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TIMA Technology is Core to Samsung's State-of-the-art Knox Platform

Security technology developed by North Carolina State University computer science researchers, called TIMA, has been sub-licensed to Samsung through CellSentry Inc., an NC State start-up with support from the NC State Office of Technology Transfer. The TIMA technology is one of the core components and part of the innermost security layer of the Samsung Knox platform deployed in their mobile phones and tablets.

TIMA or TrustZone Integrity Measurement Architecture incorporates privacy and security functions at the embedded systems level, which acts as buffer between the Android OS Kernel and mobile processor hardware.

Security software can be bypassed, creating vulnerabilities for smartphone companies and users, especially enterprise users. But the TIMA technology addresses this problem by incorporating security features with continuous monitoring that is well isolated and protected by hardware based mechanisms– making it difficult, if not impossible, to bypass. The technology is based on research that was led by **Dr. Ahmed Azab** and **Dr. Peng Ning** (pictured at right) from the Computer Science Department at NC State.

Security technology for mobile phones and tablets, called TIMA, has been developed by Dr. Peng Ning and other computer science researchers at NC State. It is one of the core components and part of the innermost security layer of the Samsung Knox platform.

According to Dennis Kekas, Associate Vice-Chancellor for NC State Partnerships and Director of the Institute for Next Generation Information Technology Systems (ITng), "Embedding TIMA security into mobile devices is a shining example of how NC State faculty and students work with industry to translate research into real world value and impact."

The research was funded in part by the U.S. Army Research Office through the Secure Open Systems Initiative based at ITng, and by the National Science Foundation. The technology was initially managed by the NC State Office of Technology Transfer and received additional proof of concept funding from the NC State Chancellor's Innovation Fund. The technology was later licensed to CellSentry, a NC State spinoff company led by the inventors. CellSentry further developed the technology and sub-licensed it to Samsung.

Since developing the TIMA technology, Dr. Ning is now on leave from the University and serves as Samsung's VP of Engineering and Head of Samsung KNOX R&D in the US, and co-head of Samsung KNOX R&D Global.

About Samsung Knox:

Samsung Knox is the comprehensive mobile solution for work and play with Security Enhancements (SE) for Android platform and application container. Samsung Knox delivers fundamental security at the platform level, which is the first line of defense against malicious attacks. If the Linux kernel is compromised, SE for Android security mechanisms could potentially be disabled and rendered ineffective. TIMA was developed with Samsung R&D to close this vulnerability. Introducing in Samsung KNOX as a unique feature on Samsung mobile devices, TIMA uses ARM TrustZone hardware and provides continuous integrity monitoring of the Linux kernel.

From the Acting Department Head

Dr. Laurie Williams

Greetings, and welcome to another issue of the NC State Computer Science Department's *Connected* newsletter! As many of you know, I assumed the role of Acting Head of the Department in December when our department head, Dr. Mladen Vouk, was tapped to serve as interim Vice-chancellor for Research, Innovation and Economic Development at NC State. I'm excited about this opportunity, and I'm very happy that John Streck, Director of the Institute for NEXT Generation IT Systems (ITng), has agreed to serve as Acting Assistant Department Head during this period. We look forward to working together to ensure that the department continues to thrive and grow!

Spring has definitely sprung around campus, and as this Spring 2015 semester draws to a close, I'm excited to share a few highlights. The Computer Science Department and our students received numerous awards and honors this year:

- Engineering Online at NC State was ranked 11th nationally on the *US News and World Report's* 2015 list of the Best Online Graduate Programs;
- the Engineering Online Computer Science and Networking program at NC State was ranked 7th nationally on the magazine's list of the Best Online Graduate Computer Information Technology programs;
- NC State's Video Game Design Program has been recognized as one of the Top 25 Undergraduate Schools to Study Game Design for 2014 in the US and Canada on The Princeton Review's Top Schools to Study Video Game Design for 2014 list. (This is the fourth consecutive year that NC State's program has been recognized.);
- PhD student Sean Mealin was selected to receive a prestigious and highly competitive NSF Graduate Research Fellowship;
- Zhe Zhang was awarded the IBM PhD Fellowship Award for the third consecutive year; and

- Pat Morrison was awarded an IBM PhD Fellowship Award for the second year.

Our faculty continue to represent the department well with their involvement in prestigious professional events, and by publishing papers in flagship journals and conferences. Many serve in various professional roles at the university, state, and national levels. A number have received prestigious awards and professional recognitions in 2013-2014:

- Dr. Douglas Reeves was named Interim Assistant Dean for the College of Engineering Graduate Program;
- Dr. George Rouskas was named Director of Graduate Programs for the Computer Science Department;
- Dr. James Lester was elected Fellow of the Association for the Advancement of Artificial Intelligence (AAAI);
- Dr. Michael Young was awarded Senior Member Status of the AAAI. He was also named a 2013 Distinguished Scientist by the Association for Computing Machinery (ACM), and was recognized by NC State as a 2014-2015 University Faculty Scholar;
- Dr. Blair Sullivan was selected to receive a $1.5 million Moore Investigator Award from the Gordon and Betty Moore Foundation as part of its Data-Driven Discovery Initiative. She was also named a 2014 National Consortium for Data Sciences (NCDS) Data Science Faculty Fellow; and
- Drs. Rada Chirkova, Vince Freeh, David Thuente, Mladen Vouk and Mr. John Streck all received prestigious IBM Faculty Awards.

Our Undergraduate Program continues to thrive:

- In 2013-2014, we awarded 161 BS degrees, an upward trend expected to continue for several more years. In the fall of 2014, we enrolled 875 undergraduate students, and the incoming freshman class was the brightest and most gifted ever, with an average SAT of 1307 (on 1600 scale) and an average GPA of 4.55.
- Demand for our undergraduates has surged as the economy continues to improve. Many of our graduates received multiple offers, and average starting salaries are now over $65K, among the highest in the College of Engineering. Large numbers of our undergraduates were hired by the likes of Cisco, Boeing, Fidelity Investments, IBM, NetApp and SAS. But a significant number of students pursued careers with smaller companies or entrepreneurial opportunities.

Highlights from our Graduate Program include:

- In Fall 2014, we enrolled 683 graduate students, including 198 PhDs. We awarded 212 graduate degrees, including 21 PhDs.
- As with our undergrads, demand for our graduate students is extremely high, with starting salaries for our masters students averaging approximately $102K, while starting salaries for our PhD students is closer to $120K. Our students began employment with companies like Amazon, IBM, Cisco, Microsoft, EMC, SAS and NetApp.
- We are pleased to announce the approval and launch of a Masters Track in Data Science in the Computer Science Graduate Program Curriculum, beginning Fall 2015. This track will complement various academic and research initiatives in data science on campus. It will provide students with 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.

Research is crucial to the success of our department, and we are pleased to report that our research productivity continues to grow with annual research expenditures reaching a record of more than $14M. And, we currently have more than $53M in active research grants, which ranks us in the top ten departments for sponsored research funding among computer science departments in colleges of engineering in the United States.

Finally, we are especially grateful for the generous financial support from our alumni, friends and corporate partners (~$800K in total unrestricted cash contributions from all sources.) This unrestricted funding allows the department to continue to grow in emerging areas of computer science while providing the highest quality educational experience for our students.

I look forward to moving forward with the department, and I am very aware that you, our more than 7,400 alumni, are key to our success. Please come back to campus and take a look around EB2, our home on Centennial Campus since 2006. Meet some of our students and talk to our faculty and staff. I'm sure you will be amazed and impressed with the caliber of our students!

NC State and SAS Partner to Tackle Major Analytics Challenges

North Carolina State University Chancellor Randy Woodson and SAS CEO Jim Goodnight recently announced the signing of an innovative new partnership that will better enable collaborative research in the areas of computer science and data analysis.

SAS sponsorships will support academic opportunities for NC State professors and students and bolster the university's reputation as a top research institution.

"NC State is grateful to have a partner like SAS that has long supported our vision to build the preeminent research enterprise in higher education where business, industry and government come together to address the grand challenges of society," Woodson said. "This agreement expands our ability to drive research, share technology and enhance academic opportunities for our students for many years to come."

While specific projects have not been named, the partnership is expected to address the areas of cyber security, big data, text analytics, data visualization and sensors and health-monitoring technologies.

This agreement is the latest in a long relationship between two of the largest employers in North Carolina. The master research agreement simplifies sponsored research by setting terms regarding intellectual property, cost and scope of work.

SAS, one of the world's largest privately held software companies, emerged from NC State's Department of Statistics in the 1970s. Since then, SAS has provided support for education and research at NC State through student scholarships and endowed professorships.

"NC State has been a vital source of talent and innovation for SAS since our beginning," said Goodnight. "We are investing in new areas of research by supporting some of the brightest talent in academia, and accelerating innovation in the analytics space."

SAS funded the nation's first Master of Science in Analytics (MSA) degree at NC State, and has provided significant support for the William and Ida Friday Institute in the College of Education. NC State's math and statistics building, SAS Hall, is named in honor of SAS' founders, Goodnight and Executive Vice President John Sall.

"Both organizations are now better positioned to benefit from the fruits of their research more quickly," said Terri Lomax, NC State vice chancellor for research, innovation and economic development. "This agreement further establishes NC State as a leader in industry partnerships focused on results-driven research and providing students with relevant opportunities to put learning into practice."

While SAS is used at more than 3,000 institutions worldwide for teaching, research and administration, this is the first master research agreement the company has entered into with a university.

Dogs, Technology and the Future of Disaster Response

Imagine a team of humans, dogs, robots and drones swooping onto the scene in the aftermath of a disaster and working together to find and rescue anyone trapped in collapsed buildings. That's the goal of a team of researchers from around the US working on what they call the Smart Emergency Response System (SERS).

NC State researchers, **Drs. David Roberts** (pictured here with Diesel) and **Alper Bozkurt**, have developed a high-tech dog harness equipped with sensors and other devices that will make dogs more effective at collecting information and incorporate the dogs into the larger network of coordinated disaster response.

The harness includes new sensors developed by Bozkurt and Roberts that monitor a dog's behavior and physiology, such as heart rate. These sensors will allow both dog handlers and the emergency response command center to remotely track a dog's well-being and to determine if the animal has picked up a scent or found a specific object or area of interest. Communication technologies on the harness will allow handlers to relay commands to a dog remotely. Bozkurt and Roberts have incorporated audio communication, via speakers, into the vest. However, they think the more reliable remote communication will come via "tactile inputs" – they're training dogs to respond to gentle "nudges" that come from within the electronic harness itself. "I want to be clear that these are not aversive punishments, but slight, tactile nudges from motors in the vest – like a vibrating cell phone. We're using exclusively reward-based training techniques," Roberts says.

Bozkurt, Roberts and the rest of the SERS team participated in the Smart America Challenge event in Washington, D.C., last summer.

New Framework Would Facilitate Use of New Android Security Modules

Computer security researchers from North Carolina State University and Technische Universität Darmstadt/CASED in Germany have developed a modification to the core Android operating system that allows developers and users to plug in new security enhancements. The new Android Security Modules (ASM) framework aims to eliminate the bottleneck that prevents developers and users from taking advantage of new security tools.

"In the ongoing arms race between white hats and black hats, researchers and developers are constantly coming up with new security extensions," says **Dr. William Enck**, an assistant professor of computer science at NC State and a senior author of a paper describing the new framework. "But these new tools aren't getting into the hands of users because every new extension requires users to change their device's firmware, or operating system (OS).

"The ASM framework allows users to implement these new extensions without overhauling their firmware," Enck says. "The framework is available now for security enthusiasts. But for widespread adoption, either Google or one of the Android phone manufacturers will need to adopt the framework and incorporate it into the OS."

The ASM framework allows the creation of custom security control modules that better protect phones owned by consumers and businesses. The custom security modules receive "callbacks" for every security-sensitive operation in the Android OS. In this context, a callback means that Android is contacting the security module to determine whether an operation should proceed.

"Our ASM framework can be used in various personal and enterprise scenarios. For instance, security modules can implement dual persona: i.e., enable users to securely use their smartphones and tablets at home and at work while strictly separating private and enterprise data," says Enck.

"Security modules can also enhance consumer privacy. The framework provides callbacks that can filter, modify, or anonymize data before it is shared with third-party apps, in order to protect personal information," Enck says. "For instance consider an app like Whatsapp, which usually copies all your contacts to its server – which is not needed for it to function." With ASM, the user can make sure Whatsapp only gets the information it really needs.

"In addition, we designed the framework to allow apps to create their own hooks, which could be enforced by the security module," Enck says. "This increases flexibility for app developers and allows them to benefit from the security protections provided by the module."

The researchers also went to great lengths to ensure that the ASM framework complies with the security guarantees Google and others make with app developers. For example, the framework can only make data access more restrictive.

The ASM framework allows the creation of custom security control modules that better protect phones owned by consumers and businesses.

The researchers presented a paper on the ASM framework August 22 at the USENIX Security Symposium in San Diego, California. The researchers are now reaching out to Google and Android phone manufacturers to demonstrate the effectiveness of the ASM framework.

Co-lead authors of the paper, "ASM: A Programmable Interface for Extending Android Security," are Adwait Nadkarni, a Ph.D. student at NC State, and Stephan Heuser, a Ph.D. student at TU Darmstadt/CASED. Co-authors include Enck and Dr. Ahmad-Reza Sadeghi, of TU Darmstadt/CASED. The work was supported by National Science Foundation grants CNS-1253346 and CNS-1222680.

Researchers Aim to Improve Educational Sofware Through Speech and Emotion Detection

North Carolina State University researchers have won a $1.2 million grant from the National Science Foundation to improve educational software by enabling it to assess facial expression, body language, speech and other cues to better respond to a student's emotional state during the learning process.

"Educational software can be a valuable tool, but so far these tools don't account for student emotion or affect," says **Dr. Kristy Boyer**, an assistant professor of computer science at NC State and co-primary investigator (PI) of the grant. "We're planning to develop and test techniques and technologies for incorporating affect and dialogue into educational games and other software."

The ultimate goal is to develop a software tool to support the learning process by assessing a student's verbal and nonverbal cues and using that information to customize how the program responds to each student.

The first step for the researchers will be to modify an existing game, Crystal Island, to incorporate spoken dialogue and affect sensors that track eye movement, facial expressions and posture. The researchers will then use the program in middle schools to collect preliminary data on how students interact with the program, both in terms of natural language (what the students say) and nonverbal cues (what the students do).
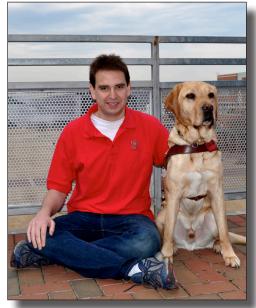
"This preliminary data will serve as the basis for all of the subsequent modeling we do, as well as our development of techniques for how the game should respond to the student," says **Dr. James Lester**, a professor of computer science at NC State and PI of the grant.

The grant is for three years and focuses specifically on middle school science education, though the findings are expected to be broadly applicable to other subjects and age groups. Co-PIs on the project include Dr. Brad Mott, a senior research scientist in NC State's Department of Computer Science, and Dr. Eric Wiebe, a professor of science, technology, engineering and mathematics education at NC State.

Student Wolf Bytes

◆ PhD student **Rogelio Cardona-Rivera** co-authored a book entitled "Cognitive Neuroscience of Human Systems: Work and Everyday Life." The book is co-authored by Chris Forsythe, Huafei (Harry) Liao and Michael C.S. Trumbo. It was written while Cardona-Rivera was on appointment as Visiting Department of Energy Computational Science Graduate Fellow at Sandia National Laboratories.

◆ Congratulations to PhD students **Magreth Mushi** and **Savera Tanwir** on receiving **2014 Google Anita Borg Memorial Scholarships**. Recipients each receive a $10,000 award and are invited to attend the Annual Google Scholars Retreat in Mountain View, CA. There were only 78 recipients of the scholarship in North America, Europe, Middle East and Africa.

◆ **Steven Harenberg**, **Ameeta Muralidharan**, **Vedika Seth**, **Namita Shubhy**, and **Savera Tanwir** are recipients of **Graduate Industrial Traineeships (GIT)** from **SAS**. They will provide SAS with research, analysis, generation, testing and documentation of operations research software.

◆ PhD student **Savera Tanwir** and her advisor, Alumni Distinguished Graduate Professor **Dr. Harry Perros**, published a book entitled "VBR Video Traffic Models" last spring.

◆ The Computer Science Masters program recently received the **Students Before Profits Award**. The award was created to promote nonprofit colleges and universities offering online degree programs that put students before profits and education before the bottom line. Winners were selected from accredited, nonprofit colleges and universities with objectively lower than average tuition cost and a higher than average student engagement ranking from US News & World Report, which measures student satisfaction and instructor responsiveness.

◆ Congratulations to **PhD student Sean Mealin** (pictured above) on being chosen to receive a prestigious and highly competitive **NSF Graduate Fellowship**. Fellows benefit from three years of funding (approximately $122,500) for research-focused degrees in science, technology, engineering and mathematics fields.

◆ PhD students **Zhe Zhang** and **Pat Morrison** were recently awarded prestigious **2014 IBM Ph.D. Fellowship Awards**. Fellows are awarded tuition, fees and a stipend for one academic year. This is Zhang's third consecutive year, and Morrison's second consecutive year, of winning the award. Fellowships are eligible for renewal yearly for up to three years. Zhang is advised by **Dr. Munindar Singh**. Morrison is advised by **Dr. Laurie Williams**.

◆ Congratulations to PhD student **Xi Ge** and **Dr. Emerson Murphy-Hill**, assistant professor of computer science, for winning the **Best Paper Award** at the IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC 2014). The winning paper is titled "How Developers Use Multi-Recommendation System in Local Code Search."

◆ Congratulations to **Alexandria Vail**, an undergraduate student in the Computer Science Department, on being chosen to receive a **2014 Generation Google Scholarship**. The Scholarship, valued at $10,000, was established in 2012 to encourage aspiring computer scientists to excel in technology and become active role models and leaders in the field. Vail is a senior majoring in computer science and mathematics, while also pursuing a dual minor in physics and cognitive science.

◆ Undergraduate **Melissa Novitsky** is the recipient of the **2014 NC State Computer Science Aspirations Scholarship Award**. The Scholarship was launched last year in conjunction with the **National Center for Women in Technology (NCWIT)**. The $1,000 award is given annually to a high school student who wins a national or regional NCWIT Aspirations in Computing Award, and who attends NC State to pursue a degree in computer science. IT is renewable for a total of four years as long as the student maintains acceptable academic progress toward a BS degree in computer science.

Our Financial Needs Change as Our Life Evolves.

In fact, if you are now a:

- ✔ Grandparent wanting to help with college expenses,
- ✔ Baby-boomer or Gen X who wants to supplement your retirement plans
- ✔ Retiree on a fixed income
- ✔ Adult caring for aging parents

then you might be an excellent candidate for a **Charitable Gift Annuity**. Contact Ken Tate (tate@csc.ncsu.edu) and he will connect you with one of NC State's gift planning experts. There is no cost; you have nothing to lose!

Engineering Online at NC State Ranked in the Top 10 Nationally

The **Engineering Online Computer Science and Networking** programs at NC State have been ranked 7th nationally in the *U.S. News & World Report 's* 2015 list of the **Best Online Graduate Computer Information Technology Programs**.

Engineering Online at NC State has again been recognized as one of the top online engineering programs in the United States coming in 11th nationally on the magazine's list of **Best Online Graduate Engineering Programs**.

The College of Engineering at NC State established what is now known as Engineering Online in 1978. The program, designed for working professionals, allows students to earn master's degrees in engineering without coming to campus. Courses offered by Engineering Online are identical to on-campus courses in terms of content, requirements and academic rigor.

Engineering Online offers master's degree programs in aerospace engineering, civil engineering, chemical engineering, computer engineering, computer networking, computer science, electrical engineering, environmental engineering, industrial engineering, integrated manufacturing systems engineering, materials science and engineering, mechanical engineering, nanoengineering, and nuclear engineering. The program also offers a master of engineering degree.

NC State Awarded $25 Million NNSA Grant

NC State today was awarded a five-year, $25 million grant by the National Nuclear Security Administration's (NNSA) Office of Defense Nuclear Nonproliferation Research and Development to develop the next generation of leaders with practical experience in technical fields relevant to nuclear nonproliferation. NC State was selected by NNSA over 22 other proposals following a competitive process that began in May 2013.

The vision of the new Consortium for Nonproliferation Enabling Capabilities, or CNEC, is to be the pre-eminent research and education hub dedicated to the development of enabling technologies and technical talent for meeting the grand challenges of nuclear nonproliferation in the next decade.

"For NC State to be selected to lead this vital national effort is a testament to our great faculty and strong leadership in nuclear engineering," said NC State Chancellor Randy Woodson. "NC State is increasingly recognized as the university of choice for government and industry partners who want to collaborate with world-leading faculty and students to solve some of our nation's biggest challenges."

This announcement follows NC State's selection by the Department of Energy in January to lead a $140 million manufacturing innovation institute to develop next-generation power electronics. In August 2013, NC State was chosen by the National Security Agency to create the $60 million Laboratory for Analytic Sciences to advance the science of big data.

The NC State-led CNEC will implement educational activities with the goal to develop a pool of future nuclear nonproliferation and other nuclear security professionals and researchers. In addition, the consortium will provide the U.S. government with cutting-edge research and development to identify and address multidisciplinary and cross-functional technology and research needs that are critical to detecting foreign nuclear weapon proliferation activities.

Specifically, the research projects pursued by the consortium will include technologies to enhance simulation capabilities, algorithms and modeling; new test and evaluation models for detection sensors; new remote-sensing capabilities; and applications of data analytics and data fusion to better characterize and detect special nuclear materials.

"This grant will link students with world-class researchers and introduce them to career possibilities at the national labs while providing education in areas of great

Dr. Nagiza Samatova, professor of computer science at NC State, is one of nine faculty members in six departments spanning three colleges that will be involved in the research efforts.

importance for the nonproliferation mission," said NNSA Deputy Administrator for Defense Nuclear Nonproliferation Anne Harrington.

"NC State is increasingly recognized as the university of choice for government and industry partners who want to collaborate with world-leading faculty and students to solve some of our nation's biggest challenges."

Robin Gardner, NC State professor of nuclear and chemical engineering and director of the Center for Engineering Applications of Radioisotopes, or CEAR, will lead the consortium; John Mattingly, associate professor of nuclear engineering,

is co-principal investigator on the project. Other CNEC partners include the University of Michigan, Purdue University, the University of Illinois at Urbana-Champaign, Kansas State, Georgia Tech and North Carolina Agricultural and Technical State University, as well as several national laboratories, including Los Alamos, Oak Ridge and Pacific Northwest.

At NC State, CNEC will engage nine faculty members in six departments spanning three colleges. It will annually involve two undergraduates, 13 graduate students as well as five post-doctoral fellows. Additionally, CNEC will establish a competitive graduate fellowship program that will sponsor six fellows per year. It is designed to attract top talent to the research and development areas critical for nuclear nonproliferation missions.

NC State houses the only nuclear engineering program in North Carolina – one of the premier departments in the United States – and is recognized as a global leader in nuclear engineering research and education. Home to the world's first university-based nongovernmental nuclear reactor for teaching and research, NC State is the lead university in the unique Department of Energy-funded Consortium for Advanced Simulation of Light Water Reactors initiative, which uses advanced computer simulations to create safer, most cost-effective nuclear power plants.

Established by Congress in 2000, NNSA is a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear science.

Video Game Design Program at NC State in the Top 25 Again

The Video Game Design Program at NC State has been recognized as one of the "Top 25 Undergraduate Schools to Study Game Design for 2014." NC State ranks 23rd on The Princeton Review's fifth annual list which salutes the best schools in the U.S. and Canada. This is the fourth consecutive year that NC State's program has been recognized.

The Princeton Review selected the schools based on a survey it conducted in 2013-2014 of 150 institutions in the U.S., Canada and abroad offering video game design coursework and/or degrees. The 50-question survey asked schools to report on a range of topics from their academic offerings and faculty credentials to graduates' employment and professional achievements. Among the 60 data points the company considered in its assessments: the program curriculum, facilities, career services, and technology.

TOP UNDERGRAD GAME DESIGN PROGRAM
The Princeton Review.
2014

◆ **Dr. Mladen Vouk** (below), professor and head of the Department of Computer Science and associate vice provost for information technology at NC State, will serve as **Interim Vice Chancellor for Research, Innovation and Economic Development** while NC State seeks a permanent leader for this high performing division.

◆ **Dr. Laurie Williams**, professor of computer science and one of the foremost researchers in agile software developement and the the security of healthcare IT applications, has been named **Acting Department Head of the Computer Science Department.** She will hold this position while current Department Head, **Dr. Mladen Vouk**, serves as interim vice chancellor for research, innovation and economic development at NC State.

◆ Congratulations to **Dr. James Lester**, Distinguished Professor of Computer Science, on being elected a **Fellow** of the **Association for the Advancement of Artificial Intelligence (AAAI)**.

◆ **Dr. R. Michael Young** (above), professor of computer science, has been named a **2014-2015 University Faculty Scholar**. Scholars are top NC State early- and mid-career faculty who will receive $10,000 in donated funds for each of the next five years to support their academic endeavors. The recognition and award program is part

Moore Award Will Help Sullivan Put Computer Science Theory into Practice

The Gordon and Betty Moore Foundation has announced that it has selected North Carolina State University's **Dr. Blair D. Sullivan** for a $1.5 million **Moore Investigator Award** – one of only 14 nationally – as part of its Data-Driven Discovery Initiative. Sullivan's work focuses on transforming theoretical algorithms into practical tools that could be used in fields ranging from biomedical science and social media research to business analytics and online retailing.

"This award will enable us to drastically advance the understanding of intermediate-scale structure in massive, real-world graph data and design targeted, efficient algorithms based on ideas from theoretical computer science," says Sullivan, an assistant professor of computer science at NC State. Graphs, in the context of computer science, are used to model discrete entities which have connections between them, for example neurons in the brain or individual users on Facebook.

"Unfortunately, structure-based algorithms have mainly been studied from a theoretical point of view, and need significant improvement if we want to use them in practical tools," Sullivan says. "For example, we'll need to adapt the framework to deal with the uncertainty present in real-world data."

Dr. Sullivan's work is based on a field of study called parameterized complexity. These algorithms leverage a graph's structure to solve time-consuming problems much more quickly. Technically speaking, this approach attains polynomial algorithms for NP-hard problems in special classes of graphs.

"The biggest challenge is that the algorithms are theoretical," Sullivan adds. "My group is working to put those theories into practice."

Sullivan's award from the Moore Foundation is part of a $60 million, five-year Data-Driven Discovery Initiative within the Gordon and Betty Moore Foundation's Science Program. The initiative – one of the largest privately funded data science programs of its kind – is committed to enabling new types of scientific breakthroughs by supporting interdisciplinary, data-driven researchers.

of the university's strategic initiative to invest in and retain top faculty.

◆ **Ms. Margaret Heil** has been named **Director** of the **NC State Computer Science Department Senior Design Center (SDC)**. She served as associate director of the SDC for 19 years, and served as interim director following the retirement of **Dr. Robert Fornaro** in 2014.

◆ **Dr. Harry Perros**, Alumni Distinguished Graduate Professor of computer science, and his former student, **Dr. Bushra Anjum**, assistant professor in the Computer Science Department at Missouri University of Science and Technology, have published a book entitled "Bandwidth Allocation for Video Under Quality of Service Constraints."

◆ The Computer Science Department added several new faculty this year: **Dr. Guoliang Jin** - assistant professor. His specialty is systems and reliability. **Dr. Tim Menzies** - professor. His general area of specialty is software engineering. **Dr. Chris Parnin** - assistant professor. His general area of specialty is software engineering. **Dr. Xipeng Shen** - associate professor in the Chancellor's Faculty Excellence Data Driven Science Cluster. His specialty is systems and extreme-scale data-intensive computing. **Dr. Ranga Raju Vatsavai** - associate professor in the Chancellor's Faculty Excellence Geospatial Analytics Cluster, and associate director for Computational Methods in the new NC State Center for Geospatial Analytics.

Alumna Sees Computer Science as Creativity and Innovation at its Best

Dr. Bushra Anjum (CSC PhD 2012) is passionate about computer science. She shares that passion with her students back in her native Pakistan where she teaches and mentors computer science students. When she describes her passion for the field, she intentionally includes all the factors that make her field unique. Like a complicated recipe that lists many ingredients, combined together, it can be a masterpiece, but standing alone, each ingredient is one-dimensional. Computer science, she says, is certainly not one-dimensional.

"Students need to see the bigger picture of computer science. For example, you recognize a problem and you try to weigh out various options, then you set your goal at one solution or maybe a couple of solutions," she says. "And then you try to find technological feasible thoughts from the problem to the solution. Programming or coding is just a little part of that process. It's creativity and innovation at its best."

Building a picture in the minds of her students of all the possibilities that computer science has to offer is vitally important to her, since she sees some one-dimensional thinking in her native country. She finds that students who have not had the inter-national exposure that she has had, tend not to think outside of what is occurring in Pakistan, a gap she intends to bridge.

"There is a huge disconnect for students in Pakistan," she said. "People who have not had the chance to have the experience I had – living and studying in the States, making new friends and having mentors – they feel ok living in one world while the rest of the world is like another universe on another planet."

"Computer science is not just about programming," she said. "If you say computer science is programming, it is like saying all cooking is just chopping. Programming is certainly a part of it, but it's a very small part of it. Computer science is more about building solutions."

Her desire to be a teacher and mentor was born from her experience at NC State, as a new international student, in a completely unfamiliar environment several years ago.

"I found the general environment and the people here very warm and welcoming and since NC State – especially the Computer Science Department - gets so many international students, they have developed this culture which is really encouraging and motivational," she said. "I was the only one from Pakistan when I came here but after a few days, I didn't feel that way at all. It's an inclusive culture that I think was very helpful for me."

True to form, she found exactly what she was looking for at NC State, not just simply stated in a mission statement, but lived out on a day-to-day existence on the campus.

"I still remember one line from the mission statement of the Computer Science department, that says 'we want our graduates to be leaders and innovators in industry, education and government for the state, nation and world,'" she said. "I thought that was a very simple, yet powerful statement."

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