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RESEARCH

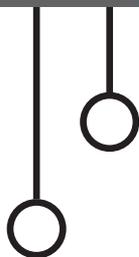
2015 – 2016

The NC State Computer Science Department ranks **#1 in number of tenure-track female faculty** among all departments of computer science within colleges of engineering.

Pictured here are 14 of our department's 20 fabulous female research and/or teaching faculty.



Research Highlights



INSIDE:

- Highlights
- Projects
- Faculty Profiles

Greetings and welcome to the 2015-2016 issue of Research, our annual synopsis of research activities in the NC State Department of Computer Science. NC State is a Tier 1 research institute, and with over 30 centers, labs and groups, research is at the very core of our department mission.

Our research productivity continues to grow with more than \$64 million in active research grants, and annual expenditures in the \$16.5 million range. This ranks us in the top ten departments for sponsored research funding among computer science departments in colleges of engineering in the United States. On the following page you will

see a list of some of our research highlights, and a list of select representative projects appears on page four of this newsletter. We invite you to visit our website at www.csc.ncsu.edu to learn more about the department, our faculty and staff, and our game-changing research.

In addition, our faculty and students benefited from a record level of corporate collaboration and research support over the year. Industry research partners including Cisco, Google, IBM, Northrop Grumman, LexisNexis, Microsoft and SAS provided research support of approximately \$1M to our faculty in 2015-16.

(cont.)

Research Highlights

- **Dr. Laurie Williams**, professor and associate department head in the NC State Computer Science Department, recently received one of 32 Microsoft Research Outstanding Collaborator Awards for 2016. She was recognized for her exceptional contributions to software engineering research, not only in Microsoft Research but throughout Microsoft at unprecedented levels for over 10 years.
- **Dr. Frank Mueller**, professor of computer science, was recently elevated to IEEE Fellow status for his contributions to real time, embedded systems, and timing analysis research. Mueller is now the seventh IEEE Fellow in the department, joining Drs. George Rouskas, Harry Perros, Donald Bitzer, Wushow “Bill” Chou, Mladen Vouk, and Munindar Singh, who have been selected between the years of 1982 and 2011.
- **Dr. Mladen Vouk** has taken on new responsibilities in the Office of Research, Innovation and Economic Development as associate vice chancellor for research development. The computer science department head and distinguished professor of computer science also directs the Data Sciences Initiative.
- **Dr. Helen Gu**, associate professor of computer science, has launched a start-up called InsightFinder to help companies that use cloud computing improve the user experience for their customers. The technology that Gu developed allows companies that use cloud computing to gain insight into user and program behavior in order to diagnose potential problems in their code so 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.
- **The Video Game Design Program** at NC State has been recognized on the Princeton Review’s list saluting the top 50 undergraduate schools to study game design for 2016. NC State ranked 9th on the list of public universities, and 33rd overall.
- The NC State Department of Computer Science is pleased to announce the approval and launch of a **Masters Track in Software Engineering** in the Graduate Program curriculum. Curriculum requirements 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.
- An international team of computer science researchers, including **Dr. William Enck**, associate professor of computer science, has identified serious security vulnerabilities in the iOS – the operating system used in Apple’s iPhone and iPad devices. The vulnerabilities make a variety of attacks possible. The researchers focused on the iOS’s “sandbox,” the interface between applications and the iOS. The iOS sandbox uses a set profile for every third party app. This profile controls the information that the app has access to and governs which actions the app can execute. Researchers have discussed the iOS vulnerabilities with Apple, and they are working on fixing the security flaws, and policing any apps that might try to take advantage of them.
- The Departments of Computer Science and the Statistics at NC State are pleased to announce the approval and launch of a **Graduate Certificate in Data Science Foundations**. 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.

(continued from page 1)

Over the last year, our department has continued to experience exciting growth. Enrollments continue to increase – in fall 2015 we enrolled 1,617 students in our department – 913 undergraduates and 704 graduate students (212 PhD students). In 2015-2016, we awarded 196 undergraduate degrees and 283 graduate degrees. Demand for our graduates continues to be extremely high with starting salaries for those graduating with a BS degree averaging over \$72,400, while starting salaries for our master's degree students is more than \$102,000, and for PhD students, it's even higher. We are one of the top suppliers of new grad talent to companies like IBM, Cisco, SAS, NetApp, Amazon, Fidelity Investments, Microsoft, Intel, Facebook, Bank of America & VMware.

The department received a number of accolades this year: Our Video Game Design program has been recognized on the Princeton Review's list saluting the top 50 undergraduate schools to study game design for 2016. NC State ranked 9th on the list of public universities, and 33rd overall; NC State's Engineering Online Computer Science and Networking programs are ranked 7th nationally on the U.S. News & World Report's 2016 list of the Best Online Graduate Information Technology Programs; Engineering Online at NC State is ranked 12th nationally on the U.S. News & World Report's 2016 list of Best Online Graduate Engineering Programs; NC State's Online Master's Degree in Computer Science has been ranked #8 on Affordable Colleges Online's list of the Best Online Master's in Computer Science Degrees; NC State Computer Science Online Master's Degree program is ranked 5th on Go Grad's 2015-2016 List of Best Master's Programs in Computer Science. Of all the rankings, I am most proud of the fact that we rank #1 in number of tenure-track female faculty among all departments of computer science within colleges of engineering.

Our faculty have received numerous prestigious awards and professional recognitions in 2015-2016: **Dr. Laurie Williams** was named Associate Department Head of the Computer Science Department. She was also the recipient of one of 32 Microsoft Research Outstanding Collaborator Awards for 2016. Additionally, Williams has been selected as part of the inaugural class of the NC State Research Leadership Academy; **Dr. Frank Mueller**

was recently elevated to the Institute of Electrical and Electronics Engineers

(IEEE) Fellow status for his contributions to real time, embedded systems, and timing analysis research; **Drs. Rudra Dutta, Xipeng Shen, and Laurie Williams** were elevated to IEEE Senior Member grade; **Dr. Munindar Singh** received the NC State Alumni Association Distinguished Graduate Professorship Award. He also recently won the 2016 International Foundation for Autonomous Agents in MultiAgent Systems (IFAAMAS) Influential Paper Award for his paper "Agent Communication Languages: Rethinking the Principles" which appeared in IEEE Computer in December 1998; **Dr. Tiffany Barnes** received the National Center for Women and Information Technology (NCWIT) Undergraduate Mentoring Award; the NC State Institute for Advanced Analytics has appointed **Dr. Christopher Healey** to the Goodnight Distinguished Professorship in Advanced Analytics; **Dr. Xipeng Shen** has been named an Association for Computing Machinery (ACM) Distinguished Speaker; and **Dr. Injong Rhee's** paper, "Mobile Data Offloading: How Much Can Wifi Deliver?" selected to receive the 2016 IEEE Communications Society William R. Bennett Prize in the Field of Communications Networking.

As we approach our 50th anniversary in 2017, we are proud to be one of the oldest and largest computer science departments in the nation. I want to take this opportunity to thank our alumni, friends and funding partners who have helped make this another record year for both research and unrestricted support! Your collective support allows the department to continue to grow in emerging areas of computer science, while providing the highest quality educational experience for our students.

Mladen A. Vouk

Distinguished Professor and Department Head



Selected Projects

Consortium for Nonproliferation Enabling Capabilities, **Nagiza Samatova, Robin Gardner**. **\$9,744,249 by US Department of Energy**.

Growing the Science of Security Through Analytics, **Laurie Williams, Munindar Singh**. **\$5,939,339 by NSA (US Dept. of Defense)**.

A Game-Based Curricular Strategy for Infusing Computational Thinking into Middle School Science, **James Lester, Brad Mott, Eric Wiebe**. **\$2,498,862 by National Science Foundation**.

Moore Foundation Data-Driven Discovery Investigator, **Blair Sullivan** (pictured at right). **\$1,500,000 by Gordon and Betty Moore Foundation**.

The Effectiveness of Intelligent Virtual Humans in Facilitating Self-Regulated Learning in STEM with MetaTutor, **James Lester, Roger Azevedo**. **\$1,365,603 by National Science Foundation**.



Guiding Understanding via Information from Digital Environments (GUIDE), **James Lester, Eric Wiebe**. **\$1,238,549 by Concord Consortium via National Science Foundation**.

Collaborative Research: Research in Student Peer Review: A Cooperative Web-Services Approach, **Edward Gehringer**. **\$1,034,166 by National Science Foundation**.

CPS: Synergy: Integrated Sensing and Control Algorithms for Computer-Assisted Training (Computer-Assisted Training Systems (CATS) for Dogs, **David Roberts, Alper Bozkurt (ECE), Barbara Sherman (CVM)**. **\$1,029,403 by National Science Foundation**.

Identification of Translational Hormone-Response Gene Networks and Cis-Regulatory Elements, **Steffen Heber, Jose Alonso, Anna Stepanova, Cranos Williams**. **\$897,637 by National Science Foundation**.



TWC: Frontier: Collaborative: Rethinking Security in the Era of Cloud Computing, **Mladen Vouk, Peng Ning**. **\$749,996 by National Science Foundation**.

Educational Data Mining for Individualized Instruction in STEM Learning Environments, **Min Chi, Tiffany Barnes**. **\$639,401 by National Science Foundation**.

Holistic, Cross-Site, Hybrid System Anomaly Debugging for Large Scale Hosting Infrastructures, **Xiaohui (Helen) Gu** (pictured at right). **\$518,000 by National Science Foundation**.

Scaling CS Principles Through STARS Community and Leadership Development, **Tiffany Barnes**. **\$500,000 by National Science Foundation**.

Direct Physical Grasping, Manipulation, and Tooling of Simulated Objects, **Robert St. Amant, Christopher Healey**. **\$496,858 by National Science Foundation**.

CAREER: Expanding Developers' Usage of Software Tools by Enabling Social Learning, **Emerson Murphy-Hill**. **\$495,721 by National Science Foundation**.

SHF: Small: Improving Memory Performance on Fused Architectures Through Compiler and Runtime Innovations, **Xipeng Shen** (pictured at right), **Frank Mueller**. **\$470,000 by National Science Foundation**.



SHF: Medium: Collaborative Transfer Learning in Software Engineering, **Tim Menzies**. **\$464,609 by National Science Foundation**.

CAREER: Enable Robust Virtualized Hosting Infrastructures via Coordinated Learning, Recover, and Diagnosis, **Xiaohui (Helen) Gu**. **\$450,000 by National Science Foundation**.

Correct Enforcement of Access Control Policy in Modern Operating Systems; Research Area: 5.3 Information and Software Assurance, **William Enck** (pictured at right). **\$411,895 by US Army - Army Research Office**.

Data Locality Enhancement of Dynamic Simulations for Exascale Computing, **Xipeng Shen**. **\$409,214 by US Department of Energy**.

Transforming Computer Science Education Research Through Use of Appropriate Empirical Research Methods: Mentoring and Tutorials, **Sarah Heckman**. **\$406,557 by National Science Foundation**.

CAREER: Secure OS Views for Modern Computing Platforms, **William Enck**. **\$400,000 by National Science Foundation**.

Collaborative Research: Semi and Fully Automated Program Repair and Synthesis via Semantic Code Search, **Kathryn Stolee**. **\$387,661 by National Science Foundation**.

Science of Software, **Christopher Parnin, Emerson Murphy-Hill, Sarah Heckman**. **\$355,365 by National Science Foundation**.

I/UCRC: Site Application to join I/UCRC know as CHMPR, **Rada Chirkova**. **\$298,533 by National Science Foundation**.

Creating Semantically-Enabled Programmable Networked Systems (SERPENT), **Kemafor Ogan**. **\$278,271 by National Science Foundation**.



Senior Faculty



DR. TIMOTHY MENZIES

Professor of Computer Science

Menzies is a professor of computer science at NC State where he teaches software engineering and automated software engineering. His research relates to synergies between human and artificial intelligence, with particular application to data mining for software engineering. He is the author of over 230 publications; and is one of the 100 most-cited

authors in software engineering out of over 80,000 researchers (<http://goo.gl/BnFJs>). In his career, he has been a lead researcher on projects for the National Science Foundation (NSF), the National Institute of Justice (NIJ), the Department of Defense (DoD), the National Aeronautics and Space Administration (NASA), the U.S. Department of Agriculture (USDA), as well as joint research work with private companies. He is the co-founder of the PROMISE conference series devoted to reproducible experiments in software engineering (<http://openscience.us/repo>), and he is also the director of the NC State RAISE (Real World AI for SE) lab that explores software engineering, data mining, artificial intelligence, search-based software engineering, and open access science. He is an associate editor of *IEEE Transactions on Software Engineering*, *Empirical Software Engineering*, the *Automated Software Engineering Journal*, and the *Software Quality Journal*. Menzies received his PhD from the University of South Wales in Australia in 1995.



DR. CARLA SAVAGE

Professor of Computer Science

Savage is a professor of computer science at NC State. In 2012, she was named to the inaugural class of Fellows of the American Mathematical Society (AMS). The Fellows of the AMS designation recognizes members who have made outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics.

In February 2013, Savage was named Secretary of the American Mathematical Society. In the years since the Society was formed in 1888, there have only been nine secretaries; Savage becomes the tenth. In her role as secretary, she serves as the primary point of contact between the AMS and its 30,000 members. The Secretary implements scientific policies of the Society, oversees the scientific program of AMS conferences, manages the AMS Committee Structure, oversees 30 AMS prizes and awards and the AMS Fellows program, coordinates the annual AMS elections, and serves to maintain the institutional memory of the Society. Savage received her BS in mathematics from Case Western Reserve University in 1973, and her MS and PhD in mathematics from the University of Illinois, Urbana-Champaign in 1975 and 1977, respectively. Her research interests lie in combinatorics; enumeration and structure in combinatorial families; theory of partitions; linear Diophantine enumeration; lattice point enumeration; permutation statistics; and the combinatorics, geometry, and number theory of lecture hall partitions.

New Faculty Profiles



ALEXANDROS KAPRAVELOS

joined the department in spring 2016 as an assistant professor in computer science.

His research interests span the areas of systems and software security. He received his BS, and MS from the University of Crete, and his PhD (2015) in Computer Science from the University of California, Santa Barbara.



JASON KING

joined the department in spring 2016 as a teaching assistant professor in computer science.

His research focuses on logging for user accountability, nonrepudiation, and forensicability. He received his BS, MS, and PhD (2016) in Computer Science from NC State University.



KATHRYN STOLEE

joined the department in spring 2016 as an assistant professor in

computer science. Her research interests are in the areas of program analysis, empirical software engineering, and crowdsourcing. She received her BS, MS, and PhD (2013) in Computer Science from the University of Nebraska-Lincoln.

Researchers*

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

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

Suzanne Balik, Teaching Assistant Professor
PhD, North Carolina State University, 2014

Graphics, human computer interaction

Tiffany Barnes, Associate Professor
PhD, North Carolina State University, 2003

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

Lina Batestilli, Teaching Assistant Professor
PhD, NC State University, 2005

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

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, Assistant Professor
PhD, University of Pittsburgh, 2009

Machine learning, artificial intelligence, cognitive science and learning science

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

Database performance, query-processing efficiency, data sciences

Jon Doyle, SAS Professor of Computer Science
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
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, Associate Professor
PhD, Purdue University, 1979

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

Xiaohui (Helen) Gu, Associate 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, Associate Professor
PhD, Universität Heidleberg, Germany, 2001

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

Sarah Heckman, Teaching Associate Professor
PhD, NC State University, 2009

Computer science and software engineering education, open educational resources

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

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

Logging for user accountability, nonrepudiation and forensicability

Michael Kowolenko, Managing Director of ITng
PhD, Northeastern University, 1985

Data science

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

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

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

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

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

Brad 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

Emerson Murphy-Hill, Associate Professor
PhD, Portland State University, 2009

Software engineering, especially the intersection of human-computer interaction and software engineering.



**list includes 2015-16 faculty as well as faculty promotions, and faculty joining the department in August 2016.*

Peng Ning, Professor
PhD, George Mason University, 2001

Computer and network security: new techniques for building trustworthy systems and wireless security

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

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

Chris Parnin, Assistant Professor
PhD, College of Computing, Georgia Tech, 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

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

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

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

Internet protocols, multimedia computing and networking, information security, computer org.

Injong Rhee, Professor
PhD, UNC Chapel Hill, 1994

Computer/wireless/sensor networks, multimedia networking, distributed systems, operating systems

David Roberts, Associate Professor
PhD, College of Computing, Georgia Tech, 2010

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

Robert D. Rodman, Professor
PhD, University of California, Los Angeles, 1973

Computational forensic linguistics, applying artificial intelligence to error recovery in speech recognition

George N. Rouskas, Professor
PhD, Georgia Institute of Technology, 1994

Network architectures and protocols, optical networks, grid computing

Nagiza Samatova, Professor (joint apt. w/ORNL)
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, Assistant Professor
PhD, Michigan State, 2015

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

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

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

Robert St. Amant, Associate Professor
PhD, University of Massachusetts, Amherst, 1996

Human-computer interaction, artificial intelligence, intelligent user interfaces, statistical expert systems

Jessica Staddon, Associate Professor
PhD, University of California, Berkeley, 1997

Privacy, security, user experience, data mining, human computer interaction

Matthias Stallmann, Professor
PhD, University of Colorado, 1982

Algorithm design and analysis of serial and parallel models of computation

William J. Stewart, Professor
PhD, Queen's University, Northern Ireland, 1974

Performance evaluation of computer sys., numerical linear algebra, computer operating systems

Kathryn Stolee, Assistant Professor
PhD, University of Nebraska-Lincoln, 2013

Program analysis, empirical software engineering and crowdsourcing

John Streck, Chief Technologist of ITng
MS, Rensselaer Polytechnic Institute, 1974

Networks, cloud computing

David Sturgill, Teaching Assistant Professor
PhD, Cornell University, 1996

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

Blair Sullivan, Associate Professor (joint apt. w/ORNL)
PhD, Princeton University, 2008

Algorithms and theory of computation, scientific and high performance computing, and analytics

David Thuente, Professor
PhD, University of Kansas, 1974

Denial of service and security for wireless systems; media access control protocols

Hung-Wei Tseng, Assistant Professor
PhD, University of California-San Diego, 2014

Systems, heterogeneous computing

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

Advanced data sciences, geospatial analytics

Mladen Vouk, Distinguished Computer Science 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

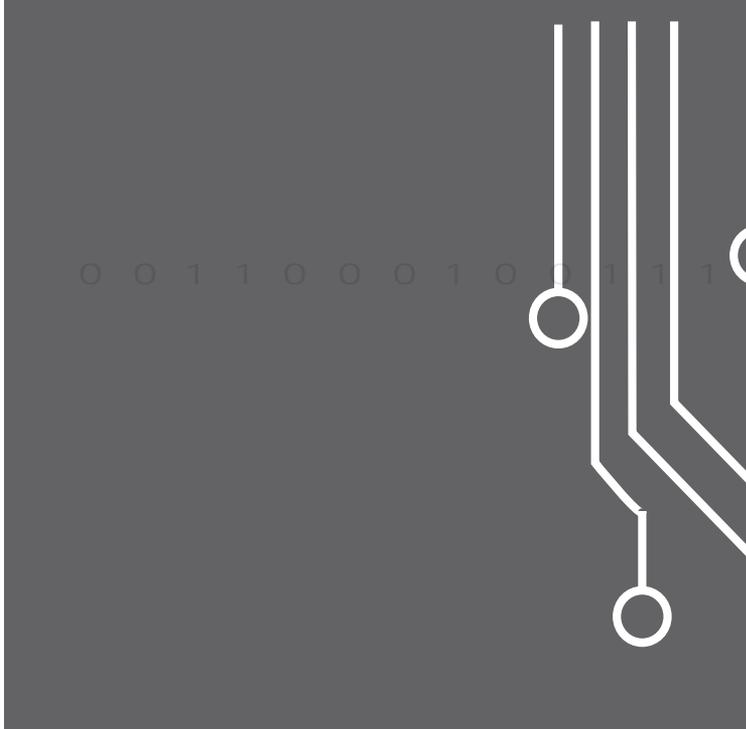
Laurie Williams, Professor
PhD, University of Utah, 2000

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

R. Michael Young, Professor
PhD, University of Pittsburgh, 1997

AI: planning & plan recognition, natural language processing, dev. of human-computer interaction



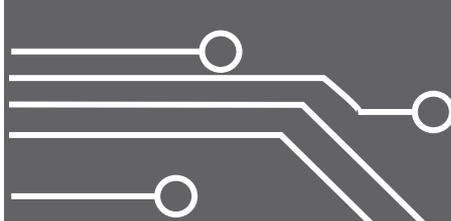


Computer Science Research

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)
- **Security and Networks** (including Software and Network Systems Security, Information Assurance, Privacy, Policies, Regularity Compliance, Networking and Performance Evaluation, Web security, Mobile security, Crypto, Internet of Things)
- **Software Engineering and Systems** (including Requirements, Formal Methods, Policies, Reliability Engineering, Process and Methods, Programming Languages, 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.



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