

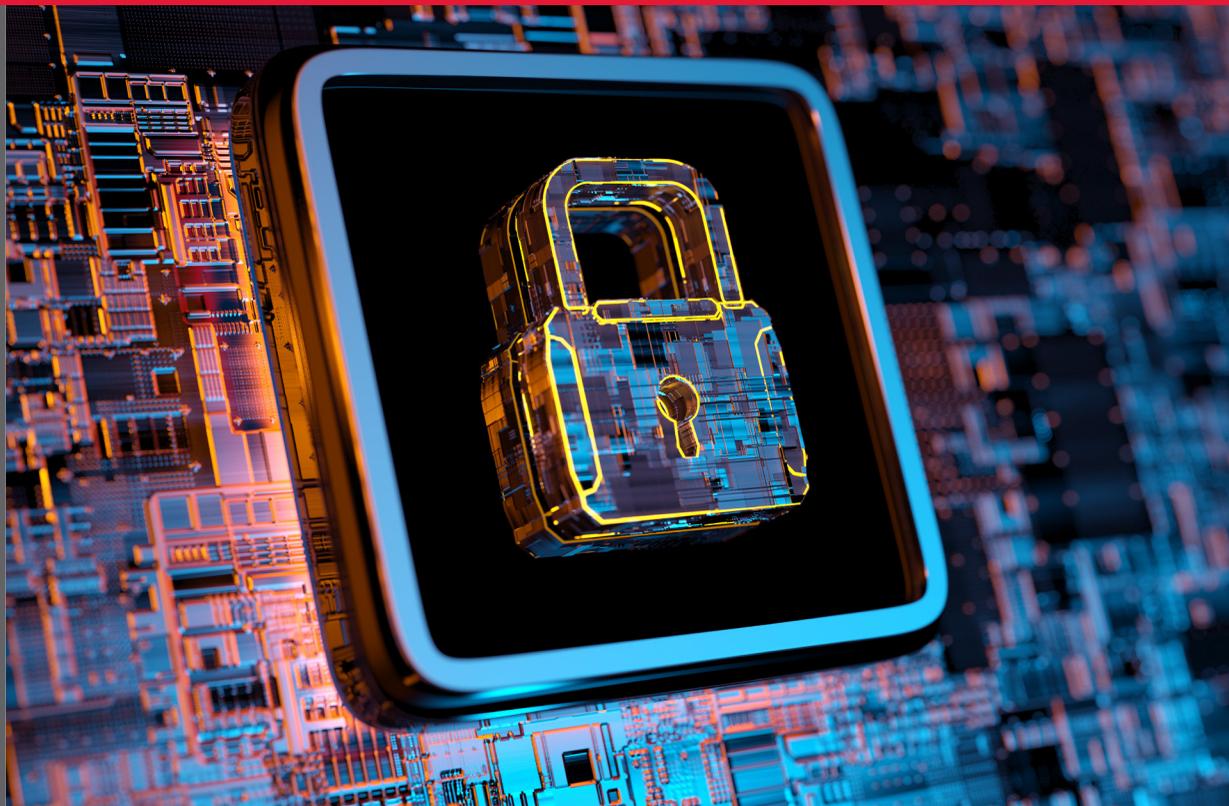
# RESEARCH

2019 – 2020

In partnership with a growing number of companies and federal agencies, the NC State Department of Computer Science (CSC) is building on its position as a leader in cybersecurity research and education, under the newly created Secure Computing Institute (SCI).

Co-led by Drs. Laurie Williams and Will Enck, the SCI is deploying a comprehensive cybersecurity initiative to create a vibrant multi-faceted community of practice that meets the growing need for security research and expands the pool of highly trained cybersecurity professionals.

As part of this initiative, the department is launching a new cybersecurity undergraduate concentration and masters degree, as well as exploring extension services to provide cybersecurity training to existing professionals. Much of these efforts will be coordinated by newly hired director of cybersecurity education, Dr. Thierry Wandji Ketchiozo, as well as a new director of cybersecurity practice.



As we all can attest, 2020 has been a challenging year for everybody, including our Wolfpack community. I am happy to report that the NC State Department of Computer Science (CSC) is weathering the storm and proceeding with our mission of educating our students and conducting impactful research. We have had to adjust our teaching and learning methods, and the way we do business as a department. The challenges aren't over yet, but together we continue to move forward.

Some things don't change - research remains key to our mission, and the CSC Department is home to 13 research centers, and more than 35 research labs and groups. Our key research areas are in Theory (Algorithms, Theory of Computation), Systems (Computer Architectures and Operating Systems, Embedded and Real-Time Systems, Parallel and Distributed Systems, Scientific and High Performance Computing), Artificial Intelligence (Intelligent Agents; Data-Mining,

Information and Knowledge Discovery, Engineering and Management; eCommerce Technologies; Information Visualization, Graphics and Human-Computer Interaction), Networks (Networking and Performance Evaluation), Security (Software and Network Systems Security, Information Assurance, Privacy), Software Engineering (Requirements, Formal Methods, Reliability Engineering, Process and Methods, Programming Languages), and Computer-Based Education.

Inside this newsletter you will see a sampling of the department's research activities during the last fiscal year. We would love to share all of our research with you, but space simply will not allow.

Even in the middle of a global pandemic, our research productivity hit new highs with research expenditures exceeding \$11.6M for the year, while we received new awards of almost \$14.4M, both records for our department. This ranks us in the top ten departments for sponsored research

*(continued on page 3)*

## INSIDE:

- Highlights
- Projects
- Faculty Profiles

# Research Highlights

- NC State analytics experts **Christopher Healey** and **Susan Simmons** built a visualization dashboard using publicly available data that can answer questions like “How does where I live compare with other regions in reports of COVID-19 infections and deaths;” “When should we expect our region to start ‘flattening its curve,’ or showing declines in the number of COVID-19 cases?” Their dashboard shows these comparisons and predictions, information that is hard to find elsewhere. They focused on exploration and prediction – properties that visualization and analytics are well suited to provide. The dashboard can be found at [csc2.ncsu.edu/faculty/healey/covid/](http://csc2.ncsu.edu/faculty/healey/covid/).
- **Dr. Bradley Reaves** and other researchers at NC State are finding that the number of robocalls isn’t going up, and that answering a robocall doesn’t make you more likely to get additional robocalls. However, stories you’ve heard about individuals getting hundreds of back-to-back unsolicited calls are true. “These findings stem from a broader study that is the first step toward a more robust set of tools for reducing robocalls, if not eliminating them,” says Reaves, co-author of a paper on the work and an assistant professor of computer science. “We made some fundamental advances in tracking robocalls back to their source, and upended a lot of the conventional wisdom regarding robocalls.”
- NC State researchers have designed an artificial intelligence (AI) model that is better able to predict how much students are learning in educational games. The improved model makes use of an AI training concept called multi-task learning, an approach in which one model is asked to perform multiple tasks. It could be used to improve both instruction and learning outcomes. “In our case, we wanted the model to be able to predict whether a student would answer each question on a test correctly, based on the student’s behavior while playing an educational game called Crystal Island,” says **Jonathan Rowe**, a research scientist in NC State’s Center for Educational Informatics (CEI).
- **Dr. Chris Parnin** and other researchers from NC State are working with Microsoft on a project that finds that the technical interviews currently used in hiring for many software engineering positions test whether a job candidate has performance anxiety rather than whether the candidate is competent at coding. The interviews may also be used to exclude groups or favor specific job candidates. “Technical interviews are feared and hated in the industry, and it turns out that these interview techniques may also be hurting the industry’s ability to find and hire skilled software engineers,” says Parnin, an assistant professor of computer science and co-author of a paper on the work. “Our study suggests that a lot of well-qualified job candidates are being eliminated because they’re not used to working on a whiteboard in front of an audience.”
- Statistics show that women occupy just 28% of STEM jobs and account for only 17% of computer science majors and 21% of engineering majors. **Drs. Bitu Akram, Tiffany Barnes, Thomas Price** and **Lina Battestilli**, are collaborating with Dr. Susan Fisk at Kent State University to find out what can be done to broaden participation in STEM fields and improve the persistence of women in computer science. Based on existing social-psychology theory and the results of their 2018 pilot study, they suspect that the differences in career choices arise partially from gender differences in self-assessment of STEM ability while in school. The researchers have received almost \$300,000 in grant funding (\$174,938 to NC State; \$125,062 to Kent State) from the National Science Foundation (NSF) to test whether educational institutions can use a simple, easily-to-implement intervention, such as an encouraging email message, to increase the persistence of women in computer science and other STEM disciplines.
- **Dr. Muhammad Shahzad**, assistant professor of computer science, and research assistant, **Usman Khan**, have developed a system that generates maps of buildings without entering the building. “Our project includes wireless-transmission equipment that uses radio frequencies. We set this equipment outside a building and it does a sweep of the entire building,” Shahzad said. “By looking at the reflection of the signals that come back from objects within the building, we can take this information and construct a map of the insides of the building.” According to Khan, law enforcement and first responders would benefit greatly from this technology. “First responders could use this technology at the scene to know what the building looks like inside, locate the different victims, and allocate their resources accordingly.”

(continued from page 1)

funding among computer science departments in colleges of engineering in the United States. Some of our 2019-2020 research highlights are listed on page two, and a sampling of some of our research projects appears on page four of this newsletter. Please visit our website ([csc.ncsu.edu](http://csc.ncsu.edu)) to learn more about the department, our faculty and staff, and our state-of-the-art research.

Here are some selected research highlights and numerous prestigious and professional accomplishments by our faculty and staff that deserve special recognition:

- NC State ranks **#1 in tenure-track female faculty** among computer science departments in colleges of engineering.
- **Dr. Min Chi**, associate professor, **Dr. Tiffany Barnes**, professor, and **Dr. Thomas Price**, assistant professor, have received a National Science Foundation (NSF) grant worth nearly \$2M in support of their work on developing “generalizable data-driven tools that address the conceptually and practically complex activity of constructing adaptive support for individualized learning in STEM domains.”
- **Dr. Munindar Singh**, Alumni Distinguished Graduate Professor of Computer Science at NC State, received the 2020 ACM/SIGAI Autonomous Agents Research Award.
- **Dr. Bradford Mott**, senior research scientist at NC State’s Center for Educational Informatics (CSI), and other researchers at NC State have developed a new video game framework that brings together two well-studied approaches to educational software in order to keep multiple players engrossed in the learning experience while fostering collaboration and problem solving. The team developed a conceptual framework for combining two educational approaches - interactive narratives and collaborative, problem-based learning – and then created a software architecture and suite of game-creation tools for implementing that framework. The framework is one of the first to integrate narrative-centered learning and collaborative learning techniques, laying the groundwork for future efforts in the field.
- **Dr. George Rouskas**, Director of Graduate Programs and Alumni Distinguished Graduate Professor of Computer Science at NC State, received the 2019 Outstanding Service Award from the Optical Networking Committee (ONTC) of the IEEE Communications Society at the 2019 IEEE GLOBECOM conference.
- **Dr. Noburo Matsuda**, associate professor of computer science, is researching ways to develop learning-engineering methods to efficiently build an effective online STEM learning environment, in the form of adaptive online courseware called CyberBook, to promote robust mathematics learning with understanding. The proposed CyberBook is

a combination of traditional online courseware (that promotes conceptual understanding) and intelligent tutoring systems (that support guided learning-by-doing).

- Researchers, led by assistant professor **Dr. Alexandros Kapravelos**, have developed an open-source tool that allows users to track and record the behavior of JavaScript programs without alerting the websites that run those programs. The tool, called VisibleV8, runs in the Chrome browser and is designed to detect malicious programs that are capable of evading existing malware detection systems.
- **Dr. Will Enck**, associate professor, and **Dr. Bradley Reaves**, assistant professor, are working to make network operations more secure by creating a novel primitive called network views that allows a physical or virtual host to have a different set of accessible peers, regardless of network address or topological placement of those peers. They plan to explore and characterize the utility and practicality of network views in different work environments, ranging from traditional LANs to multi-site, multi-tenant networks such as those emerging in cloud and cellular networks.
- With over 15 years of experience on the front lines of cybersecurity efforts, **Dr. Thierry Wandji Ketchiozo** has joined the department as Director of Cybersecurity Education. He will help train the next generation of computer scientists to protect critical systems from dangerous attacks.

Producing well educated students who are prepared for the workforce is also key to the mission of the department, and our graduates continue to be in high demand. Computer science degree holders lead the University with the highest median starting salaries across all disciplines; \$81,250 for BS (Dec. ‘19) and \$112,000 for MS. Our students are recruited and hired by companies like IBM, Cisco Systems, NetApp, SAS and other top financial and IT organizations, as well as other high-tech companies.

Even though the last six months have been nothing like we had hoped or planned for, I am proud of the way our faculty, staff and students have come together to move forward in the face of the COVID-19 pandemic. It has been a year in which every challenge has been met with new solutions, and we have weathered the storm with great determination! We are stronger as a Pack!

Dr. Gregg Rothermel  
*Professor and Department Head*



# Selected Research Projects

*A Cybersecurity Educational Partnership for the Government Workforce*, **Douglas Reeves, Sarah Heckman. \$2,748,558 by National Science Foundation.**

*Development of a Nearly Autonomous Management and Control System for Advanced Reactors*, **Min Chi, Nam Dinh, Maria Avramova, Abhinav Gupta. \$2,686,834 by US Department of Energy (DOE) – Advanced Research Projects Agency – Energy (ARPA-E).**

*Tools for Natural Language-Based Team Communication Assessment and team Feedback in Collective Synthetic Training Environments*, **James Lester, Bradford Mott, Jonathan Rowe, Randall Spain. \$2,018,810 by US Army – Army Research Laboratory.**

*Generalizing Data-Driven Technologies to Improve Individualized STEM Instruction by Intelligent Tutors*, **Min Chi, Tiffany Barnes, Thomason Price. \$1,999,578 by National Science Foundation.**



*Multimodal Visitor Analytics: Investigating Naturalistic Engagement with Interactive Tabletop Science Exhibits*, **James Lester, Jonathan Rowe, James Minogue. \$1,951,956 by National Science Foundation.**

*Collaborative Research: Building a Computational Thinking Foundation in Upper Elementary Science with Narrative-Centered*

*Maker Environments*, **Bradford Mott, James Minogue, Kevin Oliver. \$1,599,339 by National Science Foundation.**

*Collaborative Research: FW-HTF: Augmented Cognition for Teaching: Transforming Teacher Work with Intelligent Cognitive Assistants*, **James Lester, Bradford Mott. \$1,499,736 by National Science Foundation.**

*Developing an Online Environment for Learning Algebra by Teaching a Synthetic Peer*, **Noboru Matsuda. \$1,399,947 by US Department of Education (DED).**

*Investigating Emergency Response Performance with VR-Based Intelligent User Interfaces*, **James Lester, Bradford Mott, Randall Spain. \$1,112,175 by National Institute of Standards and Technology.**

*Defining Security Policy in Distributed Environments Using Network Views*, **William Enck, Bradley Reaves. \$1,033,306 by US Navy – Office of Naval Research.**

*Collaborative Research: Primary AI: Integrating Artificial Intelligence into Upper Elementary Science with Immersive Problem-Based Learning*, **James Lester, Bradford Mott. \$985,585 by National Science Foundation.**

*CHECRS: Cognitive Human Enhancements for Cyber Reasoning Systems*, **Alexandros Kapravelos. \$884,817 by Arizona State University/DARPA.**

*Intelligent Support for Creative, Open-ended Programming Projects*, **Thomason Price, Tiffany Barnes, Christopher Martens. \$749,920 by National Science Foundation.**

*IUCRC Pre-Proposal Phase I NC State University: Center for Accelerated Real Time Analytics (CARTA)*, **Rada Chirkova. \$747,647 by National Science Foundation.**

*Developing Integrated Teaching Platforms to Enhance Blended Learning in STEM*, **Collin Lynch, Tiffany Barnes, Sarah Heckman. \$599,992 by National Science Foundation.**

*Elements: Can Empirical SE be Adapted to Computational Science?*, **Timothy Menzies. \$592,129 by National Science Foundation.**

*Simulating Social Influence Based on Real-World Geographic Data: Emergent Narratives and Interactive Hypothesis Testing*, **Christopher Martens. \$577,574 by US Air Force – Office of Scientific Research (AFOSR).**

*CAREER: Explorable Formal Models of Privacy Policies and Regulations*, **Christopher Martens. \$555,000 by National Science Foundation.**

*CAREER: Improving Adaptive Decision Making in Interactive Learning Environments*, **Min Chi. \$547,810 by National Science Foundation.**

*Science of Security Lablet: Impact through Research, Scientific Methods, and Community Development*, **Laurie Williams, Munindar Singh. \$537,539 by US Department of Defense (DOD).**

*CAREER: On the Foundations of Semantic Code Search*, **Kathryn Stolee. \$500,000 by National Science Foundation.**

*Detecting the 1%: Growing the Science of Vulnerability Detection*, **Laurie Williams, Timothy Menzies. \$499,998 by National Science Foundation.**

*Automated Discovery of Cross-Language Program Behavior Inconsistency*, **Christopher Pamin, Kathryn Stolee. \$499,994 by National Science Foundation.**

*Detecting Vulnerabilities and Remediations in Software Dependencies*, **William Enck, Bradley Reaves. \$499,928 by National Science Foundation.**

*SmartChainDB – Enabling Smart Marketplaces with a Scalable Semantically-Enhanced Blockchain Platform*, **Kemafor Ogan, Alessandra Scafuro, Binil Starly. \$499,773 by National Science Foundation.**

*Adaptive Rendering and Display for Emerging Immersive Experiences*, **Ben Watson. \$497,177 by National Science Foundation.**

*On the Value of Learning from 10,000+ Software Projects*, **Timothy Menzies. \$472,024 by National Science Foundation.**

*Principles of Normative Multiagent Systems for Decentralized Applications*, **Munindar Singh. \$450,000 by National Science Foundation.**

*On Parallelizing Optical Network Design Problems: Towards Network Optimization as a Service*, **George Rouskas. \$439,148 by National Science Foundation.**

*Cyberinfrastructure for Robust Learning of Interconnected Knowledge*, **Noboru Matsuda. \$386,884 by National Science Foundation.**



# New Faculty Profiles



## XU LIU

joined the department as an assistant professor in fall 2020. He received his B.S. in software engineering from Beihang University, his M.S. in computer science from Chinese Academy of Sciences and a Ph.D. in computer science from Rice University. Prior to joining the NC State faculty, he

was an assistant professor at the Department of Computer Science at the College of William & Mary. He works on building performance tools to pinpoint and optimize inefficiencies in HPC code bases. He has developed several open-source profiling tools, which are world-widely used at universities, DOE national laboratories, and industrial companies. He is the recipient of a 2019 IEEE TCHPC Early Career Researchers Award for Excellence in High Performance Computing. Liu's research interests lie in program analysis in high performance computing systems.



## SHUYIN JIAO

joined the department in fall 2020 as a teaching assistant professor. She received her B.S. in materials science and engineering from Beihang University in China, her Diplome Grande Ecole in Engineering from Ecole Centrale de Lyon in France, and her Ph.D. from the University of Houston (2015). Prior to coming to NC State,

she was a teaching faculty in the College of William & Mary, and before that, she was a research assistant at the University of Houston. She received an ABS Scholarship and Amoco Minority Scholarship in 2014, and a Kalsi Research Award in 2012. Her research interests are in program analysis and computer science education.



## THIERRY WANDJI KETCHIOZO

*Director of Cybersecurity Education*

After spending 15 years on the front lines of cybersecurity efforts working as an engineer for the Department of Defense, Ketchiozo has joined NC State as the director of cybersecurity education in the Department of Computer Science. His goal is to help train the next generation of engineers and computer scientists who will continue his work protecting critical systems from dangerous attacks.

Ketchiozo, who started with NC State on August 24, holds a bachelor's degree from University of Montreal, master's degrees from Morgan State University and University of Maryland University College (UMUC) and a Ph.D. from George Washington University. After jobs in private industry, he held senior positions as a researcher and software and systems engineer for the U.S. Naval Research Laboratory and Naval Air Systems Command.

At the same time, he has held teaching positions in the area of cybersecurity at Morgan State and UMUC. Ketchiozo said that he sees an urgent need for increased cybersecurity expertise in the United States and saw the new position at NC State as a chance to pass on what he has learned in industry, academia and public sector work both to students and to professionals who need more expertise.

The newly created position is a critical piece of CSC's effort to increase its role as a national leader in cybersecurity education and research. It is a key part of the Security Computing Institute (SCI), founded at NC State in 2019 with a goal of enhancing the security and privacy of computing systems through basic and applied research and advancing and delivering cybersecurity education.

## Senior Faculty Spotlight

### DR. XIAOHUI (HELEN GU)

*Professor of Computer Science*

Xiaohui (Helen) Gu received her Ph.D. (2004) and her M.S. (2001) degrees from the Department of Computer Science at the University of Illinois at Urbana-Champaign. She received her B.S. (1999) degree in computer science from Peking University in Beijing, China. She was a research staff member at the IBM T.J.Watson Research Center from 2004-2007 before joining NC State in 2008.

Gu received IBM Invention Achievement Awards in 2004, 2006, and 2007. She has filed nine patents, and has published more than 80 research papers in international journals and major peer-reviewed conference proceedings. Gu is a recipient of the National Science Foundation (NSF) CAREER Award (2012), four IBM Faculty Awards (2008, 2009, 2010, 2011), and two Google Research Awards (2009 and 2011). She received Best

Paper Awards from CNSM 2010, ICDCS 2012, and an NC State Faculty Research and Professional Development Award. She served as program co-chair for IEEE/ACM IWQoS 2013 and USENIX ICAC 2014. She is an associate editor for IEEE Transactions for Parallel and Distributed Systems (TPDS). She is a Senior Member of IEEE and a member of ACM. She was on sabbatical at Google as a visiting scientist in 2015. That same year, she also founded InsightFinder, an NC State startup company commercializing cloud management technologies which were invented by her research group. One of their unsupervised machine learning based anomaly detection technologies has been licensed to Google.



# Researchers\*

**Dennis R. Bahler, Associate Professor**  
PhD, University of Virginia, 1987

Artificial intelligence: constraint processing, machine learning, hybrid neural-symbolic computing

**Tiffany Barnes, Professor**  
PhD, NC State University, 2003

Educational data mining, serious games for education, health and energy, broadening computing participation

**Donald Bitzer, Distinguished University Research Professor**  
PhD, University of Illinois, 1960

Convolutional codes, signal processing for biological systems, computer-based education

**Franc Brglez, Visiting Research Professor**  
PhD, University of Colorado, 1970

Distributed and collaborative workflows, databases, and groupware for the Internet

**Min Chi, Associate Professor**  
PhD, University of Pittsburgh, 2009

Machine learning, artificial intelligence, cognitive science and learning science

**Rada Y. Chirkova, Professor**  
PhD, Stanford University, 2002

Database performance, query-processing efficiency, data sciences

**Anupam Das, Assistant Professor**  
PhD, University of Illinois, 2016

Data science

**Jon Doyle, SAS Distinguished Professor**  
PhD, Massachusetts Institute of Technology, 1980

Artificial Intelligence, mathematical and philosophical foundations, rational agents, decision making

**Patrick Dreher, Research Professor**  
PhD, University of Illinois, 1991

Cloud computing, scientific and high performance computing

**Rudra Dutta, Professor and Interim Associate Department Head**  
PhD, NC State University, 2001

Network design: optical, wireless sensor and mesh networks; future Internet design

**William Enck, Associate Professor**  
PhD, The Pennsylvania State University, 2011

Systems security, mobile operating systems security

**Vincent Freeh, Associate Professor**  
PhD, University of Arizona, 1996

Operating systems, compilers, programming languages, storage

**Edward Gehringer, Professor**  
PhD, Purdue University, 1979

Memory management, object-oriented software systems, computer-aided education

**Xiaohui (Helen) Gu, Professor**  
PhD, University of Illinois, 2004

Distributed systems, operating systems, computer networks

**Khaled Harfoush, Associate Professor**  
PhD, Boston University, 2002

Computer networking, Internet measurements, peer-to-peer systems, routing protocols

**Christopher G. Healey, Goodnight Distinguished Professor**  
PhD, University of British Columbia, Canada, 1996

Visualization and computer graphics: methods for rapidly, accurately, effectively visualizing large complex datasets

**Steffen Heber, Professor**  
PhD, Universität Heidelberg, Germany, 2001

Algorithms to compare and analyze gene order permutations, animation development for bioinformatics education

**Arnav Jhala, Associate Professor**  
PhD, NC State University, 2009

Artificial intelligence, storytelling in games, intelligent machinima generation, smart graphics, and intelligent user interfaces

**Guoliang Jin, Assistant Professor**  
PhD, University of Wisconsin-Madison, 2014

Architecture and operating systems, parallel and distributed systems, software engineering and programming languages

**Alexandros Kapravelos, Assistant Professor**  
PhD, University of California-Santa Barbara, 2015

Systems and software security

**James C. Lester, Distinguished University Professor**  
PhD, University of Texas, 1994

Artificial intelligence, intelligent user interfaces, intelligent tutoring systems, computational linguistics

**Xu Liu, Assistant Professor**  
PhD, Rice University, 2014

Program analysis in high performance computing systems

**Collin Lynch, Assistant Professor**  
PhD, University of Pittsburgh, 2014

Graph-based educational data mining, development of robust intelligent tutoring systems, adaptive educational systems for ill-defined domains

**Chris Martens, Assistant Professor**  
PhD, Carnegie Mellon University, 2015

Formal methods for creative media, game design, believable virtual agents, collaborative digital storytelling, simulation modeling

**Noboru Matsuda, Associate Professor**  
PhD, University of Pittsburgh, 2005

Technology innovation and integration to advance the sciences of learning

**Tim Menzies, Professor**  
PhD, University of New South Wales, 1995

Artificial intelligence, data-mining and search-based software engineering

**Bradford Mott, Senior Research Scientist**  
PhD, NC State University, 2006

Artificial intelligence, game-based learning environments, computational models of interactive narrative

**Frank Mueller, Professor**  
PhD, Florida State University, 1994

Compilers and code optimization, concurrent and distributed, real-time and embedded systems

**Kemafor Anyanwu Ogan, Associate Professor**  
PhD, University of Georgia, 2007

Semantic computing: semantic Web, databases, data mining, information retrieval, services computing

**John-Paul Ore, Assistant Professor**  
PhD, University of Nebraska-Lincoln, 2019

Software engineering, robotics, program analysis, and system testing using high-resolution physical simulators

**Chris Parnin, Assistant Professor**  
PhD, Georgia Institute of Technology, 2014

Graphics and computer interaction, software engineering, programming languages

**Harry Perros, Alumni Distinguished Graduate Professor**  
PhD, Trinity College, Ireland, 1975

Performance analysis of optical networks, performance monitoring of grids, queueing networks

**Thomas Price, Assistant Professor**  
PhD, NC State University, 2018

Computing education, intelligent tutoring systems, educational data mining, and novice programming environments



\*list includes 2019-20 faculty as well as faculty promotions, and faculty joining the department in August 2020.

**Michael Rappa, Distinguished University Professor**  
**PhD, University of Minnesota, 1987**

Analytics, e-commerce, open courseware, open educational content, technology management

**Bradley Reaves, Assistant Professor**  
**PhD, University of Florida, 2017**

Measuring and improving the security and privacy of computer systems, with emphasis on telephony networks and software for mobile platforms

**Douglas S. Reeves, Professor**  
**PhD, The Pennsylvania State University, 1987**

Architecture and operating systems, cyber security, networking and performance evaluation

**David Roberts, Associate Professor**  
**PhD, Georgia Institute of Technology, 2010**

Machine learning and artificial intelligence and their application to interactive technological experiences

**Gregg Rothermel, Professor and Department Head**  
**PhD, Clemson University, 1985**

Software engineering and program analysis with emphases on the application of techniques to problems in software maintenance and testing, end-user software engineering, and empirical studies.

**George N. Rouskas, Alumni Distinguished Graduate Professor**  
**PhD, Georgia Institute of Technology, 1994**

Network architectures and protocols, optical networks, grid computing

**Nagiza Samatova, Professor**  
**PhD, Russian Academy of Science (CCAS), 1993**

Graph theory and algorithms, bioinformatics, systems biology, data management, data integration, data science

**Carla D. Savage, Professor**  
**PhD, University of Illinois, 1977**

Combinatorics, combinatorial algorithms, network algorithms, graph theory, discrete mathematics

**Alessandra Scafuro, Assistant Professor**  
**PhD, University of Salerno, 2013**

Cryptography, secure computation

**Muhammad Shahzad, Associate Professor**  
**PhD, Michigan State University, 2015**

Embedded and real-time systems, networking and performance evaluation, cyber security

**Don Sheehy, Associate Professor**  
**PhD, Carnegie Mellon University, 2011**

Computational geometry and topological data analysis

**Xipeng Shen, Professor**  
**PhD, University of Rochester, 2006**

Architecture and operating systems, extreme-scale data-intensive computing

**Munindar Singh, Alumni Distinguished Graduate Professor**  
**PhD, University of Texas, 1993**

Multiagent systems, intelligent agents, service-oriented computing, agent languages and protocols

**Matthias Stallmann, Professor**  
**PhD, University of Colorado, 1982**

Algorithm design and analysis of serial and parallel models of computation

**Kathryn Stolee, Associate Professor**  
**PhD, University of Nebraska-Lincoln, 2013**

Program analysis, empirical software engineering and crowdsourcing

**Ranga Raju Vatsavai, Associate Professor (joint apt. w/ORNL)**  
**PhD, University of Minnesota, 2008**

Advanced data sciences, geospatial analytics

**Mladen Vouk, Distinguished Professor**  
**PhD, King's College, England, U.K., 1976**

Software engineering, scientific computing, computer-based education, cloud computing, data science

**Benjamin Watson, Associate Professor**  
**PhD, Georgia Institute of Technology, 1997**

Relationships between computer graphics and design

**Laurie Williams, Distinguished Professor**  
**PhD, University of Utah, 2000**

Agile software processes, software security, open software systems, healthcare information technology

**Ruozhou Yu, Assistant Professor**  
**PhD, Arizona State University, 2019**

Computer networks, distributed systems, and cybersecurity

## Teaching Professors

**Bitra Akram, Teaching Assistant Professor**  
**PhD, NC State University, 2019**

Advanced learning technologies, and improving access and quality of computer science education

**Suzanne Balik, Teaching Assistant Professor**  
**PhD, NC State University, 2014**

Graphics, human computer interaction

**Lina Battestilli, Teaching Associate Professor**  
**PhD, NC State University, 2005**

Computer science education, cloud computing and datacenter networks, networking architecture

**Ignacio Domínguez, Teaching Assistant Professor**  
**PhD, NC State University, 2018**

Human behavior in video games and virtual environments that can be used to identify, predict, and influence behavior and decision-making

**Sarah Heckman, Alumni Distinguished Undergraduate Professor**  
**PhD, NC State University, 2009**

Computer science and software engineering education, open educational resources

**Jamie Jennings, Teaching Assistant Professor**  
**PhD, Cornell University, 1995**

Theory, programming languages, software engineering, robotics, and artificial intelligence

**Shuyin Jiao, Teaching Assistant Professor**  
**PhD, University of Houston, 2015**

Program Analysis and computer education

**Jason King, Teaching Assistant Professor**  
**PhD, NC State University, 2016**

Logging for user accountability, nonrepudiation and forensicability

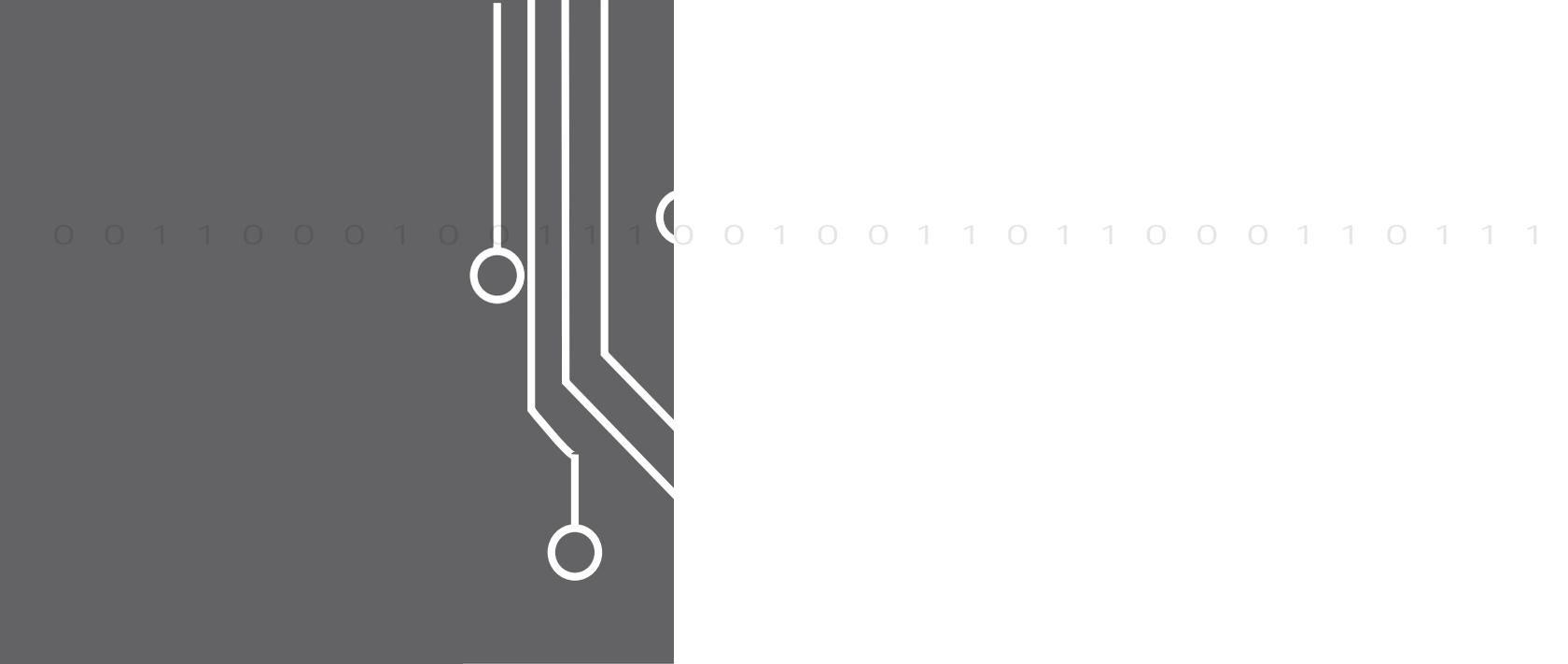
**Jessica Young Schmidt, Teaching Assistant Professor**  
**PhD, NC State University, 2012**

Scholarship of teaching and learning

**David Sturgill, Teaching Associate Professor**  
**PhD, Cornell University, 1996**

Parallel computation and its application to computationally hard problems, parallelism, machine learning intelligence



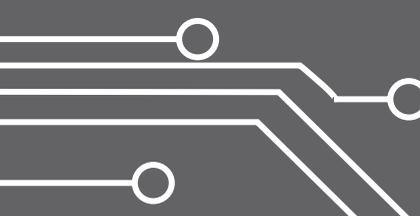


## Computer Science Research

*Our key research areas are in:*

- **Artificial Intelligence and Theory** including Intelligent Agents, Machine Learning, Knowledge Representation, Planning, Natural Language Processing, Computational Economics and Management, Algorithms, Theory of Computation
- **Computational Applications and Analytics** including Data Intensive Computing, Scientific Computing, Bioinformatics, Data/Text Mining, Information Visualization, HealthCare Information Technology, Analytics Clouds, Data Science
- **Games, Interaction, and Education Informatics** including Games, Human-Computer Interaction, Graphics, Intelligent Tutoring, Undergraduate Education in Computing
- **Cyber Security** including Information Assurance, Privacy, Policies, Regularity Compliance, Networking and Performance Evaluation, Web Security, Mobile Security, Crypto, Internet of Things
- **Networks** including Software and Network Systems Security, Performance Analysis, Wireless and Mobile Networking, Network Analytics, Internet of Things, Internet Architecture and Protocols
- **Software Engineering** including Requirements, Formal Methods, Policies, Reliability Engineering, Process and Methods, Programming Languages, Testing and Verification
- **Systems** including Computer Architectures and Operating Systems, Databases, Embedded and Real-Time Systems, Parallel and Distributed Systems, High Performance Computing, Cloud Computing

*The department has a number of teaching and research laboratories, centers, institutes and other facilities that support its education, research and outreach missions.*



**NC STATE** Engineering

**Department of Computer Science**  
Campus Box 8206  
Raleigh, NC 27695-8206

Editor: Ken Tate; Associate Editor: Tammy Coates

1,500 copies of this document were printed at a cost of \$1,621.



[www.csc.ncsu.edu](http://www.csc.ncsu.edu)