTSTANDING COLLABORATOR

Dr. Laurie Williams, professor and interim department head, received one of 32 Microsoft Research Outstanding Collaborator Awards for 2016.

The Microsoft Research Outstanding Collaborator Awards highlight and celebrate some of the amazing academics who have worked with Microsoft Research over the years.

Per her biography in the Outstanding Collaborator Award Booklet, "Williams has made exceptional contributions to software engineering research not only in Microsoft Research (MSR) but throughout Microsoft at unprecedented levels for over 10 years. She has collaborated and continues to work with a wealth of Microsoft researchers spanning several continents on a number of research projects, ranging from continuous deployment, software security, agile development, software engineering, software analytics and many others. She has helped Microsoft product teams including Windows Client and Server, DevDiv, Bing, Skype, and Yammer. Her collaboration with MSR has led to many high-profile publications as well as book projects, and she has helped organize joint research and product group seminars on branching. Laurie's collaboration has involved many students and interns who, like her, have continued to make a positive impact at Microsoft and the software engineering research community. Laurie has been an inspiration for empirical software engineering at Microsoft."

SINGH NAMED ALUMNI ASSOCIATION DISTINGUISHED GRADUATE PROFESSOR

Dr. Munindar Singh, professor of computer science, was selected as one of four recipients of the Alumni Association Distinguished Graduate Professorship Awards for 2016.

The Award Selection Committee, which is made up of the dean of the Graduate School, president of the University Graduate Student Association, the previous year's award recipients and one member of the Graduate Administrative Board, was unanimous in its praise for Singh's exceptional record of graduate student training and the extraordinary quality of the mentoring he provided both during and after their graduate programs at NC State.

Singh, who joined the department in 1995, has served as a mentor to seven postdoctoral fellows, 26 Ph.D. advisees, including six that are in progress, and has graduated 27 research master's students. He is an Institute of Electrical and Electronics Engineers (IEEE) Fellow, and a member of the Association for Computing Machinery (ACM) and the Association for the Advancement of Artificial Intelligence (AAAI).

He is the editor-in-chief of the *ACM Transactions on Internet Technology* and was previously the editor-in-chief of *IEEE Internet Computing.* He serves on the editorial boards of the leading journals in his specialty, including *Autonomous Agents* and *Multi-Agent Systems, IEEE Internet Computing, IEEE Transactions on Services Computing* and *ACM Transactions on Intelligent Systems and Technology.* He has also served on the boards of *Journal of Web Semantics* and *Journal of Artificial Intelligence Research.*

SHEN NAMED ACM DISTINGUISHED SPEAKER

Dr. Xipeng Shen

Dr. Xipeng Shen, associate professor in the department, has been named an Association for Computing Machinery (ACM) Distinguished Speaker.

The ACM Distinguished Speaker Program (DSP) is an outreach program of ACM that brings distinguished speakers from academia, industry, and government to give presentations to ACM chapters, members, and the greater IT community in a variety of venues and formats. DSP has always operated in the spirit of service and outreach. Its goals are to provide some of the best content ACM has to offer through its network of high-quality speakers and to facilitate professional networking.

The DSP Committee votes on the acceptability of a nominated speaker, based on his or her CV, most recent three years' talks/speeches/short courses/presentations, and minimum of five years' experience (either in academia or industry or a combination of both).

SINGH ELECTED AAAI FELLOW

Dr. Munindar Singh, Alumni Distinguished Graduate Professor of Computer Science, has been elected a Fellow of the Association for the Advancement of Artificial Intelligence (AAAI).

The AAAI Fellows program was started in 1990 to recognize individuals who have made significant, sustained contributions – usually over at least a 10-year period – to the field of artificial intelligence. Fellows are recognized as having unusual distinction in the profession, and the program, as originally chartered, honors a small percentage of AAAI membership. Singh, who became an Institute of Electrical and Electronics Engineers (IEEE) Fellow in 2009, was recognized by the AAAI for his significant contributions to multiagent systems, especially via seminal formalizations of the interactions, communications, trust and commitments among intelligent agents and services.

Singh's research interests include multiagent systems and service-oriented computing, wherein he addresses the challenges of trust, service discovery, and business processes and protocols in large-scale open environments. He is currently editor-in-chief of *ACM Transactions on Internet Technology*, and was the editor-in-chief of *IEEE Internet Computing* from 1999-2002. He is a founding member of the editorial boards of *IEEE Internet Computing*, *Journal of Autonomous Agents and Multiagent Systems*, and *Journal of Trust Management*. He serves on the editorial boards of *ACM Transactions on Intelligent Systems and Technology* and *IEEE Transactions on Services Computing*.

VOUK STEPS DOWN AS DEPARTMENT HEAD; WILLIAMS SERVES AS INTERIM HEAD

Dr. Mladen Vouk

Dr. Mladen Vouk stepped down from his position as head of the Department of Computer Science effective January 1, 2017. He continues to serve NC State in the roles of associate vice chancellor for research development and administration, director of the NC State Data Initiative, and as a computer science faculty member.

Dr. Louis Martin-Vega, dean of the College of Engineering, expressed his gratitude for Vouk saying, "I would like to extend my sincere appreciation to Mladen for his dedicated leadership and commitment to CSC for the 11 plus years that he has served in this position. The progress and accomplishments of the CSC faculty, students and staff over these years has been outstanding and reflect both the care and concern that Mladen has felt for the faculty, staff and the department every day that he has been in this position."

Dr. Laurie Williams, professor and associate department head, is serving as interim head of the department. Williams' accomplishments as an outstanding researcher and educator are well known and recognized both within NC State and externally. Her current responsibilities as associate head and prior tenure as acting department head have also served as excellent preparation for this role.

The department plans to carry out a national search for a new computer science department head during the 2017-18 academic year with the intent of having a new department head in place by fall 2018. Williams will serve as the interim head for at least 18 months to allow time for the search to be carried out. Martin-Vega will be setting up a search committee during fall 2017. The search will be completely open, allowing both internal and external candidates to apply and/or be nominated.

SHEN, DUTTA AND WILLIAMS NAMED IEEE SENIOR MEMBERS

Dr. Rudra Dutta, professor, Dr. Xipeng Shen, associate professor, and Dr. Laurie Williams, interim department head and professor, have been elevated to Senior Member grade of the Institute of Electrical and Electronics Engineers (IEEE).

As IEEE Senior Members, they are among an elite group in IEEE, as only 9 percent of the IEEE's 433,000 members have achieved this level. Senior membership requires experience reflecting professional maturity as an engineer, scientist, educator, technical executive, or originator in IEEE-designated fields for a total of 10 years. Also, members must demonstrate five years of significant performance.
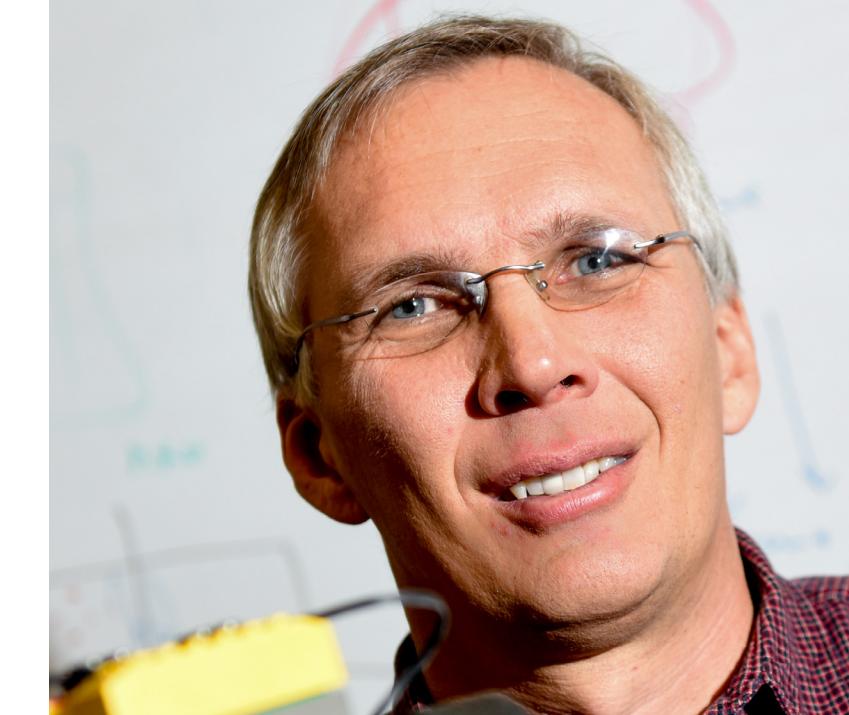
VOUK HONORED WITH IEEE LIFE MEMBERSHIP

Dr. Mladen Vouk, Distinguished Professor of Computer Science and associate vice chancellor for research development at NC State, has been selected for Institute of Electrical and Electronics Engineers (IEEE) Life Membership.

This special honor is reserved for individuals who have truly distinguished themselves through their sustained and lasting contributions to IEEE. Life Membership status speaks to both professional achievements in technology as well as the significant impact recipients have made on the growth and development of IEEE.

Designees of this top echelon of membership are among the most active, engaged and influential volunteers. Life Members serve as reviewers, editors and conference organizers. They participate in the development of standards, organize and participate in local meetings and serve in leadership roles at all levels of the organization.

Vouk is a highly respected computer scientist and IEEE Fellow who has received both the IEEE Distinguished Service Award and the Golden Core Award. He is co-inventor of NC State's Virtual Computing Laboratory, one of the world's first cloud computing systems, and co-founder of NC State's Computer Science Software Systems and Engineering Laboratory. He formerly served as technical director of the Center for Advanced Computing and Communication and was associate vice provost for information technology from 2002 to 2012. ▪

MUELLER HONORED AS IEEE FELLOW FOR ACHIEVEMENTS IN TIMING ANALYSIS RESEARCH

Dr. Frank Mueller, professor in the department, has received the distinguished honor from the Institute of Electrical and Electronics Engineers (IEEE), by being voted an IEEE Fellow for his contributions to real time, embedded systems and timing analysis research.

Mueller is now the seventh IEEE Fellow in his department, joining Drs. George Rouskas, Harry Perros, Donald Bitzer, Wushow "Bill" Chou, Mladen Vouk, and Munindar Singh, who were selected between the years of 1982-2011.

"In the Computer Science Department, I wear many different hats when it comes to research," Mueller said. "I build software for both large-scaled systems and small embedded devices. A lot of it is nitty gritty work but I enjoy the interaction with students, as well as doing the work myself."

A typical example of the nitty gritty would be systems in peril, involving super computers with 10,000 computers in a server room and Mueller's team orchestrating them to solve one problem.

"The computers look at very critical issue such as CFD codes — we look at air flow over a wing of an airplane, to see if there is enough lift, low wind resistance, if it is optimized for fuel consumption, etcetera," he said. ▪

Dr. Arnav Jhala

Dr. Alexandros Kapravelos

DR. ARNAV JHALA has joined the department as an associate professor in computer science in the Visual Narrative cluster. Jhala's specialty is artificial intelligence (AI), and his current research interests are in the areas of storytelling in games, intelligent machinima generation, smart graphics and intelligent user interfaces. He received his B.Eng. in computer engineering from Gujarat University in 2001, and his M.S. and Ph.D. in computer science from NC State in 2004 and 2009, respectively.

DR. ALEXANDROS KAPRAVELOS has joined the department as an assistant professor in computer science. His research interests span the areas of systems and software security. He received his B.S. and M.S. from the University of Crete, and his Ph.D. (2015) in computer science from the University of California, Santa Barbara. He is the lead developer of Wepawet, a publicly available system that detects drive-by downloads with the use of an emulated browser, and Revolver, a system that detects evasive drive-by download attempts. Currently, he studies how the web changes on the client side via browser extensions and how we can protect the browser from malicious client-side attacks. He is also interested in Internet privacy and browser fingerprinting specifically, where he is working on making Internet users less distinctive while they browse the web.

DR. KATHRYN STOLEE has joined the department as an assistant professor in computer science. Stolee's general area of specialty is software engineering. Her research interests are in the areas of program analysis, empirical software engineering and crowdsourcing. She received her B.S., M.S., and Ph.D. (2013) in computer science from

Dr. Kathryn Stolee

the University of Nebraska-Lincoln. Her prior work in program analysis includes coding programs as constraints for the purpose of code search with I/O examples, and is the first to use behavioral specifications with constraint solvers for code search. Additionally, she has transformed web mashup programs through refactoring. In empirical software engineering, she had designed and run nearly a dozen empirical studies with human participants, using crowdsourcing for many of them.

Dr. Collin Lynch

DR. COLLIN LYNCH has joined the department as an assistant professor in computer science. Lynch's research interests are in the area of graph-based educational data mining, development of robust intelligent tutoring systems, and adaptive educational systems for ill-defined domains such as scientific writing, law and engineering. He received his B.A. in artificial intelligence from Hampshire College in 2000, and his M.S. and Ph.D. in intelligent systems from the University of Pittsburgh in 2011, and 2014, respectively.

Dr. Jason King

DR. JASON KING has joined the department as a teaching assistant professor in computer science. His research focuses on software logging to hold users accountable, to mitigate repudiation threats (nonrepudiation), and to enable forensic analysis of detailed traces of user activity after a security/privacy breach has occurred. His work includes developing heuristics to support identifying log events that must be captured to hold users accountable, and measuring the degree to which user activity logs actually capture the identified log events. He is also interested in empirically researching both teaching and learning in computer science education. He received his B.S., M.S., and Ph.D. (2016) in computer science from NC State.

Dr. Chris Martens

DR. CHRIS MARTENS has joined the department as an assistant professor in computer science. Martens' specialty is formal methods for creative media, and her current research interests are in the areas of game design, believable virtual agents, collaborative digital storytelling, simulation modeling and mixed-initiative creativity applications. She received her B.S. and Ph.D. in computer science from Carnegie Mellon University in 2008, and 2015, respectively.

DR. ALESSANDRA SCAFURO has joined the department as an assistant professor in computer science. Scafuro's specialty is cryptography, and her current interests are in the area of secure computation. She received her M.S. and Ph.D. in computer science from the University of Salerno in 2009 and 2013, respectively.

Dr. Alessandra Scafuro

DR. HUNG-WEI TSENG has joined the department as an assistant professor in computer science. Tseng's specialty is systems, and his current interests are in the area of heterogeneous computing. He received his B.S. and M.S. in computer science from National Taiwan University in 2003 and 2005, respectively, and his Ph.D. in computer science from the University of California, San Diego in 2014. ▪

Dr. Hung-Wei Tseng

Denae Ford

CATETE WINS 2017 EQUITY FOR WOMEN AWARD, NAMED OUTSTANDING STUDENT VOLUNTEER

Veronica Catete, a Ph.D. candidate in the department, received the 2017 Equity for Women Award in the student category during the Sisterhood Dinner on Monday, February 27 in the Talley Student Union.

She was also one of several student leaders and organizations recognized

Veronica Catete

for their passion and service to NC State during the Leadership, Engagement and Development (LEAD) Award Ceremony held in April.

The Equity for Women Award is made annually to recognize faculty, staff and students for their outstanding leadership in establishing equity for women at NC State. Nominees are evaluated based on demonstrated excellence in one or more of the following areas over the past twelve months:

Leadership – taking action to promote gender equity on and beyond campus through leadership roles

Service – supporting equity for women through job-related or voluntary roles

Scholarship – contributing to the knowledge and informing policy and practice related to women's well-being and equality.

Catete was awarded the Deborah S. Moore Service Award as Outstanding Student Volunteer for her exemplary service to the department, and to the university during the LEAD ceremony.

The Deborah S. Moore Service Awards recognize exemplary service by NC State students and organizations. Deborah S. Moore, a graduate of NC State, served as the first volunteer coordinator of the NC State Student Center.

Catete is involved in the Students and Technology in Academia, Research and Service (STARS) Student Leadership Corps, Women in Computer Science (WiCS), the University Graduate Student Association, the Student Centers Board of Directors, and Students in Programming, Robotics and Computer Science (SPARCS). She is a National Science Foundation Graduate Research Fellow, and a Microsoft Research Graduate Women's Scholar.

FORD RECEIVES TWO PRESTIGIOUS FELLOWSHIPS

Ph.D. candidate Denae Ford received both a National Science Foundation (NSF) Graduate Research Fellowship and a Microsoft Ph.D. Research Fellowship.

Ford, who graduated magna cum laude with a bachelor's degree from the department in 2014, is now working toward her Ph.D. in computer science while pursuing a minor in cognitive science. Her research interests are a blend of human computer interaction, software engineering and social interactions to characterize programming knowledge representation.

The NSF Graduate Research Fellowship recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering and mathematics disciplines who are pursuing research-based master's and doctoral degrees at accredited US institutions.

Fellows share in the prestige and opportunities that become available when they are selected. Fellows benefit from a three-year annual stipend of $34,000 along with a $12,000 cost of education allowance for tuition and fees (paid to the institution), opportunities for international research and professional development, and the freedom to conduct their own research at any accredited US institution of graduate education they choose.

Ford is the first NC State student to receive a Microsoft Ph.D. Research Fellowship.

The Fellowship is a two-year program for outstanding Ph.D. students nominated by their universities. The program recognizes and supports outstanding graduate students who are pursuing doctoral degrees in computer science, electrical engineering and mathematics. Her submitted research proposal identified how to "Explore the Knowledge Gap of Software Engineering Technical Interviews Using Biometric Sensing."

Microsoft Research awarded the Graduate Research Fellowship to 12 individuals nationwide out of 211 applicants. Each fellowship recipient's award will cover tuition and fees for two academic years, a $28,000 stipend to cover living expenses while in school, a $4,000 conference and travel allowance to attend professional conferences or seminars, and an opportunity to complete one salaried internship during the year following the award.

GOODRICH RECEIVES NDSEG AND NASA/NC SPACE GRANT FELLOWSHIPS

Timothy Goodrich, a Ph.D. candidate, has received the National Defense Science and Engineering Graduate (NDSEG) Fellowship. The Fellowship is a highly competitive, portable fellowship that is awarded to students pursuing a doctoral degree in one of 15 supported disciplines.

Timothy Goodrich

NDSEG Fellowships last for three years and pay full tuition and all mandatory fees, a monthly stipend, and up to $1,000 a year in medical insurance. The estimated value of the Fellowship is $102,000.

The Department of Defense (DoD) is committed to increasing the number and quality of our nation's scientists and engineers, and toward this end, has awarded approximately 3,200 NDSEG Fellowships since the program's inception 22 years ago. The NDSEG Fellowship is sponsored by the Air Force Office of Scientific Research (AFOSR), the Army Research Office (ARO), the High Performance Computing Modernization Program (HPCM), and the Office of Naval Research (ONR), under the direction of the Director of Defense Research and Engineering (DDR&E).

In addition to winning the NDSEG Fellowship, Goodrich was also recently awarded a NASA/NC Space Grant Graduate Research Fellowship in the amount of $7,000 for the summer of 2016 for his project titled "Learning Beneficial Structure Properties of High-Quality Quantum Embeddings."

The joint North Carolina Space Grant/North Carolina Sea Grant Graduate Research Fellowship Program provides research support to graduate students across North Carolina colleges and universities. The objective of this research fellowship is to support research within North Carolina's nearshore environs and coastal watersheds to address research needs in these areas. Research projects will apply relevant measurement instruments and/or remote sensing data sources from National Aeronautics and Space Agency (NASA), National Oceanic and Atmospheric Administration (NOAA), and other data sources that include, but are not limited to, radiometers, spectroradiometers, satellite sensors, LIDAR, aerial imagery, and other data collected from airplanes, unmanned aerial vehicles, and/or unpiloted submersibles.

Goodrich is a member of Dr. Blair Sullivan's Theory in Practice group and researches ways to utilize structural graph theory for improving algorithm design. His recent work includes developing an embedding algorithm framework for adiabatic quantum computers, in collaboration with the Quantum Computing Institute at Oak Ridge National Laboratory. ▪

REMEMBERING
DR. ROBERT RODMAN
(1940-2017)

NC State professor of computer science and author Dr. Robert Rodman passed away on January 15, 2017.

Rodman was born in Boston, Mass., and raised in Los Angeles, Calif. The professor attended undergraduate school at The University of California - Los Angeles, where he also earned his Ph.D. Rodman's research interests included many topics within the field of linguistics.

While at NC State, Rodman worked as a professor, researcher and author. His textbook, "An Introduction to Language" is currently in its 11th edition, having sold more than one million copies worldwide. Rodman impacted linguistics throughout the world participating in research projects, and translating his textbook into seven different languages. This renowned textbook brought a fresh take on his field, and was the first to contain a chapter on computational linguistics.

ToniAnn Marini, undergraduate lab coordinator and lecturer in the department, watched Rodman's success in the classroom on many different levels. She worked with Rodman as his student, lab assistant and, later, colleague. Marini's memories of Rodman highlight his easygoing personality and creativity in the classroom.

"The best was when he started to incorporate Harry Potter into his lectures. He talked about The Deathly Hallows, and how it related to computing. Some of the students really got into that."
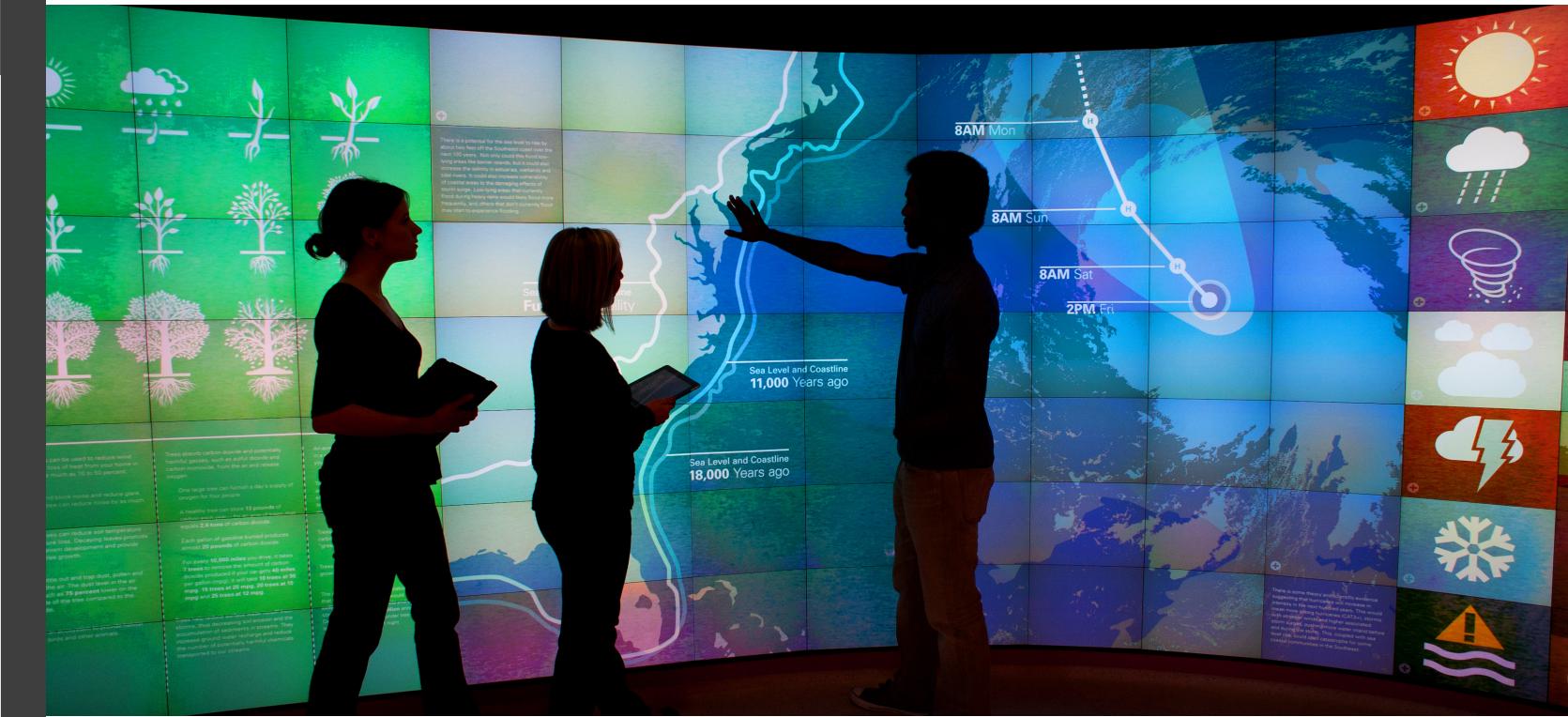
In 2009, Rodman was elected into the American Academy of Social Sciences as an Associate Fellow for his achievements in Computational Forensic Linguistics. His work in the forefront of linguistics awarded him the honor of coining the term "montague grammar" by the Oxford English Dictionary in 2002. Among Rodman's various honors and achievements, his research in speaker verification and computational forensic linguistics is recognized on a worldwide scale.

Dr. Suzanne Balik, teaching assistant professor in the department, fondly remembers Rodman for his many years at the university and his willingness to lend a helping hand. Balik recalls that within Rodman's 38 years of teaching at the university, both she and her son were students of Rodman's in his discrete mathematics course, 15 years apart.

"When my original professor was sick, I needed someone to do an independent study for me, and Dr. Rodman stepped in. Dr. Rodman helped me out again for my Ph.D., and became my advisor for that too."

Prior to his passing, Rodman retired from NC State on January 1, 2017. He taught thousands of students throughout his 38 years as an NC State professor, making an impact on the lives of many. A professor, author, researcher, and friend: Rodman's legacy is one of incredible stature. ▪

THREE TRACKS TO A GREAT CAREER

The department offers a highly ranked master's degree program with three tracks to choose from

SOFTWARE ENGINEERING

As software becomes increasingly important to our day-to-day lives, building and maintaining high quality software is critical. The Master's Track in Software Engineering teaches students the skills necessary to build and maintain such software systems. Topics include both an overview of software engineering and a variety of more in-depth topics, including software security, testing, and DevOps. The track has offerings both in the state-of-the-practice and state-of-the-art software engineering, with a special focus on evidence-based practice.

SECURITY

As information technology continues to become ingrained in society, there are real-world impacts whenever the security or privacy of these systems fail. The Master's Track in Security teaches students the skills necessary to build, analyze, and reason about secure and private systems. Topics include both an overview of computer and network security and a variety of more in-depth topics, including systems security, software security, privacy, and cryptography. The track can be customized to be more practice-oriented or theoretically oriented based on the interests of the student.

DATA SCIENCE

Data Science has become increasingly important in nearly every industry sector and academic field, and the discovery and forecasting of insightful patterns from "Big Data" is at the core of analytical intelligence in government, industry, and science. The Master's Track in Data Science instills in students the skills essential to knowledge discovery efforts to identify standard, novel and truly differentiated solutions and decision making, including skills in managing, querying, analyzing, visualizing, and extracting meaning from extremely large data sets.

Learn more at **www.csc.ncsu.edu/academics/graduate**