School of Computing, Informatics, and Decision Systems Engineering

2019 Annual Report

Redefining excellence

Societal impact and educational experience

ASU Ira A. Fulton Schools of Engineering
Arizona State University

Ira A. Fulton Schools of Engineering
Arizona State University

The Ira A. Fulton Schools of Engineering at Arizona State University offers **25 undergraduate programs and 46 graduate programs in its six schools:**

SBHSE — School of Biological and Health Systems Engineering — *Marco Santello, Director*

CIDSE — School of Computing, Informatics, and Decision Systems Engineering — *Sandeep Gupta, Director*

ECEE — School of Electrical, Computer and Energy Engineering — *Stephen Phillips, Director*

SEMTE — School for Engineering of Matter, Transport and Energy — *Lenore Dai, Director*

SSEBE — School of Sustainable Engineering and the Built Environment — *Ram Pendyala, Director*

TPS — The Polytechnic School — *Ann McKenna, Interim Director*

Innovation at scale

#1 in the U.S. for innovation
ASU ahead of Stanford and MIT
– U.S. News & World Report, 5 years, 2016–2020

BEST COLLEGES U.S.News & World Report MOST INNOVATIVE 2020

8 National Academy of Engineering Members

10 American Association for the Advancement of Science Fellows

4 National Academy of Construction Members

11 American Society of Mechanical Engineers Fellows

42 NSF CAREER Awardees in the last five years

38 IEEE Fellows

7 PECASE Awardees

5 National Academy of Inventors Fellows

7 American Society of Civil Engineers Fellows

3 American Institute for Medical and Biological Engineering Fellows

Lead institution on two
National Science Foundation Engineering Research Centers

QESST

CBBG
Center for Bio-mediated & Bio-inspired Geotechnics

Lead institution of the Department of Homeland Security Center of Excellence

CAOE | Center for Accelerating Operational Efficiency
A DEPARTMENT OF HOMELAND SECURITY CENTER OF EXCELLENCE

Redefining excellence: Ensuring societal impact in the educational experience

This past year has been one of tremendous growth, both in size and stature, for the School of Computing, Informatics, and Decision Systems Engineering. Throughout this period of continued expansion, my goal has been to ensure our standards of academic excellence grow alongside our student populations, now spanning two campuses and online. We are committed to providing an educational experience befitting a top research institution — at a grand, and inclusive, scale.

A Fall 2019 enrollment of 7,773 students equates to a nearly 15% increase across our undergraduate and graduate programs. In these pages you will find that our students are achieving at all levels — receiving NSF Graduate Research Fellowships, earning awards and recognition at national and international competitions, and not only working with industry on business challenges, but also starting their own innovative companies.

Leading the way is our core group of senior faculty, who are advancing the burgeoning fields of robotics and artificial intelligence. We welcomed Professor Dimitri Bertsekas, CIDSE's first-ever NAE member, and his deep expertise in reinforcement and machine learning. Professor Stephanie Forrest was recognized with an ISCE Ten-Year Most Influential Paper Award for her seminal research on using genetic programming to fix software bugs.

Professor Sethuraman "Panch" Panchanathan was named a vice president of the National Academy of Inventors and helped ASU secure a $3 million National Science Foundation Research Traineeship award to train students for careers in smart city-related fields as urban populations rapidly grow and change.

Following the robust growth of our recently launched online Master of Computer Science degree, we have added a cybersecurity concentration to the program. Not only does this provide our advanced-degree students with greater opportunities, it also shines a light on our junior faculty and their considerable achievements.

Assistant Professors Yan Shoshitaishvili and Ruoyu "Fish" Wang received an $11.7 million DARPA award to create a human-assisted autonomous tool that learns human strengths like intuition and ingenuity to find software vulnerabilities. Assistant Professor Tiffany Bao won the NSA's Best Scientific Cybersecurity Paper competition for her exploration of game-theory in finding methods to exploit and patch weaknesses prior to strategic cyberbattle.

In early 2019 we assisted in launching academia's largest drone motion capture studio, which will be used to study multi-robot swarming, cyberphysical systems and human-robot interactions. The idea and creation of this new facility was organized by faculty working across several disciplines — a truly collaborative effort. This entrepreneurial mindset also appears in the form of IP activity. I am proud of our faculty and students for their seven patents and four spinout companies this year. We also have 37 technologies available for license.

While making great technical strides in our research, we remain keenly aware of the communities we serve and the societal implications of our work. As educators we must ask ourselves "Should we build it?" as often as "Can we build it?" This is especially true in sensitive fields like artificial intelligence, where technological advancements threaten to automate jobs. Assistant Professor Siddharth Srivastava is working toward a solution to that very problem. His NSF-funded research aims to reprogram autonomous robots, equipping them with intelligent tutoring systems to retrain workers in AI technology so they are not displaced from their jobs.

I am excited for what the future of the School of Computing, Informatics, and Decision Systems Engineering holds, especially as we advance research and discovery in robotics, artificial intelligence and cybersecurity. While doing so we strive to validate ASU's charter by drawing value from whom we include and how they succeed. If you are interested in the work we are doing and would like to collaborate, I would love to hear your thoughts on our publication and how we can work together.

Sandeep Gupta
Director and Professor
School of Computing, Informatics,
and Decision Systems Engineering

Fall 2019 enrollment

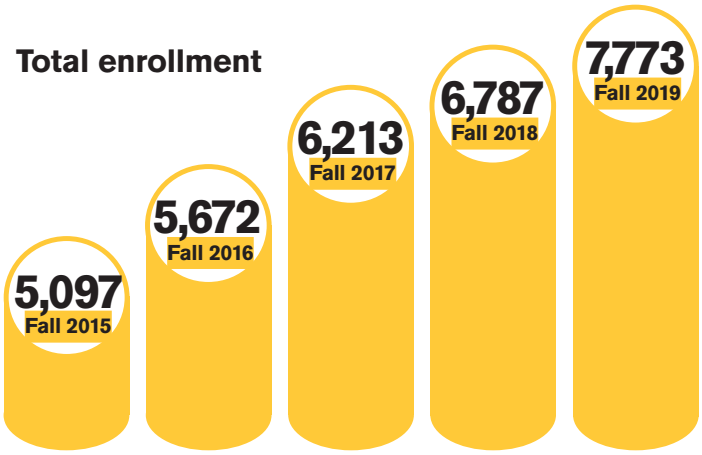
By degree program

Program	Bachelor's	Master's	Doctoral
Computer engineering (computer systems)	--	143	62
Computer science	2,981	769	201
Computer systems engineering	436	--	--
Engineering management	669	--	--
Industrial engineering	313	93	59
Informatics	153	--	--
Robotics and autonomous systems (artificial intelligence)*	--	27	--
Software engineering	1,322	190	--

-- No degree offered.

* New degree program established January 2019.

Total enrollment



On-ground	4,186	4,666	4,986	5,257	5,887
Online	911	1,006	1,227	1,530	1,886

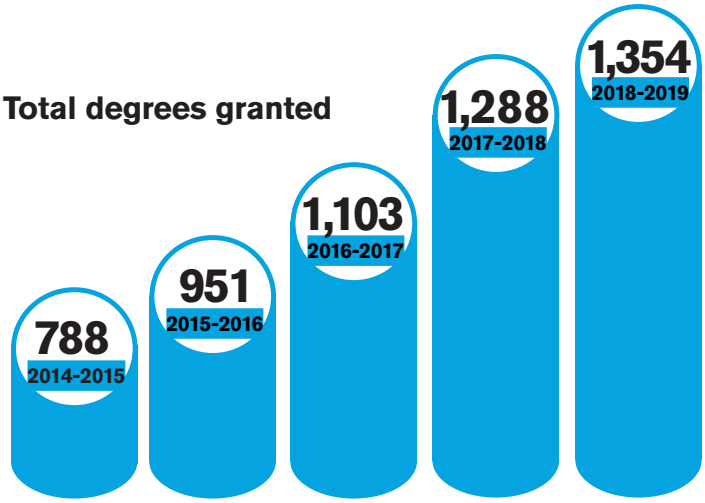
Degrees granted 2018-2019

By degree program

Program	Bachelor's	Master's	Doctoral
Computer engineering (computer systems)	--	76	4
Computer science	383	268	25
Computer systems engineering	87	--	--
Engineering management	70	--	--
Industrial engineering	81	76	4
Informatics	25	--	--
Software engineering	143	112	--

-- No degree offered.

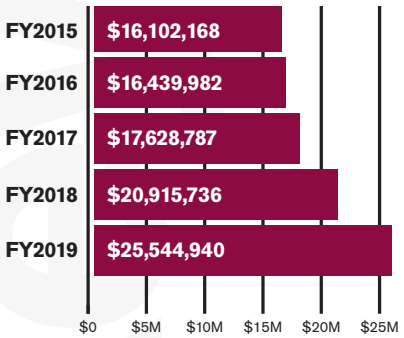
Total degrees granted



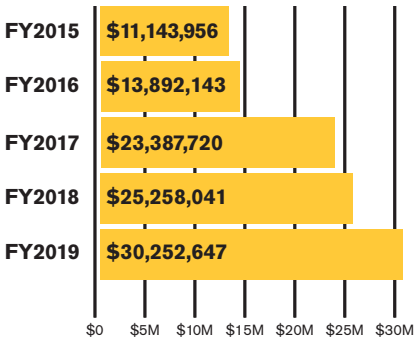
On-ground	775	937	1,050	1,195	1,243
Online	13	14	53	93	111

Research

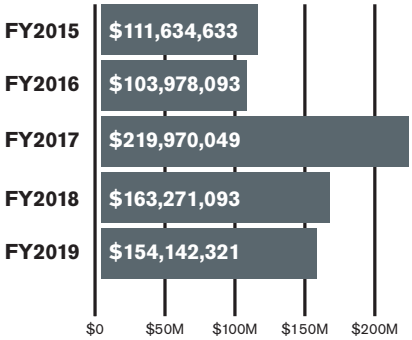
Expenditures



Awards



Proposals



CIDSE Report 2019

CONTENTS

Faculty

Campaign ASU 2020

Artificial intelligence and robotics

Cybersecurity

Big data

Research centers

Innovation

Students and curriculum

Industry

IP activity

Staff

Stay in touch

Keep up to date on news about Fulton Engineering and CIDSE at our news site, Full Circle *fullcircle.asu.edu*

Find us on

(ASU School of Computing, Informatics, and Decision Systems Engineering) to connect with CIDSE students, alumni and faculty. *facebook.com/ASU.CIDSE*

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Use the QR code to send **Sandeep Gupta** a message or share our Fall 2019 report online.

cidse.engineering.asu.edu

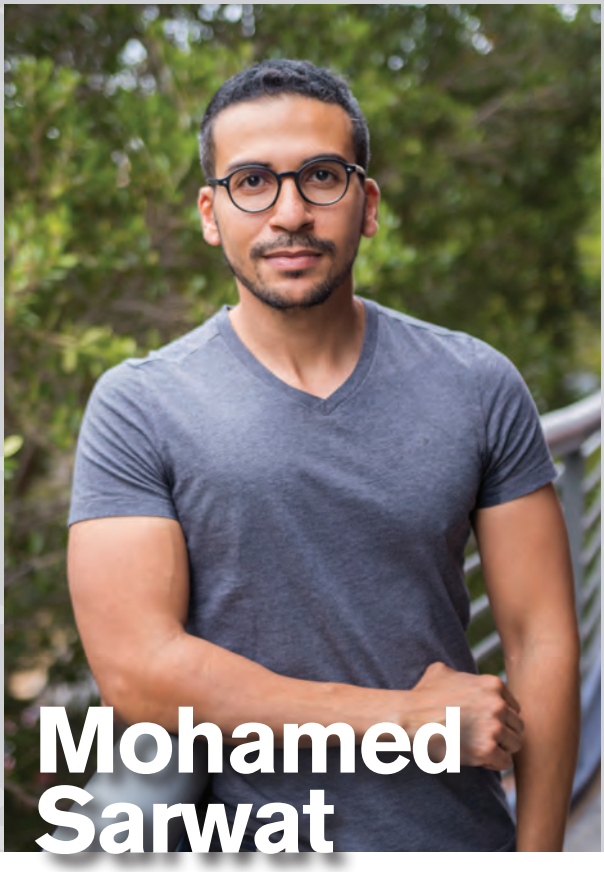
Engineering excellence

Stephanie Gil

Stephanie Gil will bridge robotics and communications to help **multi-agent cyberphysical systems** gain robust contextual awareness for better coordination and decision-making in a project supported by a $500,000 five-year NSF CAREER Award.

For these systems to reach their full potential, the intelligent agents must understand their environment, know the state of other agents in the system, and use this information to coordinate and complete mission-level goals across diverse platforms.

Gil's algorithms have the potential to make fleets of interacting intelligent agents more capable in situations where higher levels of contextual awareness are integral for achieving mission-focused tasks. Such situations include making driving safer for autonomous cars on the road, carrying critical medical supplies to accident sites as quickly as possible, or having robotic counterparts working with human emergency responders during search-and-rescue or reconnaissance missions. ❖



Mohamed Sarwat

Mohamed Sarwat will build innovative scalable technologies capable of seamlessly connecting data collected from various geographically distributed internet of things devices. His project is supported by a $550,000 five-year NSF CAREER Award.

Sarwat's research is the first step toward building **next-generation computing infrastructure** that can effectively manage and analyze the ever-growing internet of things data.

The new technology will organize data in a way that allows a commodity computer system to digest and store large-scale data from the interconnected devices. Sarwat and his team will also build new data processing techniques that will enable convenient and fast access of such data. More entities will be able to leverage the new data processing techniques to build many applications ranging from simple data filtering and integration operations to artificial intelligence methods being employed in autonomous vehicles and robots. ❖

The **National Science Foundation's Faculty Early Career Development (CAREER) Program** identifies the nation's most promising junior faculty members and provides them with funding to pursue outstanding research, excellence in teaching and the integration of education and research.

The School of Computing, Informatics, and Decision Systems Engineering at Arizona State University has a strong record of winning multiple prestigious early career awards, including four NSF CAREER Awards in the past two years.

Heni Ben Amor

Heni Ben Amor conducts research at the intersection of robotics and human-machine interaction. He investigates how humans and machines can work together to accomplish important tasks in service, health care and other industries.

Ben Amor received a five-year, $500,000 NSF CAREER Award that will focus on establishing the concept of **preventative robotics** to intelligently minimize the risk of physical injury. In contrast to rehabilitation robotics that focuses on therapeutic procedures after an injury, preventative robotics is a novel approach that incorporates human well-being into robot control and decision-making to steer away from injury.

Ben Amor is seeking to generate and deploy assistive robotic technologies, such as a prosthesis or an exoskeleton, that seamlessly blend with actions of a human partner to achieve an intended function while minimizing biomechanical stress on the body. Combining these goals will unlock new potential for robotics to improve public and occupational health. ❖

Yezhou Yang

Yezhou Yang focuses his research on creating intelligent robots that can understand humans through the lens of visual perception.

He studies active perception, an area of computer vision with a focus on computational modeling, decision and control strategies for **robotic perception**. Yang combines active perception with natural language processing and artificial intelligence reasoning to advance robotic visual learning. Together they improve the capabilities of a robot or any intelligent agent to make sense of a specific environment.

A $550,000 NSF CAREER Award is supporting Yang's project to address the challenging task of pairing visual recognition with knowledge. This research will attempt to enable a seeing machine to identify unknown visible concepts from previous encounters and other contextual information.

Yang's project will lay the foundation for the development of robust personal mobile applications and service robots, such as visual assistants for people with impaired vision and/or voice-enabled agents for elder care. ❖

National Academy of Inventors Vice President

Sethuraman **Panchanathan**

National Academy of Inventors ASU Chapter Members

Ayan **Banerjee**

Sandeep **Gupta**

J.P. Morgan AI Research Awards 2019

"Human-Aware AI Assistants for Interactive Decision Support in Finance"

Subbarao **Kambhampati**

Faculty Women's Association Outstanding Mentor Award

Sharon **Hsiao**

Fulton Exemplar Faculty

K. Selçuk **Candan**

Fulton Outstanding Assistant Professor

Heni **Ben Amor**

2019 Teaching Excellence Award

Ajay **Bansal**

Top 5% Teachers

Ajay **Bansal**

K. Selçuk **Candan**

James **Collofello**

Adam **Doupé**

Georgios **Fainekos**

Esma **Gel**

Troy **McDaniel**

Fengbo **Ren**

Students' fresh perspectives lead to success

Professor **Huan Liu** has built a renowned research career in the areas of social computing, data mining and artificial intelligence by letting his doctoral students lead the way.

As an AI researcher, Liu's expertise focuses on discovering actionable patterns or insights from data, particularly social media data — a challenging type of information.

His work attracts high-achieving students, who as users of social media know which problems they can solve. Current and recent graduate students are tackling online issues like fake news, cyberbullying, data privacy, thwarting malicious users and many more challenges.

His body of work recently earned recognition from three prominent professional organizations.

In the last few months of 2018, Liu was named a Fellow of the **Association for Computing Machinery, the Association for the Advancement of Artificial Intelligence and the American Association for the Advancement of Science.** He is already a Fellow of the Institute of Electrical and Electronic Engineers.

"It's a very pleasant surprise to get all three in the same year," Liu says. "To get this kind of recognition is a reinforcement of our pursuit of excellence. It will help us reach a wider audience and also encourages us to be more creative and diligent." ❖

Yalin Wang, associate professor of computer science, and Junwen Wang, research faculty member at the Mayo Clinic, will work together on a research project, "Integrating genomic and imaging biomarkers for early detection of Alzheimer's disease." Their project is one of eight innovative pilot studies that received funding through the 2019 Mayo Clinic and Arizona State University seed grant program. The program launches new, interdisciplinary and translational projects on a small scale and enables the researchers to attract funding needed for larger studies. ❖

Dan Shunk, joined ASU's industrial engineering faculty in 1984 and has recently been conferred the title of professor emeritus. He has been recognized in industry communities for his innovative approaches to product development and productivity improvements. He has published more than 30 journal articles, one book and two book chapters, more than 35 refereed conference proceedings and has presented a dozen keynote speeches. Shunk is a senior member of the Institute of Industrial Engineers and Society of Manufacturing Engineers. ❖

Reinforcing computational decision-making

Throughout his career, Dimitri Bertsekas has enjoyed engineering's rich variety of challenges and how many of them can be viewed through a "unifying mathematical lens."

An avid researcher, author and educator, Bertsekas has used this approach to contribute to advances in multiple research areas, including optimization, reinforcement learning, machine learning, dynamic programming and data communications.

In Fall 2019, he joined ASU's School of Computing, Informatics, and Decision Systems Engineering as Fulton Chair of Computational Decision Making.

"I found ASU to be an exciting place for research where I can work with outstanding colleagues," says Bertsekas.

Bertsekas has spent much of his career — since 1979 — as a faculty member at the Massachusetts Institute of Technology, where he held the position of McAfee Professor of Engineering.

His main research focus at present is reinforcement learning — "a field that addresses large and challenging multistage decision problems, often with the use of neural networks and self-learning."

Reinforcement learning is widely known for helping computers successfully learn how to play and win games such as chess and Go. While games have defined rules, real-world challenges often do not. However, Bertsekas says reinforcement learning includes a big enough pool of methods that students and researchers can begin to address engineering problems of enormous size and unimaginable difficulty.

Bertsekas has written numerous research papers and 17 books and research monographs on the topics of optimization theory and algorithms, dynamic programming and optimal control, data communications, parallel and distributed computation, and applied probability. His work has been recognized with many prestigious awards and honors over the years.

He was elected member of the National Academy of Engineering in 2001 for "pioneering contributions to fundamental research, practice and education of optimization and control theory, and especially its application to data communication networks."

Additionally, he has earned several key awards over the span of 20 years from American Automatic Control Council and from the Institute for Operations Research and the Management Sciences, known as INFORMS.

Bertsekas received the Richard E. Bellman Control Heritage Award for "contributions to the foundations of deterministic and stochastic optimization-based methods in systems and control," the 2014 Khachiyan Prize for Life-Time Accomplishments in Optimization, the 2015 George B. Dantzig Prize and the 2018 John von Neumann Theory Prize with his co-author John Tsitsiklis for their research monographs "Parallel and Distributed Computation: Numerical Methods" and "Neuro-Dynamic Programming." He and Tsitsiklis have also received the 1997 Prize for Research Excellence in the Interface Between Operations Research and Computer Science for "Neuro-Dynamic Programming."

Bertsekas' passion for education has also won him accolades. His educational efforts have been awarded the 2001 John R. Ragazzini Education Award for outstanding contributions to automatic control education and the 2009 INFORMS Expository Writing Award.

When he's not teaching or researching optimization and control theory, Bertsekas enjoys the visual arts, particularly travel and nature photography. His original photos, which can be found on Instagram, have been exhibited at several locations within MIT. He looks forward to exploring the art scene and nature Arizona has to offer. ❖

Faculty

Leading and contributing to discoveries

With expertise spanning artificial intelligence, robotics, cybersecurity, software and enterprise systems, our faculty drive transformative advances in human-technology systems. We are energized and boundless; teaching robots in hours not days, revolutionizing programmable material and paving the way for future innovation.

Ruben **Acuna**
Lecturer
MS, Arizona State University
Software engineering

Gail-Joon **Ahn**
Professor
PhD, George Mason University
Computer science and engineering

Ronald **Askin**
Professor
PhD, Georgia Institute of Technology
Industrial engineering

Robert **Atkinson**
Associate Professor
PhD, University of Wisconsin, Madison
Informatics

Janaka **Balasooriya**
Lecturer
PhD, Georgia State University
Computer science and engineering

Ajay **Bansal**
Assistant Professor
PhD, University of Texas at Dallas
Software engineering

Srividya **Bansal**
Assistant Professor
PhD, University of Texas at Dallas
Software engineering

Chitta **Baral**
Professor
PhD, University of Maryland, College Park
Computer science and engineering

Rida **Bazzi**
Associate Professor
PhD, Georgia Institute of Technology
Computer science and engineering

Heni **Ben Amor**
Assistant Professor
PhD, Technical University Freiberg
Computer science and engineering

Kevin **Burger**
Lecturer
MS, University of Kansas
Computer science and engineering

Debra **Calliss**
Senior Lecturer
PhD, Arizona State University
Computer science and engineering

K. Selçuk **Candan**
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Computer science and engineering

Linda **Chattin**
Principal Lecturer
PhD, State University of New York at Buffalo
Industrial engineering

Yinong **Chen**
Senior Lecturer
PhD, University of Karlsruhe
Computer science and engineering

Michael **Clough**
Lecturer
MS, Arizona State University
Industrial engineering

Charles **Colbourn**
Professor
PhD, University of Toronto
Computer science and engineering

James **Collofello**
Professor, Vice Dean
PhD, Northwestern University
Computer science and engineering

Partha **Dasgupta**
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PhD, University of New York at Stony Brook
Computer science and engineering

Hasan **Davulcu**
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Computer science and engineering

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Computer science and engineering

Adolfo **Escobedo**
Assistant Professor
PhD, Texas A&M University
Industrial engineering

Georgios **Fainekos**
Associate Professor
PhD, University of Pennsylvania
Computer science and engineering

Xuerong **Feng**
Lecturer
PhD, University of Texas, Dallas
Computer science and engineering

Stephanie **Forrest**
Professor
PhD, University of Michigan
Computer science and engineering

Ashraf **Gaffar**
Assistant Professor
PhD, Concordia University
Software engineering

Kevin **Gary**
Associate Professor, Program Chair
PhD, Arizona State University
Software engineering

Esma **Gel**
Associate Professor
PhD, Northwestern University
Industrial engineering

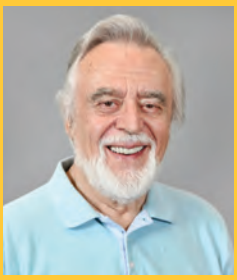
New faculty

Tiffany **Bao**

Assistant Professor
PhD, Carnegie Mellon University
Computer science and engineering

Software security, automated binary analysis techniques, autonomous game-theoretical strategy for software vulnerabilities.

Dimitri **Bertsekas**



Fulton Chair of Computational Decision Making
National Academy of Engineering
PhD, Massachusetts Institute of Technology
Computer science and engineering

Network optimization, linear and nonlinear programming, data communication networks, parallel and distributed computation.

Chris **Bryan**

Assistant Professor
PhD, University of California, Davis
Computer science and engineering

Data visualization, visual analytics, data science, human-computer interaction, virtual reality.

Heewook **Lee**

Assistant Professor
PhD, Indiana University Bloomington
Computer science and engineering

Computational biology, bioinformatics, genetic variation.

Joint appointment with the Biodesign Institute

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Computer science and engineering

Javier **Gonzalez-Sanchez**
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Software engineering

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Computer science and engineering

Robert **Heinrichs**
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Software engineering

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Cheryl L. **Jennings**
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Industrial engineering

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Industrial engineering

Joseph **Juarez**
Lecturer
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Industrial engineering

Subbarao "Rao" **Kambhampati**
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Yann-Hang **Lee**
Professor
PhD, University of Michigan
Computer science and engineering

Baoxin **Li**
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PhD, University of Maryland, College Park
Computer science and engineering

Jing **Li**
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PhD, University of Michigan
Industrial engineering

Tim **Lindquist**
Professor
PhD, Iowa State University
Software engineering

Huan **Liu**
Professor
PhD, University of Southern California
Computer science and engineering

Ross **Maciejewski**
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PhD, Purdue University
Computer science and engineering

Daniel **McCarville**
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PhD, Arizona State University
Industrial engineering

Alexandra **Mehlhase**
Lecturer
PhD, Technische Universität Berlin, Germany
Software engineering

Ryan **Meuth**
Lecturer
PhD, Missouri University of Science and Technology
Computer science and engineering

Phill **Miller**
Lecturer
MBA, Northcentral University
Computer science and engineering

Pitu **Mirchandani**
Professor, The Avnet Chair in Supply Chain Networks
ScD, Massachusetts Institute of Technology
Industrial engineering

Douglas **Montgomery**
Regents Professor
PhD, Virginia Tech
Industrial engineering

Mutsumi **Nakamura**
Principal Lecturer
PhD, University of Texas, Arlington
Computer science and engineering

Rong **Pan**
Associate Professor, Program Chair
PhD, Pennsylvania State University
Industrial engineering

Sethuraman "Panch" **Panchanathan**
Professor, ASU Senior Vice President for Knowledge Enterprise Development
PhD, University of Ottawa
Computer science and engineering

Paolo **Papotti**
Assistant Professor
PhD, Universita' degli Studi Roma Tre
Computer science and engineering

Ruoyu "Fish" **Wang**

Assistant Professor
PhD, University of California, Santa Barbara
Computer science and engineering

System security, with emphasis in automated binary program analysis, reverse engineering of software.

Yingzhen **Yang**

Assistant Professor
PhD, University of Illinois at Urbana-Champaign
Computer science and engineering

Statistical machine learning, functional analysis, large scale data.

Jia **Zou**

Assistant Professor
PhD, Tsinghua University, China
Computer science and engineering

Data-intensive distributed systems, machine learning systems, blockchain, development of dynamic applications.

Mike **Findler**
Lecturer
PhD, Wright State University
Software engineering

Samira **Ghayekhloo**
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Computer science

Ali **Kucukozyigit**
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PhD, Old Dominion University
Industrial engineering

Vijay **Suthar**
Lecturer
MS, Stanford University
Software engineering

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Industrial engineering

Fengbo **Ren**
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Computer science and engineering

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PhD, Carnegie Mellon University
Computer science and engineering

George **Runger**
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Industrial engineering

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Justin **Selgrad**
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MS, Washington University in St. Louis
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Industrial engineering

Violet **Syrotiuk**
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Computer science and engineering

Farideh **Tadayon-Navabi**
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MS, University of Louisiana at Lafayette
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Professor, The Diane and Gary Tooker Chair for Effective Education in Science, Technology, Engineering and Math
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Industrial engineering

Sarma **Vrudhula**
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Computer science and engineering

Yalin **Wang**
Associate Professor
PhD, University of Washington
Computer science and engineering

Carole-Jean **Wu**
Associate Professor
PhD, Princeton University
Computer science and engineering

Teresa **Wu**
Professor
PhD, University of Iowa
Industrial engineering

Guoliang **Xue**
Professor
PhD, University of Minnesota
Computer science and engineering

Hao **Yan**
Assistant Professor
PhD, Georgia Institute of Technology
Industrial engineering

Yezhou **Yang**
Assistant Professor
PhD, University of Maryland, College Park
Computer science and engineering

Stephen **Yau**
Professor
PhD, University of Illinois
Computer science and engineering

Nong **Ye**
Professor
PhD, Purdue University
Industrial engineering

Yu "Tony" **Zhang**
Assistant Professor
PhD, University of Tennessee, Knoxville
Computer science and engineering

Ming **Zhao**
Associate Professor
PhD, University of Florida
Computer science and engineering

Eminent scholar gives $2 million to support ASU industrial engineering program

The world has no shortage of worthwhile causes to support.

Diseases need cures. Environments need preservation. People need a higher quality of life. One ASU professor has found that supporting graduate student education in industrial engineering is his top priority.

"Graduate student education is really important," says Douglas C. Montgomery, a Regents Professor of industrial engineering. "Industrial engineers play a vital role in a huge range of industrial and business settings, from manufacturing to health care. So, we should do whatever we can to improve graduate education and make it a good experience."

Montgomery's passion to help graduate students develop their research interests has motivated him to become an investor and partner in their education by making contributions over the years to ASU and his alma mater, Virginia Tech. And in 2018, the eminent scholar and statistician made a personal contribution of $2 million to the Ira A. Fulton Schools of Engineering.

"Doug is fueled by a sincere commitment to scholarship at the highest levels in his teaching, service and research," says Kyle Squires, dean of the Fulton Schools. "He embodies the core tenets of the New American University and his impact on the next generation of thought leaders in industrial engineering has been, simply put, top of class. His investment is instrumental in elevating the profile, potential and contributions of our learning community in the Fulton Schools."

Among his long list of accomplishments, Montgomery is most proud of the 68 doctoral students he has mentored, with four students under his wing currently.

Montgomery's first doctoral student was Ronald G. Askin, whom he continued to mentor as Askin's career progressed at the University of Iowa, the University of Arizona and finally to ASU when he joined the Fulton Schools faculty in 2006 as the chair of the industrial engineering program. Askin went on to serve as director of the School of Computing, Informatics, and Decision Systems Engineering from 2009 to 2016.

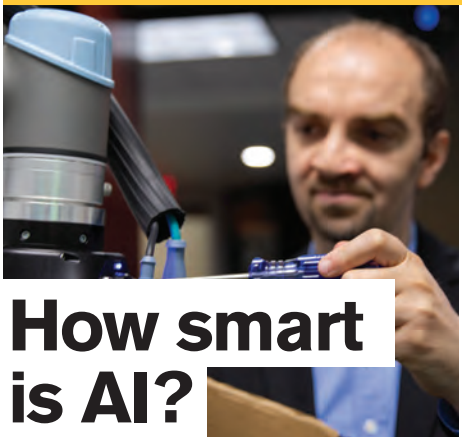
"Doug is the kind of advisor and faculty mentor you want to emulate. He's been my role model for how to be a successful classroom instructor, a high impact researcher who combines technical depth with real-world relevance and impact, and a graduate advisor," says Askin.

"I've been quite fortunate to work with excellent research students," says Montgomery. "I'm really proud of every single one of them because they've all gone on to do really great things." ❖

We believe engineering is more than a discipline — it is a mindset, a way of looking at the world to determine how challenges can be met most efficiently, sustainably, safely and in cost-effective ways to maximize impact and benefit those we serve. As a partner in our mission, you will help support our diverse faculty and students as they find innovative and entrepreneurial solutions to pressing concerns.

To make a donation of any amount, please call Margo Burdick, our school's director of development, at 480-727-7099. You can also mail your gift to Ira A. Fulton Schools of Engineering Attn: Margo Burdick, PO Box 879309, Tempe, AZ 85287-9309. Please make checks payable to the "ASU Foundation" with "School of Computing, Informatics, and Decision Systems Engineering" noted in the memo line.

Your gift is greatly appreciated. Thank you.



How smart is AI?

Creating machines that think and act like humans is as much grounded in the humanities as it is in engineering.

When a group of retired Army and Marine generals, CIA agents and scientists gathered at ASU to discuss the future of national security research, their discussion veered into how to successfully pair humans and artificial intelligence.

"In order to create machines and algorithms that adapt to a human, we first need to understand more about humans," says Heni Ben Amor, an assistant professor in the School of Computing, Informatics and Decision Systems Engineering.

For Subbarao "Rao" Kambhampati, a professor in the school and an expert in artificial intelligence, automated planning and machine learning, the answer lies in how machines learn.

Children see the world, manipulate it, play with it and then they learn. Machines, on the other hand, learn using very large sets of examples about patterns that even humans have a hard time describing. For example, you teach a machine how to recognize a dog by showing it millions of pictures of dogs using databases of labeled images.

That's where artificial intelligence is right now: using perception as a learning technique. Machines learn by doing and from examples.

"Basically we are trying to figure out how to make learning more efficient," Kambhampati says.

But when artificial intelligence fails, no one knows why it didn't work.

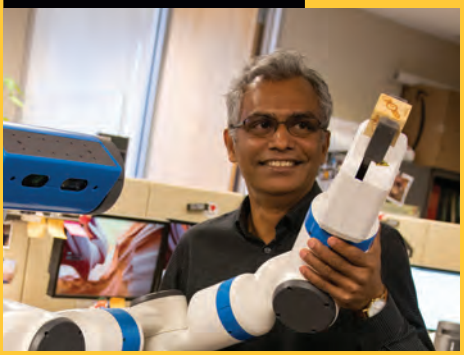
"I'm not sure machine learning has reached the point where it can extrapolate or be creative like humans are," says Spring Berman, an associate professor in the School of Engineering of Matter, Transport and Energy and associate director of ASU's Center for Human, Artificial Intelligence, and Robot Teaming.

"Our goal is to think about how best to coordinate teams of humans, software agents and robots for a variety of applications, which could be transportation, manufacturing, search and rescue or defense," she says. "We look at creating control strategies for swarms of robots that you could give them a mission and they could then carry it out on their own." ❖

Yezhou Yang (middle) participated in a panel to discuss the future of AI following a Mesa Community College theater production called The Intelligent Design of Jenny Chow. The fictional play follows a robot, designed by a young girl, that takes on humanistic emotions and behaviors. ❖

Professor Katina Michael served as a guest editor for a special edition of Proceedings of the IEEE, the leading journal for technical developments in electronics, electrical and computer engineering, and computer science. Michael and her collaborators co-authored the introduction and an article on engineering-based design methodology for embedding ethics in autonomous robots. ❖

Little AI lies



ASU computer scientist Subbarao Kambhampati and his former graduate student Tathagata Chakraborti traveled to the Artificial Intelligence, Ethics and Society conference to ask the question, "Is it okay for AI to lie?" And how do we keep humans in the loop if they do?

Kambhampati's research poses several unresolved ethical and moral questions regarding the design of autonomy in AI.

"We attempted to take the first steps toward understanding the state of the public consciousness on this topic," Kambhampati says. "We got a sense of when people are willing to be told white lies."

But only if it's for the greater good. They discussed scenarios where the research found white lies were considered acceptable, such as to achieve teaming performance.

However, other circumstances, like considering the role of AI in the future of medicine, raised discussion among experts in computing, ethics, philosophy, economics, psychology, law and politics.

"The doctor-patient relationship, and the intriguing roles of deception in it, does provide an invaluable starting point for conversation on the topic of greater good in human-AI interactions," Kambhampati says.

As AI develops, researchers will continue to seek answers to the unresolved moral and ethical questions that will continue to arise. ❖

Students

Doctoral student Tahora Nazer discussed how data mining experts are making social media an effective tool in helping the public and emergency responders during hurricanes, tornadoes, floods and other natural disasters during an appearance on Catalyst, an Arizona PBS show. ❖

Watch the video: scan the QR code or visit links.asu.edu/CHMAIvideo

NSF Graduate Research Fellow engineers big data solutions

Students

Logan Mathesen has been using industrial engineering to find solutions to big data problems since he was an undergraduate student.

Now a doctoral student, he was selected as an NSF Graduate Research Fellow. He'll earn an annual stipend and a cost-of-education allowance to support his graduate education.

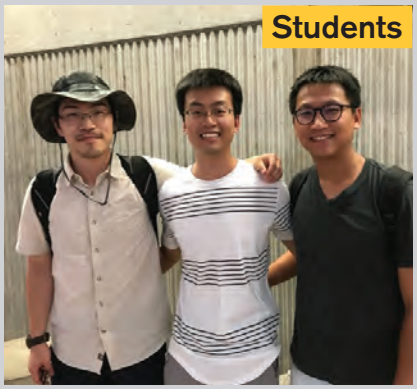
"I want to influence how the next generation interacts with data and information," he says.

Through his research, Mathesen is building the algorithms, data analysis and modeling techniques to manage large data sets and aid in decision-making. ❖

Alumni, Arizona impact

ASU alumni and students make up about two-thirds of employees at AdviNOW Medical, a Scottsdale-based medtech startup specializing in the self-guided medical stations. Tarek Saleh, the company's product director and a computer science and software engineering graduate, is among the recent Fulton Schools alumni who contribute their skills and knowledge about the latest AI technologies. ❖

Students



An ASU team won the AI commentator competition at the Korean Advanced Institute of Science and Technology AI World Cup 2018, a worldwide competition of online soccer teams simulated by AI. The team, led by Assistant Professor Yezhou Yang (left), was comprised of Siyu Zhou (middle), a doctoral student in physics, and Chia-Yu Hsu (right), a master's student in computer science. ❖

Tiny but mighty: Bee brains may hold key to miniaturizing AI

How can we miniaturize artificial intelligence? Bees may have the answer. Ted Pavlic is part of a research team studying the miniaturization of nervous systems. With support from the U.S. Department of Defense, the team is working toward miniaturizing artificial intelligence by studying the structure and function of tiny brains of multiple species of stingless bees. ❖

Artificial intelligence supports real intelligence

Kurt VanLehn applies artificial intelligence to education. He recently received nearly $1.5 million from the National Science Foundation to conduct research on the use of automated intelligent teaching assistants in the classroom.

His work is part of The Future of Work at the Human-Technology Frontier, one of the NSF's 10 Big Ideas for Future Investment.

VanLehn's approach challenges how artificial intelligence has previously been used in the classroom, which focused mainly on students. Instead, this project focuses more on designing intelligent assistants to support teachers and the current education system, rather than replacing them.

"For intelligent technology to be viable in the classroom, it must serve both the students and the teacher, and the teacher must be in charge," VanLehn says.

Over the course of three years, VanLehn and his team are observing classroom patterns, conducting trials, and collaborating with teachers to enhance education systems and improve student learning. ❖

A new way to "see" neighborhoods

Arizona impact

Computer scientists are working with researchers in ASU's College of Health Solutions to develop an automated, cost-effective tool that will inspire communities to enhance safety and increase physical fitness among its residents. Combining Google Street View, crowdsourcing, computer vision and deep learning to virtually detect a neighborhood's micro features, like sidewalks and bike lanes, the automated micro feature detection system will help determine the correlation between the presence of these features and physical activity levels. ❖

Coming soon: A robot that understands its world and the people in it

The self-directed carts that deliver supplies in hospitals. The vacuum that cleans the floors in your home and then parks at a refueling station. These are examples of autonomous agents — robots — that help humans with simple daily tasks and complex work thanks to artificial intelligence. First mentioned in research literature in the 1950s, AI has steadily gained momentum, says Assistant Professor Siddharth Srivastava.

Autonomous agents can be programmed to complete specific jobs, such as setting the table, a demonstration that Srivastava and his research assistants have produced in the lab. But what happens when the working environment changes? How can we be sure that the robot will calculate its actions so that the job is completed correctly and safely?

Srivastava's work, recently funded by grants from the National Science Foundation, is advancing the capabilities of autonomous agents, which will not only reason and plan to execute tasks even when the circumstances are uncertain, but also communicate successfully with the humans around it. He focuses on developing the frameworks, algorithms and implementations that enable robots to reason and act efficiently.

As robots move into a growing range of settings, the importance of human-robot interaction grows. The future holds many opportunities for robots to improve human life, such as caring for the sick or elderly, responding to emergencies and participating in the exploration of places inhospitable to humans.

In those roles, Srivastava says, robots will need to be able to communicate with people who may have limited knowledge of engineering or computer science. A second NSF grant is providing $275,000 to improve the ways humans talk to and question robots, and the ways robots respond.

The goal is to develop a system that generates questions humans can ask that will allow the robot to discern how much the person knows about robots so it can then tailor the interaction to the person's level of knowledge. Srivastava anticipates that humans will bring a wide range of expertise to these interactions. ❖

NSF grant supports smart city research and STEM education

A new $3 million grant from the National Science Foundation is helping ASU launch a graduate research training program focused on citizen-centered smart cities.

The grant is a part of the NSF's Research Traineeship Program, which was designed to encourage the development and implementation of bold, new and potentially transformative models for STEM graduate education training. ASU's project launched with 24 master's and 14 doctoral students.

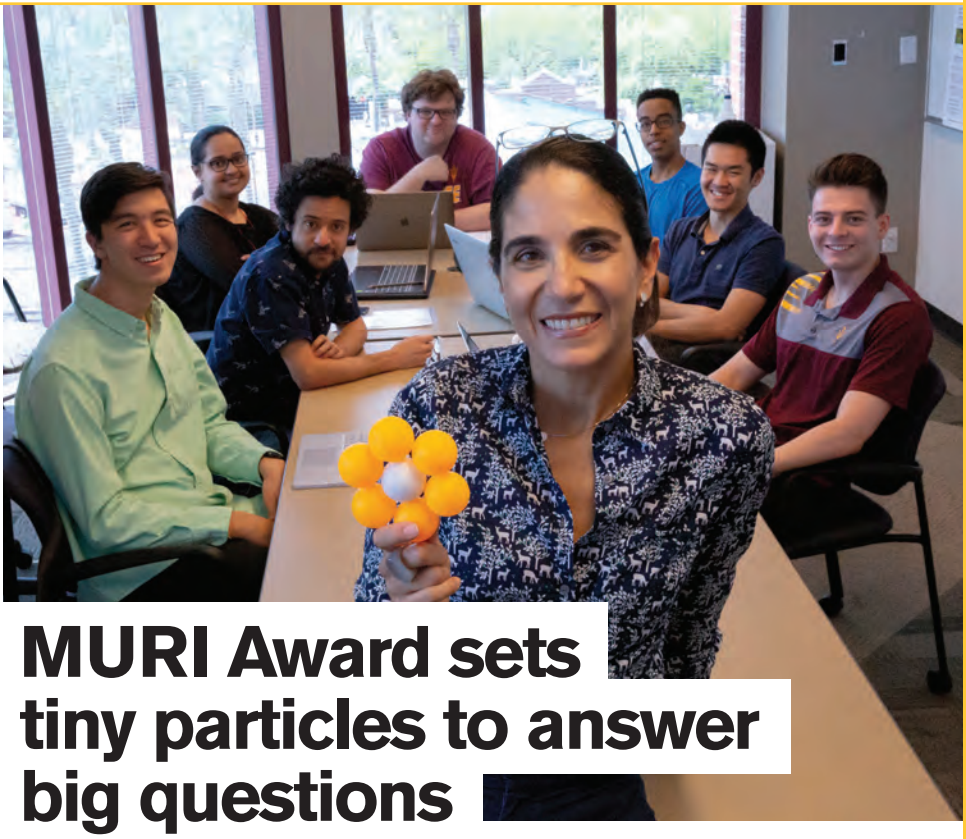
"Our project will prepare students to become the engineers, scientists, entrepreneurs and policymakers who lead this growing field and shape the future of smart cities in a human-centric way," says Sethuraman "Panch" Panchanathan, principal investigator on the project and director of ASU's Center for Cognitive Ubiquitous Computing.

The project, "Citizen Centered Smart Cities and Smart Living," is taking an interdisciplinary approach to understanding and developing smart cities, focusing on citizen awareness, engagement and education.

Career placement and finding career paths in smart-cities-related positions for STEM graduates is a main priority for organizers. They also strive to create community, national and global impact through sharing research findings and project outcomes.

The successful recruitment, retention and graduation of STEM students from diverse backgrounds, including underrepresented minorities, women and individuals with disabilities, is a main goal of the project.

The NSF selected 17 institutions across the U.S. to participate in the highly competitive program, including Stanford University, UCLA and the University of Texas, Austin. ❖



MURI Award sets tiny particles to answer big questions

What do you get when you combine computer science, physics, robotics and nanotechnology? The opportunity to advance the fundamental understanding of how tiny computer particles can work together to do great things — without any human intervention.

Professor Andrea Richa is part of a U.S. Department of Defense Multidisciplinary University Research Initiative effort that seeks to make fundamental research discoveries in the project, "Formal Foundations of Algorithmic Matter and Emergent Computation."

Richa and her ASU team received $808,000 of a $6 million MURI award to study emergent behaviors, with the rest distributed among collaborators at the Georgia Institute of Technology, the Massachusetts Institute of Technology and Northwestern University.

The study of emergent behavior has been around for decades, even before computers. Broadly, emergence occurs when the whole is greater than the sum of its parts — the whole has properties its parts do not have, and these properties only come about because of collective interactions among the parts.

In the nanotechnology realm, tiny computer "particles" that have limited computational capabilities individually can do amazing things as a group. They can behave like "matter," self-reconfiguring to repair wounds, sealing nuclear reactor leaks or fixing spacecraft cracks in flight, all without human intervention. But first, scientists and engineers need to better understand emergent behaviors so they can be predicted and built effectively.

"If we get our overarching goal of understanding, predicting and synthesizing the local rules for the emergent behaviors we want, and also of building the systems that can carry out these rules, it's a huge thing," Richa says.

The MURI project will explore the local algorithmic rules and computations particles need to perform a desired emergent behavior. Richa's team will employ a continuous feedback loop of developing theories and experimentation over the five-year period of the MURI award.

"We want to better understand what causes emergent behavior so we can start predicting when it will happen," Richa says. ❖

Safety becomes smart with breakthroughs in software dependability

The distinction between "smart" technologies and autonomous systems has been the focus of research for Georgios Fainekos, an associate professor of computer science.

Supported by a National Science Foundation CAREER Award, the overarching mission of Fainekos' project has been devising new and improved techniques and methodologies to test the abilities of cyberphysical systems.

Fainekos is advancing complex automated systems by improving the dependability of the software small computers use to trigger mechanisms — or "actuators" — in cyberphysical systems.

"A major breakthrough is our demonstration of the feasibility of mathematically expressing and testing safety requirements for complex cyberphysical systems. Before our work, the results on tests of the systems were limited in scope," Fainekos says.

The team is also working with the major international carmaker Toyota to develop effective testing for embedded processors and cyberphysical systems in cars with automated systems, like adaptive cruise control, emergency braking and lane keeping.

Next, Fainekos and his team want to lay the groundwork for advancing their analysis, testing and verification processes from the laboratory to industrial-scale operations. Progress there could help prevent embedded systems design flaws and testing errors that cost industry billions of dollars due to product defects. ❖

Adding human ingenuity to automated security tools

The world's top chess player isn't a human or a computer, it's a "centaur" — a hybrid chess-playing team comprised of a human and a computer.

The Defense Advanced Research Projects Agency is applying the same human-computer collaborative approach to cybersecurity through its Computers and Humans Exploring Software Security, or CHESS program.

A team of ASU researchers is working with collaborators at the University of California, Santa Barbara, the University of Iowa, North Carolina State University and EURECOM to make their move in this space. The team's project is called CHECRS, or Cognitive Human Enhancements for Cyber Reasoning Systems.

The $11.7 million award supports the multi-university CHECRS team's efforts to create a human-assisted autonomous tool for finding and analyzing software vulnerabilities that also learns from and incorporates human strengths of intuition and ingenuity. The ASU team, led by Ruoyu "Fish" Wang, an assistant professor of computer science and engineering, received $6.6 million of the award funding.

"It's a lot of responsibility," says Yan Shoshitaishvili, an assistant professor of computer science and engineering and co-principal investigator on the project. "It's a big undertaking that the government is making and we have a lot of responsibility to make it a success. I have no doubt we'll be successful."

The CHECRS team wants to create an autonomous tool that can be used by a wider variety of human assistants. Software developers, quality assurance specialists and other non-security experts have human intuition and ingenuity that can meaningfully aid the automated tool.

"While modern automated tools run on computers that calculate billions of times faster than a human brain, human security analysts still find the majority of software vulnerabilities," Wang says. "This is because the knowledge and intuition that humans possess outweigh the speed of calculation when facing problems with extreme complexity, for example, finding software vulnerabilities."

As part of the DARPA CHESS program, other research teams will evaluate whether the human-computer teams are working effectively by competing against the system to detect vulnerabilities. ❖

NSF Graduate Research Fellow solving society's toughest problems

Students

After having received his master's degree through the 4+1 computer science accelerated program, Scott Freitas received a National Science Foundation Graduate Research Fellowship award to support his work toward a doctoral degree in computer science at the Georgia Institute of Technology.

There, Freitas is focusing on research that explores how people connect and function through "societal constructs" — for example, energy and transportation networks and social networks. ❖

"When your DNA is out there, like data, it's sort of like Pandora's box. Once it's out there, you can't ever put it back in the box."

– Adam Doupé, assistant professor of computer science, on privacy issues surrounding DNA testing services

Photographer: Deanna Dent/ASU Now

Cybersecurity expert takes a deeper look into the dark web

In 2013 Paulo and Jana Shakarian collaborated on a book that explored cyberwarfare from "a human-centric viewpoint," as Paulo Shakarian describes it.

"We noticed that everyone who was working on cybersecurity was focused on the technical aspects of it. Things like building firewalls and virus scanning," he says. "But no one was taking a deep look at the people who are doing the bad stuff, the cyberattackers."

That research has given birth to CYR3CON, which the Shakarians define as "a next-generation cyber threat intelligence company" that employs machine learning, data mining and artificial intelligence technology — along with knowledge of the workings of the dark web — to identify emerging threats.

CYR3CON was started and is led by the Shakarians. Paulo Shakarian is the company's chief executive officer. Jana Shakarian is the president.

Their CYR3CON venture won a TechConnect Defense Innovation Award at the Defense Innovation Technology Acceleration Challenges Summit — a meeting of leaders in defense and security industries and officials in government agencies and the U.S. military.

CYR3CON was also a finalist in tech startup and business model competitions held by the Arizona Technology Council and PricewaterhouseCoopers.

"What we are essentially trying to do is get ahead of the bad guys," Paulo Shakarian explains. If you look at the major cyberattacks of recent years, he says, the vast majority were enabled by software vulnerabilities that were known about ahead of time.

Along with the power of the company's technological infrastructure, the value of its service hinges on a deep understanding of the perpetrators of malevolent cyber activity.

"I don't think you can do a good job predicting human behavior unless you have good socially rooted intuitions about what people are doing," he says. "It's knowing what the reputations of the people are and what their social connections look like that helps us create better algorithms to identify potential threats."

Research aimed at improving the company's operations and capabilities will continue. The Shakarians expect to tap into the skills of those working in Fulton Schools labs — including graduate and undergraduate students. ❖

Hackers to head off cybercriminals

Cyberattacks make the headlines seemingly every week with few untouched by the breaches.

Fulton Entrepreneurial Professor Paulo Shakarian talks about how mining the dark web can throw light on these cybercriminals and thwart their impending attacks during an ASU KEDtalk.

He likens his research strategy to that of a soldier running reconnaissance on the enemy. He and his collaborators are taking advantage of the limitations and weaknesses of malicious hackers to head off cybercriminals at the pass. ❖

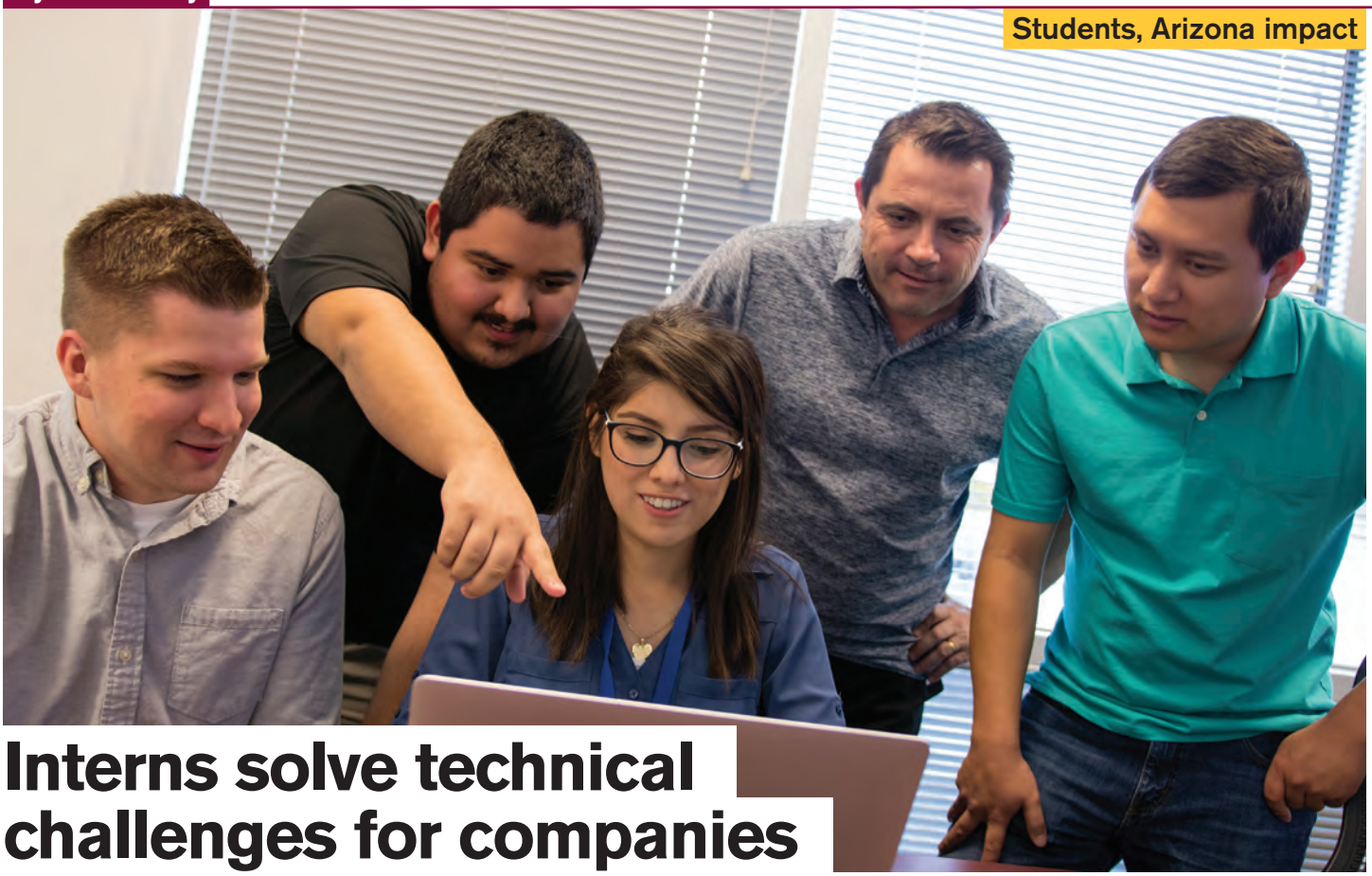
Watch the video: scan the QR code or visit links.asu.edu/cyberattacks-kedtalk

Jackpotting and US bank attacks

ATMs across the country are being targeted by a wave of cybercriminals in search of an illegal high-tech payday.

This phenomenon is called "jackpotting," and US bank attacks involving malware are imminent.

"The best long-term solutions for these types of attacks is to gather information about what the hackers are discussing from places like the deep web/dark web — as this allows us to understand where they are headed in terms of target selection," says Paulo Shakarian, director the Cyber-Socio Intelligent System Laboratory. ❖



Interns solve technical challenges for companies

When Paul Black set out to start a summer internship program in early 2017 at McKesson's Scottsdale, Arizona, office, he had high expectations.

That spring, Black, the vice president of Cybersecurity Operations and Services, hired five ASU seniors as McKesson Scottsdale's first internship class for summer.

"Early on I was impressed," recalls Black, "but in order to see what we could do together, I wanted to get interns in on the ground and make sure they had opportunities to make a difference."

Fulton Schools computer science students Chase Lybbert, Jeffrey Moore and Derek Wallace and computer systems engineering student Jonathan Villegas joined Jenny Brito, a computer information systems student in ASU's W. P. Carey School of Business, to begin their internships.

The interns worked on a project with McKesson's subject matter experts to create an automated phishing detection tool they called Phishbot.

Phishbot scans an email inbox where employees send suspicious emails, extracts relevant information and attachments and creates a ticket. It also automatically checks for duplicate tickets and consolidates the requests. Phishbot sends the potentially malicious email attachment to a sandbox environment for safe detonation, or uses another tool to check suspicious links, and adds the results to the ticket.

"We were able to be there from the design phase to the requirements, deadlines and the limitations," Villegas says. "We all were able to get a little taste of what project management is like."

After eight weeks of development, the product had dramatic results — increasing coverage of phishing detection by 80 percent and saving the time of 89 analysts who would have had to do the process manually.

Interns often learn from the experts, but at McKesson, the experts also learned from the interns. For a company that is 183 years old, the young, enthusiastic minds were well received.

"They challenged the status quo, which is awesome and made our subject matter experts think twice about what they're doing and how things are being done," Black says. "Coming in with that mindset has definitely improved my existing teams and how they approach solutions."

The five students did such a good job, they were asked to stay on in the fall.

"Knowing that I would be able to work with all the amazing people I met throughout the internship once I obtained my degree was awesome, and I am so thankful," says Lybbert who now works as a software engineer at McKesson ❖

Above: McKesson Vice President of Cybersecurity Operations and Services Paul Black (second from right) hired on the first class of interns from Arizona State University's Ira A. Fulton Schools of Engineering and W. P. Carey School of Business in summer 2017. Chase Lybbert (left), Jonathan Villegas, Jenny Brito, Jeffrey Moore and Derek Wallace (not pictured) got to work solving technical challenges at the health care company's cybersecurity division, impressing with their technical skills and professionalism.

Decrypting the mystery of blockchain technology

Arizona State University and Dash, a top digital currency for payments, announced a partnership designed to accelerate research, development and education in ways that advance blockchain transaction speed, efficiency and security, while expanding its uses.

Blockchain is a decentralized, tamper-proof digital ledger technology that is transforming prospects for financial transactions across industries. The blockchain — which consists of linked blocks of information — is the foundation for cryptocurrencies like Dash and Bitcoin. Cryptocurrencies offer a form of money that is portable, inexpensive, divisible, and fast. The blockchain structure allows for direct transactions across a network of computers without the need for a central authority.

The $350,000 agreement between ASU and Dash includes support for two ASU labs, Blockchain Research Lab and the Luminosity Lab, as well as the Dash Scholars Program, which provides scholarships to undergraduate and graduate researchers studying the blockchain. The funds will also support the development of a graduate-level course on the blockchain.

The Blockchain Research Lab, the first of its kind in academia, offers students early access to blockchain technologies.

"ASU welcomes this initiative and is ready to play its role in creating a potent blockchain research and innovation environment for young talents to develop practical blockchain applications," says Dragan Boscovic, research professor and director of the Blockchain Research Lab.

"This is a remarkable partnership precisely because both sides will benefit greatly from tight collaboration," says Ryan Taylor, CEO of Dash Core and an ASU alumnus. "Dash benefits from gaining valuable independent insights into how we can improve our plans for scaling to massively large numbers of transactions. ASU will benefit from gaining access to one of the most innovative teams in the digital currency industry."

Students have gone on to get internships at Dash, while Dash's investment in ASU is helping to generate a well-trained talent pool from which the company can recruit future employees.

Since it was established, members of the Blockchain Research Lab team have released a paper highlighting research findings on the scalability of the Dash blockchain, won several engineering competitions and hackathons and earned scholarships from several companies including Microsoft.

While cryptocurrency will remain a primary focus of the Blockchain Research Lab, the team is also looking for ways to make blockchains accessible for uses beyond cryptocurrency, such as for banking transactions, property exchanges and contract-based dealings that benefit from bypassing third-party brokers. For example, the researchers in Blockchain Research Lab is working with a Phoenix-area company to formulate a blockchain for eco-energy applications, such as exchanging stored solar power within neighborhoods.

"It takes courage and curiosity to understand how this new thing would impact their business," Boscovic says. "It's essentially doing business in a new way."

The possibilities cryptocurrency continues to grow. Arizona lawmakers considered making cryptocurrencies such as Dash and Bitcoin acceptable for tax payments, though the discussion has been dismissed for now. However, the consideration to use cryptocurrency is a positive development because it injects confidence into the marketplace.

The Blockchain Research Lab is an interdisciplinary initiative that includes faculty from ASU's Ira A. Fulton Schools of Engineering, W. P. Carey School of Business, W. P. Carey Department of Information Systems and Sandra Day O'Connor College of Law. ❖

Predicting the future with better data visualization

From the way people move through an area to the way they vote, data can be gleaned from every action and used to enhance our understanding of patterns and trends.

Ross Maciejewski, an associate professor of computer science, directs the Center for Accelerating Operational Efficiency where he focuses his research on how to enable the exploration and communication of data.

Data, such as crime statistics, census data and climate data, all encompass a specific geographic location and time.

"What we're trying to do is develop new solutions for exploring this large spatiotemporal data to find patterns and identify anomalies," Maciejewski says. "Our goal is to help analysts build models that can forecast what might occur in the future. This allows for better planning and management."

Maciejewski's work in visual analytics earned him the Faculty Early Career Development Program (CAREER) Award in 2014. Since then he's continued to expand how he uses data to observe trends.

"We had envisioned particular domains that we were going to explore such as crime, climate and health," says Maciejewski. "However, given the abundance of these types of data, we were able to really hit new areas, including movement data like taxi data and amusement park visitors as well as global trade data. This allowed us to see how well things might generalize and really strengthened our findings."

Maciejewski has produced a solid body of literature, including 10 journal publications, that demonstrate the challenges and potential solutions in this area and identify areas where more work is needed. ❖

Shifting big data into high gear

Associate Professor Ming Zhao has taken the driver's seat in developing the Energy Efficient Big Data Research System, called GEARS, a new computing infrastructure created by a consortium of interdisciplinary researchers who are turning the noise of social media into useful data sources that can improve machine learning and detect security threats or incidents like disease outbreaks or crimes in real time.

Zhao's efforts to solve both the performance and energy-efficiency challenges of big data technologies have been supported by the National Science Foundation through a three-year, $750,000 grant.

GEARS incorporates software components that help optimize the use of the various processor and accelerator types and storage resources.

"It's easy to buy the heterogeneous hardware [components] and put them together, but it's up to the software system to make good use of the devices," says Zhao, who directs the Research Laboratory for Virtualized Infrastructures, Systems and Applications, which started the development of GEARS's underlying technology.

While some researchers on the GEARS research team are focusing on developing the hardware and software infrastructure, others are developing new algorithms to make efficient use of the infrastructure and to make it user-friendly for other data scientists.

"Usability is important, so we want to make it really easy for users to develop applications for the heterogeneous hardware of GEARS," Zhao says.

So far, GEARS researchers have collaborated on several interdisciplinary projects with researchers around the globe, including projects related to neuroscience, sustainability, medicine, aerospace, botany and geography. ❖

One example of heterogeneous computing is the iPhone X's processor, which has four cores optimized for performance and two cores optimized for power efficiency. The processor also features a dual-core neural engine specialized for machine learning and Face ID, the face-recognition application in the iPhone that requires significant computing power to run quickly.

Heterogeneous computing can also be seen in other computers, that combine hard disk drives for inexpensive, high-capacity storage with solid-state drives for storage that's speedy to access.

GEARS takes a similar approach but at a larger scale, tackling tough big data problems and finding solutions to meet storage and efficiency goals.

Center for Embedded Systems

Director: Sarma Vrudhula
ces.asu.edu

Since its designation as a National Science Foundation Industry/University Cooperative Research Center in 2009, the Center for Embedded Systems has generated $4.4 million in research funding and supported 100 ASU student research associates on more than 80 industry-led research projects. Housed at ASU and working closely with its partner, Southern Illinois University Carbondale, center researchers focus on the technologies that enable sensing, communications, computing and control in everyday things and conduct pre-competitive research in consumer electronics, aerospace/avionics, industrial automation, automotive and transportation, and security. The center's active industry advisory board includes Qualcomm Technologies, Toyota Technical Center, Marvell, Robert Bosch, Ball Aerospace, Intel, Ford Motor Co., Collins Aerospace and Alphacore.

ASU-Mayo Center for Innovative Imaging

Director: Teresa Wu
amcii.asu.edu

Based on a collaboration with the Department of Radiology at Mayo Clinic Arizona, the center has now expanded to include core faculty from oncology, neurology and radiology from Mayo Clinic Arizona and Rochester, and researchers in biomedical, electrical and human systems engineering and biomedical informatics at ASU. This multidisciplinary group is improving patient care by bridging engineering research with clinical practices and developing innovative therapeutic technologies.

- Researchers in the center were awarded a DOD grant to start in Fall 2019 involving teams from Mayo Clinic, ASU, UA and TGen to discover the mechanisms, predictors and treatment for persistent post-traumatic headache.
- Also beginning in Fall 2019, ASU and Mayo Clinic teams will begin work to enable non-invasive characterization of molecular heterogeneity within the diseased tissue or organ of each individual to allow for precision treatment with funding from the NSF.

Center for Cognitive Ubiquitous Computing

Director: Sethuraman "Panch" Panchanathan
cubic.asu.edu

Also known as CUbiC, the center challenges a technology-centric view of solving real-world problems by a balanced technology and problem-centric view which addresses the underlying challenges to serving the needs of individuals with disabilities. Motivated by this approach, CUbiC researchers have assembled focus groups of individuals who are blind, scholars involved in disability studies, and mobility instructors to deliver ubiquitous and pervasive computing technologies that enrich lives.

- CUbiC was awarded an NSF Research Traineeship grant to develop the future leaders in the field of "smart cities" through an interdisciplinary master's and doctoral program.
- CUbiC faculty and students produced over 30 high quality publications, published in premier conference proceedings and journals in multimedia, human-computer interaction, haptics and machine learning.
- CUbiC Director Sethuraman Panchanathan was appointed Senior Advisor for Science and Technology, State of Arizona by Arizona Governor Doug Ducey.

The Drone Studio

Director: Stephanie Gil
engineering.asu.edu/drone

Outfitted with more than 100 high-precision, infrared cameras and a 3D tracking system, the new drone testing facility (the largest of its kind in academia) will serve as a hub for academic, government and industry research partners to study multi-robot swarming, cyberphysical systems and human-robot interactions.

From studying integrated communications systems for autonomous vehicles to biomechanics and human motion, the new instrumented space will be a hub for highly collaborative and interdisciplinary research of advanced drone technologies.

Center for Cybersecurity and Digital Forensics

Director: Gail-Joon Ahn
Associate Director: Adam Doupé
cdf.asu.edu

The Center for Cybersecurity and Digital Forensics brings together leading faculty in engineering, social sciences, law and business to conduct research focused on automated cyber reasoning systems, identity management, privacy issues, malware attribution, secure mobile devices and digital forensics. The center promotes the invention and commercialization of cybersecurity and digital forensics research.

- Hosted a qualification event of more than 1,200 teams and the finals of DEF CON CTF, the "Olympics" of ethical hacking competitions. The top 16 teams in the world were invited to compete at the final event co-located with the 2019 DEF CON security conference in Las Vegas.
- 2019 USENIX Security Distinguished Paper Award for work on understanding telephone phishing scams and robocalls.
- OKED 2019 Knowledge Enterprise Innovation Award.

Center for Assured and SCAlable Data Engineering

Director: K. Selçuk Candan
cascade.asu.edu

The Center for Assured and SCAlable Data Engineering is solving complex problems through data intensive research and providing informed answers to key societal needs. CASCADE aims to enable a principled framework for reliable and timely data-driven decision-making and supports the innovation of data architectures and tools that can match the scale of the data.

- Collaborated with academic and industrial partners to address data management and analytics challenges including but not limited to sustainability (water preservation), health care (brain trauma in children) and transportation (fuel savings in air transportation).
- Initiated a strategic partnership with Dash that enabled the formation of Blockchain Research Lab and the nation's first online, graduate-level blockchain course.
- Developed a three-course sequence on scalable data management, machine learning and data visualization that became the seed for the new online MCS program delivered via Coursera.
- Won multiple federally funded grants from NSF and NIH.

Director: Gail-Joon Ahn
cdf.asu.edu

Director: Sethuraman "Panch" Panchanathan
cubic.asu.edu

Director: Robert Atkinson
ilux.lab.asu.edu

Director: Stephanie Gil
engineering.asu.edu/drone

Director: Rene Villalobos
iac.engineering.asu.edu

Director: K. Selçuk Candan
cascade.asu.edu

Director: Ross Maciejewski
caoe.asu.edu

Director: Sarma Vrudhula
ces.asu.edu

Director: Stephanie Forrest
links.asu.edu/biocomputing

Director: Teresa Wu
amcii.asu.edu

Center for Accelerating Operational Efficiency, A Department of Homeland Security (DHS) Center of Excellence

Director: Ross Maciejewski **caoe.asu.edu**

CAOE develops and applies advanced analytical tools and technologies to support real-time decision-making to enable DHS operational components such as the Transportation Security Administration (TSA) and Customs and Border Protection (CBP) to achieve improvements in operational efficiency. The center's four major research themes include: data analytics, operations research, economic analysis and homeland security risk sciences.

iLUX (Innovative Learner and User Experience)

Director: Robert Atkinson
ilux.lab.asu.edu

iLUX sheds light on usability issues facing academic and commercial clients by providing accurate and objective consumer/learner behavior gathered with a comprehensive biometric sensor suite that includes EEG, eye tracking, face-based emotion recognition and galvanic skin response. With 100% mobile capability, iLUX researchers can accommodate small-scale usability studies during development up to large-scale user experience studies in the lab or in a client's preferred location.

- Working with adidas to understand in-depth the behavioral economics principles in eCommerce, consumer engagement at brick-and-mortar stores, influencer resonance with young creators, online vs. physical product experience, foot-fit using comfort scanner, physical activity mediated, cognitive enhancement and branding for Seattle's new NHL team.
- Developing innovative payment and tracking services for Pizza Hut on web, Android and iOS.
- Developing mixed-reality applications to improve and innovate packing best practices using Microsoft Hololens with FedEx.

Biocomputing, Security and Society

Director: Stephanie Forrest **links.asu.edu/biocomputing**

The center translates insights between computer science and biology, with a focus on understanding and mitigating malicious behavior in complex systems. For example, the center's researchers use similar tools for managing cancer and repairing cybersecurity vulnerabilities. Biocomputing, Security and Society's models of evolutionary biology and ecology are predicting which tumors are likely to become dangerous and how best to manage them. The center uses immunological concepts to invent new cybersecurity solutions and evolutionary methods to solve software engineering problems. Researchers in the center also use computing and mathematical abstractions to inform biological research, focusing on new approaches to understanding and managing cancer.

Industrial Assessment Center

Director: Rene Villalobos
iac.engineering.asu.edu

Funded by the U.S. Department of Energy, the Industrial Assessment Center conducts no-cost energy efficiency and cybersecurity assessments for small-to-medium manufacturers throughout Arizona, southern Nevada and western New Mexico. The center's faculty and students focus on finding ways to reduce operating costs through energy efficiency and productivity improvements as well as waste reduction.

- IAC researchers with funding from SRP are developing optimization tools for electricity demand management to better accommodate production schedules to time-of-use plans.
- IAC researchers with funding from EPA conduct assessments of local manufacturing facilities to identify water savings opportunities.
- IAC researchers are developing sensors and smart-manufacturing tools to implement optimal predictive maintenance.

Biocomputing + computer science = de-bugged software

Maintaining software is costly, and, for developers, repairing software bugs can be very expensive.

Today, most software bugs are still repaired by humans — highly trained software engineers. About 10 years ago, a group of researchers, including professor Stephanie Forrest, looked to biological processes like evolution for ideas about ways to automate de-bugging. The resulting paper, "Automatically Finding Patches Using Genetic Programming," was a totally new approach for locating and repairing bugs in software.

Much like mutations occur in nature, "genetic programming" uses a population of programs formed by applying random mutations to the buggy code. The program variants are then tested, all while evolving until a program that repairs the bug is found. The test suite ensures that the "repairs" don't interfere with existing functionality while correcting for the detected issue.

Once a candidate patch for the bug is discovered, developers can go back and refine the automatically generated solutions to improve them, saving vast amounts of time.

The paper's groundbreaking impact on the field of software engineering was recognized with an award at the 41st International Conference on Software Engineering conference, being "judged to have had the most influence on the theory or practice of software engineering during the 10 years since its original publication." It has now been cited more than 553 times. ❖

Decision framework

INFORMS students Logan Mathesen, Nathan Gaw and Daniel Tran presented their work to the Principal Financial Group after a second place finish at the 2018 Principal Cup. Together with Anson Park (not pictured), the team created a decision framework called kNN-Stock that fuses machine learning and conventional stock-trading expertise to make optimal trade decisions. ❖ *Photo courtesy of ASU INFORMS student chapter.*

Coding the future

Ryan Meuth and Phillip Miller, both computer science lecturers, have created a free, online, self-directed course that prepares middle and high-school teachers to facilitate computer programming activities in their classroom. Through Canvas and Vocareum, a cloud solution for computing labs, the teachers have access to virtual computer science labs in data science, robotics and more.

"Learning to program unlocks the full power of the mechanics we use every day," Meuth says. "We think that if teachers learn to program and see the potential, they'll want to share the experience with their students." ❖

Engineering success: It's all in the mind(set)

The right skills and the right mindset are both necessary for success.

Equipping engineers with technical skills means they can build something, but shifting their mindset can mean the products and processes they build will be useful to society.

This is the goal of teaching the entrepreneurial mindset, a mission of the Kern Entrepreneurial Engineering Network, or KEEN. Arizona State University is one of the 38 colleges and universities in the KEEN network, and is preparing engineering students to create personal, economic and societal value through purposeful careers.

The entrepreneurial mindset, or EM, encompasses the three C's: curiosity, connections and creating value.

Curiosity leads to discoveries by investigating what's out there, what works, what doesn't and why. Students learn that a single piece of information isn't useful on its own, so they must connect their discoveries with meaningful insights and innovative solutions. These steps lead to creating value by anticipating and meeting society's needs.

Computer science, engineering and informatics Lecturer Ryan Meuth teaches both introductory and capstone courses where he has applied the customer discovery aspects of EM to his teaching approach through a KEEN Professorship mini-grant.

In one of his FSE 100 introductory courses, Meuth tasks students with designing and building a one-eighth-scale robotic vehicle that can pick up and transport a passenger who uses a wheelchair. When students try to figure out the mechanics of their vehicle, Meuth asks them to consider how their decisions will affect the customer.

"It highlights the need to think about the customer experience when designing the solution to a problem," Meuth says.

Going forward, he's looking for more ways to develop EM content for the courses he teaches.

"I'm interested in learning more techniques and activities I can bring to my students," Meuth says, "as well as sharing what has worked for me with the KEEN network." ❖

Engineering and humanities collide for social good

According to the National Alliance to End Homelessness, 9,865 people experience homelessness on a given night in Arizona.

People who experience homelessness often lack basic necessities and opportunities for regular employment and health care because they don't have access to a permanent address, phone line or internet connection.

Since 2016, Baani Khurana, who recently graduated with a bachelor's degree in computer science, has been volunteering with ASU's Project Humanities outreach initiative to distribute aid to people experiencing homelessness in the Phoenix metropolitan area.

"My Sikh faith inspires a passion for community service," Khurana says.

"Nonprofit organizations are not given as much exposure in the tech field. I wanted to change that narrative by spreading awareness and helping meet the needs of the homeless population."

Through volunteering, she noticed organizers struggling to acquire, track and redistribute critical resources. In researching Phoenix's homelessness crisis, Khurana found many nonprofit organizations addressing the needs of people who are homeless were disconnected from one another, diminishing their ability to maximize community impact.

For her honors thesis as part of Barrett, The Honors College, Khurana developed a software solution to improve the process of collecting statistics on client needs, tracking donations and managing resources. As privacy assurance is important to people experiencing homelessness, she wanted to ensure her software could collect data with no personally identifiable information.

She also sought to offer an alternative to databases that require identity documents since many people experiencing homelessness often do not have valid forms of identification. Thus, the software could help nonprofits in assisting clients without needing to know their identity.

Khurana is pursuing computer science graduate studies through the 4+1 accelerated master's degree program and will continue to enlist other nonprofits to maximize their impact and better serve people experiencing homelessness in Arizona. ❖

Students chosen as **Outstanding Graduates** are honored for their exemplary academic performance and participation in activities that enhance their engineering skills. Students receiving the **Impact Award** have been singled out for their leadership, volunteer and service roles that positively impact their communities. **The Dean's Dissertation Award** recognizes exceptional work by doctoral students that encourages the highest levels of scholarship, research and writing.

Outstanding grads

2018

Samantha Baker, BS
Informatics

Michelle Capriles-Escobedo, BSE
Software engineering

Paulina Davison, BSE
Computer systems engineering

Erin Glavin, BSE
Industrial engineering

Thu Hoang, BSE
Computer systems engineering

Julia Liu, BS
Computer science

Ivana Ninkovic, BSE
Engineering management

Michaela Starkey, BSE
Industrial engineering

Daniel Travis, BSE
Engineering management

Janice Wallace, BS
Software engineering

Jiaqi Wu, BS
Computer science

2019

Zakk Giacometti, BSE
Computer systems engineering

Meghan Iacuelli, BSE
Industrial engineering

Niharika Jain, BS
Computer science

Allison Meyer, BSE
Engineering management

Wezley Sherman, BS
Software engineering

Impact awards

2018

Molly Baker, BSE
Engineering management

Berenice Castro, BSE
Industrial engineering

Matt W. Davis, BS
Computer science

Monica Kilehua, BSE
Industrial engineering

Sami Mian, MS
Computer engineering (computer systems engineering)

Tyrine Jamella Pangan, BS
Software engineering

Trae Waggoner, BS
Computer science

2019

Ethan Barlow, BSE
Engineering management

Robert Chandler, BS
Computer science

Briana Chavez, BSE
Industrial engineering

Emily Gilmore, BSE
Industrial engineering

Nicholas Richards, BSE
Computer systems engineering

Dean's dissertation

2018

Suhang Wang, PhD
Computer science

Software engineering graduate student powers through illness

Stefano Chang had a good job in his field and was one class away from a master's degree in software engineering from Arizona State University.

Then his vision went wonky.

He saw double because of a tumor in his head. Work, school and everything else came to a screeching halt as he went to the Mayo Clinic for treatment.

While he was there he wondered if there was a way he could take his final class online. He asked Kevin Gary, the graduate program committee chair for software engineering, about it.

"I didn't want to delay more than I already did," says Chang, the first in his family to earn a college degree. "It was the only thing I could do in terms of moving on."

While enduring eight-hour treatments, he hunched over his laptop, wrapping up his degree.

"It felt good," he says.

"Don't quit. You're going to look back and you're going to say, 'I was wise about that,' once you get through it. It's just like my treatment. I look back on it and say, 'It was a piece of cake. Nothing.'"

Nitin **Agarwal '09**

Jerry L. Maulden-Entergy Endowed Chair and Distinguished Professor of Information Science

University of Arkansas at Little Rock

Chair: Huan Liu

501-916-5224

profiles.ualr.edu/na10/

Research interests: Social computing

Best Paper Award at the International Conference on Social Media Technologies, Communication, and Informatics (SOTICS 2018) for Understanding digital ethnography: Socio-computational analysis of trending YouTube videos, October 14-18, 2018, Nice, France.

Outstanding PhD student finalist by the School of Computing and Informatics, Arizona State University, Spring 2009.

Sheikh Iqbal **Ahamed '03**

Professor and Chair

Marquette University

Chair: Stephen Yau

414-288-5222

mscs.mu.edu/~iq/

Research interest: Mobile health

Invited to serve on NIH grant review panel, 2016.

Graduate Tuition Scholarship and Graduate Academic scholarship, 1998-2003

Saud **Alashri '18**

Assistant Professor

King Abdulaziz City for Science and Technology, Saudi Arabia

Chair: Hasan Davulcu

Salem **Alelyani '13**

Assistant Professor

King Khalid University, Saudi Arabia

Chair: Huan Liu

Mohammed **Almukaynizi '19**

Assistant Professor

King Saud University, Saudi Arabia

Chair: Paulo Shakarian

Research interest: AI applications to cybersecurity

Invention US 62/581,123, licensed to CYR3CON and used in a product named CYR3CON PR1ORITY, won a Defense Innovation Challenge award (2017) as well as accolades from Cisco (2016), and PricewaterhouseCoopers (PwC) (2017).

Best Poster Award, the IEEE 1st International Conference on Data Intelligence and Security (IEEE ICDIS 2018)

Abudllah O. **Alshalan '17**

Assistant Professor

King Saud University, Saudi Arabia

Chair: Dijiang Huang

+966-11-469-5216

Research interest: Computer networks

Adel **Alshamrani '18**

Assistant Professor

University of Jeddah, Saudi Arabia

Chair: Dijiang Huang

Research interest: Intrusion detection and prevention

Abdurrahman **Alshareef '19**

Assistant Professor

King Saud University, Saudi Arabia

Chair: Hessam Sarjoughian

Sultan **Alzahrani '18**

Assistant Research Professor

King Abdulaziz City for Science and Technology, Saudi Arabia

Chair: Hasan Davulcu

Research interest: Artificial intelligence

"Vehicle task reminder device". United States patent US 9,214,079. 2015 Dec 15. (Patent is awarded and funded by The Saudi Arabian Cultural Mission)

Nicole **Ang-Wanek '15 MS**

Lecturer

Arizona State University

Chair: Violet Syriotek

Ayan **Banerjee '12**

Assistant Research Professor

Arizona State University

Chair: Sandeep Gupta

Research interest: Cyberphysical systems

Alireza **Boloori '19**

Assistant Professor

Michigan State University

Chairs: John Fowler, Soroush Saghafian

chmfamilymedicine.msu.edu/people/alireza-boloori/

Research interest: Healthcare policy and operations

Paper: Data-driven management of post-transplant medications: An APOMDP approach; INFORMS 2018: Decision Analysis Society Best Student Paper Award (runner-up)

Arun Balaja **Buduru '16**

Assistant Professor

Indraprastha Institute of Information Technology, Delhi, India

Chair: Stephen Yau

+011-26907469

iiitd.ac.in/arunb

Research interest: Cybersecurity

Maria Elena
Chavez-Echeagaray '18

Lecturer

Arizona State University

Chairs: Robert Atkinson, Winslow Burleson

Research interest: Affective computing

ACM Senior Member Award, 2014

Gennaro **De Luca '20**

Lecturer

Arizona State University

Chairs: Yinong Chen, Huan Liu

Zahra **Derakhshandeh '17**

Assistant Professor

California State University, East Bay

Chair: Andrea Richa

zderakhshandeh.com

Research interest: Distributed computing

Outstanding PhD student by School of Computing, Informatics, and Decision Systems Engineering, Arizona State University, 2017

Guanqi **Fang '20**

Assistant Professor

Zhejiang Gongshang University, China

Chair: Rong Pan

Gregory **Gelfond '18**

Research Fellow

University of Nebraska Omaha

Chair: Chitta Baral

402-554-6035

unomaha.edu/college-of-information-science-and-technology/about/faculty-staff/greg-gelfond.php

Research interest: Artificial intelligence

Javier **Gonzalez-Sanchez '16**

Lecturer

Arizona State University

Chairs: Winslow Burleson, James Collofello

javiergs.com

Research interest: Engineering self-adaptive software

ACM Distinguished Speaker, 2020

Xia Ben **Hu '15**

Associate Professor

Texas A&M University

Chair: Huan Liu

people.engr.tamu.edu/xiahu/

Research interest: Automated and interpretable data mining and machine learning algorithms

NSF CAREER Award, 2018

Outstanding Graduate Student Award, Ira A. Fulton Schools of Engineering, Arizona State University, 2015

President's Award for Innovation, Arizona State University, 2014

Nur **Kamarudin '19**

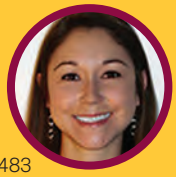
Assistant Professor

Universiti Malaysia Pahang, Malaysia

Chair: Huan Liu

shazwanipursue.wixsite.com/nurwebpage

Research interest: Social media analysis



Erin **Lanus '19**

Research Assistant Professor

Virginia Polytechnic Institute and State University

Chair: Charles Colbourn

hume.vt.edu/personnel/detail?id=483

Research interest: Security and privacy

GPSA Outstanding Research Award, 2019

Dongjin **Lee '18**

Postdoctoral Associate

Cornell University

Chair: Rong Pan

Jundong **Li '19**

Assistant Professor

University of Virginia

Chair: Huan Liu

434-243-5451

people.virginia.edu/~jl6qk/

Research interest: Data mining and machine learning

Won 2019 INFORMS QSR Best Student Paper Finalist and Best Refereed Paper Finalist.

Nichola **Lubold '18**

Academic Associate

Arizona State University

Chairs: Erin Walker, Heather Pon-Barry

Research interest: Computational linguistics and spoken language processing

Dean's Fellowship, Ira A. Fulton Schools of Engineering, 2013–2017

Kevin **Luck '19**

Postdoctoral Scholar

University of Edinburgh, Scotland

Chair: Heni Ben Amor

+44 (0) 131 651 5661

kevin-luck.com/about/

Research interest: Self-learning robots

Lydia **Manikonda '19**
Assistant Professor
Rensselaer Polytechnic Institute
Chair: Subbarao Kambhampati
faculty.rpi.edu/node/36320

Ericsson **Marin '20**
Assistant Professor
California State Polytechnic University, Pomona
Chair: Paulo Shakarian

Gary R. **Mayer '09**
Associate Professor (2009–2019)
Southern Illinois University Edwardsville
Chair: Hessam Sarjoughian

Satyajayant **Misra '09**
Professor
New Mexico State University
Chair: Guoliang Xue
575-646-6256
cs.nmsu.edu/~misra/
Research interest: Networking and mobile computing
One of the first eleven NSF CREATIV Grant awardees, 2012

Fred **Morstatter '17**
Research Assistant Professor
University of Southern California
Chair: Huan Liu

Parth **Nagarkar '17**
Assistant Professor
New Mexico State University
Chair: K. Selçuk Candan
575-646-5666

Soohyun **Oh '05**
Assistant Professor
Sungkyunkwan University, South Korea
Chair: Andrea Richa

Carlos **Rubio-Medrano '16**
Assistant Professor
Texas A&M University–Corpus Christi
Chair: Gail-Joon Ahn
sci.tamucc.edu/faculty/crubiomedrano.html

Kai **Shu '20**
Gladwin Development Chair Assistant Professor
Illinois Institute of Technology
Chair: Huan Liu
cs.iit.edu/~kshu/
Research interest: AI for social good
Rising Star Award, BDSC 2020
CIDSE Doctoral Fellowship Award, Arizona State University, 2020

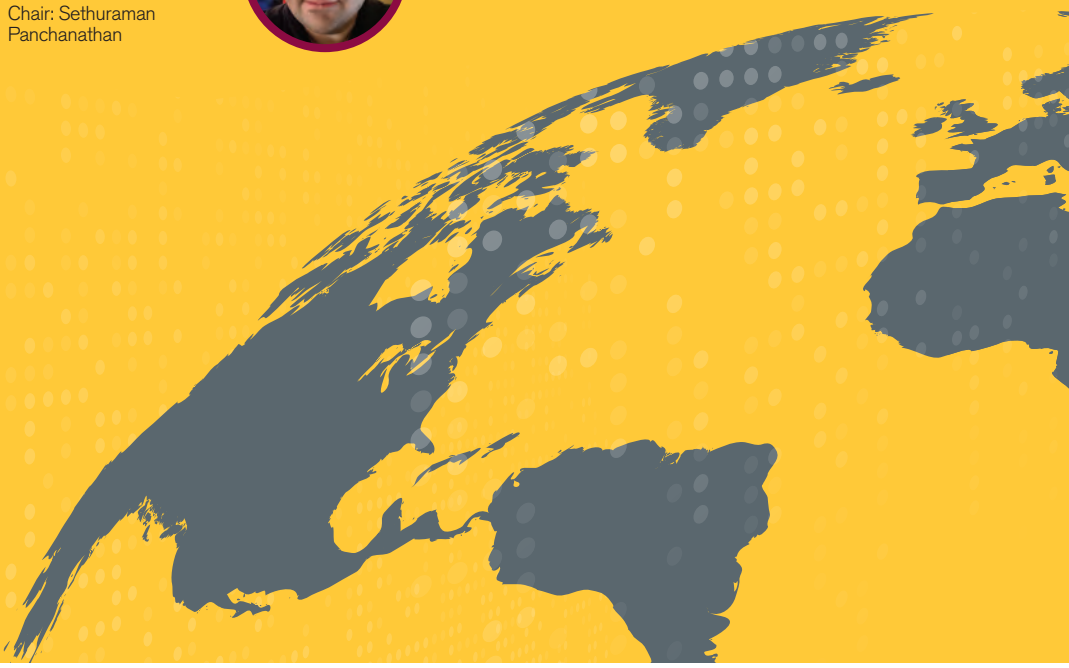
Bing **Si '18**
Assistant Professor
State University of New York
Chair: Jing Li
607-777-4776
binghamton.edu/ssie/people/profile.html?id=bsi
Research interest: Data analytics and statistical learning in patient care cycles
Dean's Dissertation Award, Arizona State University, 2017

Ramin **Tadayon '17**
Postdoctoral Researcher (2019, 2020)
Arizona State University
Chair: Sethuraman Panchanathan

Jian **Tang '06**
Professor
Syracuse University
Chair: Guoliang Xue
315-443-1197
eng-cs.syr.edu/directory/?peopleid=3287
Research interest: Cloud computing
NSF CAREER Award, 2009

Jiliang **Tang '15**
Assistant Professor
Michigan State University
Chair: Huan Liu
517-432-0608
cse.msu.edu/~tangjili/
Research interest: Feature selection
Best Paper Award, SIGKDD, ACM, 2016;
Yahoo! Invention Award, Yahoo!, 2016
Dean's Dissertation Award, Arizona State University, 2015

Raymond H. **Tu '17**
Assistant Clinical Professor
University of Maryland, College Park
Chairs: Gail-Jooh Ahn, Adam Doupe
huahongtu.me/
Research interest: Machine learning
2019 Distinguished Paper Award, USENIX Security Symposium



Krishna
Venkatasubramanian '09
Assistant Professor
University of Rhode Island
Chair: Sandeep Gupta
401-874-2701
kven.me/
Research interest: Computational and machine learning-based solutions

Hemanth Kumar Demakethepalli
Venkateswara '17
Assistant Research Professor
Arizona State University
Chair: Sethuraman Panchanathan
isearch.asu.edu/profile/1542148
Research interest: Machine learning and computer vision

Suhang **Wang '18**
Assistant Professor
Pennsylvania State University
Chair: Huan Liu
814-865-2453
suhangwang.ist.psu.edu/
Research interest: Machine learning
Editorial board of Neurocomputing, 2019
Dean's Dissertation Award, Arizona State University, 2018

Dejun **Yang '13**
Associate Professor
Colorado School of Mines
Chair: Guoliang Xue
303-273-3307
people.mines.edu/djyang/
Research interest: Networking

Hyunsoo **Yoon '18**
Assistant Professor
Binghamton University
Chair: Jing Li
607-777-5018
sites.google.com/binghamton.edu/dais/
Research interest: statistical modeling and machine learning
Best Paper Award (Applied Track), The INFORMS Data Mining and Decision Analysis Workshop, 2019
CIDSE Doctoral Fellowship, Arizona State University, 2014–2015

Jia **Yu '20**
Assistant Professor
Washington State University
Chair: Mohamed Sarwat
jiayuasu.github.io/
Research interest: Large-scale database systems
2019 Best Demo Paper Runner-Up, SSTD

Lei **Yu '05**
Associate Professor
State University of New York at Binghamton
Chair: Huan Liu
607-777-6250
cs.binghamton.edu/~lyu/
Research interest: Machine learning

Ruozhou **Yu '19**
Assistant Professor
North Carolina State University
Chair: Guoliang Xue
919-515-7938
people.engr.ncsu.edu/ryu5/
Research interest: Internet-of-Things
Distinguished TPC Member of IEEE INFOCOM 2020
ASU CIDSE Doctoral Fellowship Award, 2019

Reza **Zafarani '15**
Assistant Professor
Syracuse University
Chair: Huan Liu
315-443-2134
reza.zafarani.net
Research interest: Social media mining
NSF CAREER Award, 2020

Lishan **Zhang '15**
Associate Professor
Central China Normal University
Chair: Kurt VanLehn

Ziming **Zhao '14**
Assistant Professor
State University of New York
Chair: Gail-Joon Ahn
zzm7000.github.io/
Research interest: Hardware-assisted security

Did we make a mistake? If an error or omission has occurred, please contact Stephanie Mabee at stephanie.mabee@asu.edu.

Doctoral students

Student Name/ Graduated	Title	Chair/Members	Placement
Aditya, Somak Summer 2018	Knowledge and Reasoning in Image Understanding	**Co-Chairs: Chitta Baral, Yezhou Yang** Baoxin Li, Joohyung Lee	Adobe Research, India
Alashri, Saud Abdullah H Spring 2018	Detecting Frames and Causal Relationships in Climate Change Related Text Databases Based on Semantic Features	**Chair: Hasan Davulcu** Ross Maciejewski, Sharon Hsiao, Kevin Desouza	King Abdulaziz City for Science and Technology, Saudi Arabia
Alshamrani, Adel Fall 2018	Cyber Attacks Detection and Mitigation in SDN Environments	**Chair: Dijiang Huang** Gail-Joon Ahn, Adam Doupé, Hasan Davulcu	University of Jeddah, Saudi Arabia
Alzahrani, Sultan Spring 2018	Detecting Political Framing Shifts and the Adversarial Phrases within Rival Factions and Ranking Temporal Snapshot Contents in Social Media	**Chair: Hasan Davulcu** Baoxin Li, Sharon Hsiao, Steven Corman	King Abdulaziz City for Science and Technology, Saudi Arabia
Arunkumar, Akhil Fall 2018	Memory Subsystem Optimization Techniques for Modern High-Performance General-Purpose Processors	**Chair: Carole-Jean Wu** Hanghang Tong, Charu Aggarwal, Arunabha Sen	Samsung
Boloori, Alireza Spring 2019	Data-Driven Decision Making for Medications Management Modalities	**Co-Chairs: John Fowler, Soroush Saghafian** Douglas Montgomery, Esma Gel, Curtiss Cook	Michigan State University
Bren, Austin Spring 2018	Data-Driven Robust Optimization in Healthcare Applications	**Chair: Pitu Mirchandani (co-chair)** Soroush Saghafian (co-chair), Teresa Wu, Rong Pan	Opex Analytics
Cao, Jun Fall 2018	Towards Developing Computer Vision Algorithms and Architectures for Real-world Applications	**Chair: Baoxin Li** Huan Liu, Yu Zhang, Junshan Zhang	Intel Corp
Chakraborti, Tathagata Fall 2018	Foundations of Human-Aware Planning	**Chair: Subbarao Kambhampati** Yu Zhang, Heni Ben Amor, Kartik Talamadupula, Matthias Scheutz	IBM
Chavez-Echeagaray, Maria Elena Summer 2018	Real-Time Affective Support in Promoting Learner's Engagement	**Chair: Gail-Joon Ahn** Ziming Zhao, Adam Doupé	Arizona State University
Chen, Chen Spring 2019	Connectivity in Complex Networks: Measures, Inference and Optimization	**Chair: Hanghang Tong** Arunabha Sen, Hasan Davulcu, Lei Ying, V Subrahmanian	Google
Da Silva Girotto, Victor Augusto Spring 2019	Advancing Large-Scale Creativity through Adaptive Inspirations and Research in Context	**Co-Chairs: Erin Walker, Winslow Burleson** Kurt VanLehn, Anastasia Kuznetsov, Mary Lou Maher	Accenture Technology Labs
Danielescu, Lavinia Spring 2019	Discoverable Free Space Gesture Sets for Walk-Up-and-Use Interactions	**Co-Chairs: Erin Walker, Winslow Burleson** Kurt VanLehn, Anastasia Kuznetsov, Mary Lou Maher	Accenture Technology Labs
Demirtas, Aysegul Spring 2018	The Optimal Control of Child Delivery for Women with Hypertensive Disorders of Pregnancy	**Co-Chairs: Esma Gel, Soroush Saghafian** George Runger, Jennifer Bekki	Intel
Gelfond, Gregory Spring 2018	Representing and Reasoning about Dynamic Multi-Agent Domains: An Action Language Approach	**Chair: Chitta Baral** Subbarao Kambhampati, Joohyung Lee, Lawrence Moss, Tran Son	University of Nebraska Omaha
Kim, Nyunsu Spring 2018	Perspective scaling and trait detection on social media data	**Chair: Hasan Davulcu** Arunabha Sen, Sharon Hsiao, Steven Corman	American Express
Lanus, Erin Spring 2019	Interaction testing, Fault Location and anonymous Attribute based authentication	**Chair: Charles Colbourn** Douglas Montgomery, Violet Syrotiuk, Gail-Joon Ahn	Virginia Tech
Lee, Dongjin Spring 2018	Bayesian Network Approach to Assessing System Reliability for Improving System Design and Optimizing System Maintenance	**Chair: Rong Pan** Douglas Montgomery, Teresa Wu, Xiaoping Du	Cornell University
Li, Liangyue Fall 2018	Harnessing Teamwork in Networks: Prediction, Optimization and Explanation	**Chair: Hanghang Tong** Chitta Baral, Huan Liu, Norbou Buchler	Amazon A9.com
Li, Xinsheng Spring 2019	Density and Noise Challenge in Tensor Based Analytics: Scalability and Accuracy Solution	**Chair: Kasim Candan** Hasan Davulcu, Maria Luisa sapino, Hanghang Tong	Apple
Lin, Sangdi Summer 2018	Machine Learning Models for High-dimensional Biomedical Data	**Chair: George Runger** Rong Pan, Adolfo Escobedo, Jean-Pierre Kocher	Zillow Group

Student Name/ Graduated	Title	Chair/Members	Placement
Lin, Sangdi Summer 2018	Machine Learning Models for High-dimensional Biomedical Data	**Chair: George Runger** Rong Pan, Adolfo Escobedo, Jean-Pierre Kocher	Zillow Group
Liu, Mengxue Summer 2018	Maximizing Routing Throughput with Applications to Delay Tolerant Networks	**Chair: Andrea Richa** Guoliang Xue, Violet Syrotiuk, Thienne Johnson	Facebook
Liu, Xiaonan Spring 2019	Novel Statistical Learning Methods for Multi-Modality Heterogeneous Data Fusion in Health Care applications	**Chair: Jing Li** Rong Pan, Mirek Fatyga, Teresa Wu	Amazon
Liu, Yashu Fall 2018	Mining Data with Feature Interactions	**Co-Chairs: Guoliang Xue, Jieping Ye** Huan Liu, Hans Mittelmann	Didi Chuxing Technology Co., China
Lubold, Nichola Fall 2018	Producing Acoustic-Prosodic Entrainment in a Robotic Learning Companion to Build Learner Rapport	**Co-Chairs: Erin Walker, Heather Pon-Barry** Kurt VanLehn, Visar Berisha, Diane Litman	Arizona State University
Ning, Shuluo Spring 2018	Structure-Regularized Partition-Regression Models for Nonlinear System-Environment Interactions	**Chair: Jing Li** Teresa Wu, Rong Pan, Tanveer Rafi	Amazon Web Services
Nunes, Eric Summer 2018	Reasoning About Cyber Threat Actors	**Chair: Paulo Shakarian** Gail-Joon Ahn, Chitta Baral, Nancy Cooke	Pay Pal
Sampath, Siddhartha Spring 2018	Towards More Intuitive Frameworks in Project Portfolio Selection	**Co-Chairs: Esma Gel, John Fowler** Karl Kempf, Jorge Sefair, Rong Pan	Intel
Shaabani, Elham Spring 2019	Data-Driven Interface in Population of Agents	**Chair: Paulo Shakarian** Hasan Davulcu, Scott Decker, Ross Maciejewski	Walmart Labs
Si, Bing Spring 2018	Data Fusion and Systems Engineering Approaches for Quality and Performance Improvement of Health Care Systems: From Diagnosis to Care to System-Level Decision Making	**Chair: Jing Li** Teresa Wu, Douglas Montgomery, Todd Schwedi	Binghamton University
Song, Yaozhong Fall 2018	An Approach to QoS-Based Task Distribution in Edge Computing Networks for IoT Applications	**Chair: Steve Yau** Hessam Sarjoughian, Dijiang Huang, Yanchao Zhang	Door Dash
Tuncali, Cumhur Erkan Spring 2019	Search Based Test Generation for Automated Driving Systems: From Perception to Control Logic	**Chair: Georgios Fainekos** Aviral Shrivastava , Heni Ben Amor, Jim Kapinsky	Amazon
Wang, Kun Spring 2018	Design of Mining of Health Information Systems for Process and Patient Care Improvement	**Chair: Jing Li** Rong Pan, Theresa Wu , Christine Zwart	Tencent America LLC
Wang, Suhang Summer 2018	Network Representation Learning in Social Media	**Chair: Huan Liu** Hanghang Tong, Charu Aggarwal, Arunabha Sen	Pennsylvania State University
Wang, Yi Spring 2019	Reasoning and Learning with Probabilistic Answer Set Programming	**Chair: Joohyung Lee** Subbarao Kambhampati, Chitta Baral, Siddharth Srivastava, Sriraam Natarajan	Autodesk
Wang, Yilin Summer 2018	Social Media as Sensors: Understanding Human Sentiment via Social Media Images	**Chair: Baoxin Li** Huan Liu, Yi Chang, Hanghang Tong	Adobe
Wu, Liang Spring 2019	Misinformation Detection on Social Media	**Chair: Huan Liu** Hanghang Tong, Adam Doupé, Brian Davidson	Airbnb
Yildirim, Mehmet Yigit Spring 2019	Cost-Sensitive Selective Classification and its Applications to Online Fraud Management	**Chair: Hasan Davulcu** Dijiang Huang, Sharon Hsiao, Bertan Bakkaloglu	Emailage Corp
Yoon, Hyunsoo Fall 2018	New Statistical Transfer Learning Models for Healthcare Applications	**Chair: Jing Li** Teresa Wu, Hao Yan, Leland Hu	Arizona State University
Zhou, Chenyang Spring 2019	Design, Analysis and Computation in Wireless and Optical Networks	**Chair: Arunabha Sen** Guoliang Xue, Andrea Richa, Krzysztof Walkowiak	IRubrik Inc.
Zhou, Xu Fall 2018	Towards Addressing Key Visual Processing Challenges in Social Media Computing	**Chair: Baoxin Li** Hasan Davulcu, Yezhou Yang, Sharon Hsiao	Amazon
Zohrevandi, Mohsen Summer 2018	Improving Desktop System Security Using Compartmentalization	**Chair: Rida Bazzi** Gail-Joon Ahn, Adam Doupé, Ming Zhao	Fortanix

Computer science Degrees offered: BS, MS, MCS, PhD

The Master of Computer Science (MCS) program is offered at the Tempe campus and online.

Our programs in computer science focus on the design of computers and computational processes for problem-solving and information transfer and transformation with an emphasis on security, performance and usability. The curriculum supports the integration of computer and information sciences with engineering, science and other disciplines.

Computer engineering/Computer systems engineering (computer science)

Degrees offered: BSE, MS, PhD

Our computer systems engineering programs are concerned with the analysis, design and evaluation of computer systems, both hardware and software. This field of study not only focuses on how computer systems work, but also how they address emerging complex societal, health, security and sustainability problems.

Engineering management Degrees offered: BSE

Tempe campus and online

Our engineering management program is designed to provide graduates with the competencies for effective management and leadership of engineering-driven enterprises. The curriculum provides a breadth of engineering science and design with depth in one specific engineering area suitable for practice.

Industrial engineering Degrees offered: BSE, MS, PhD

Our industrial engineering programs concentrate on the design, operation and improvement of the systems required to meet societal needs for products and services. The curriculum combines knowledge from the physical, mathematical and social sciences to help design efficient manufacturing and service systems that integrate people, equipment and information.

Informatics Degrees offered: BSE

Our informatics program prepares skilled professionals with a transdisciplinary, user-oriented perspective toward information and computing systems to apply current informatics methods to address society's needs. The discipline of informatics makes connections between the work people do and the technology that can support that work.

Robotics and autonomous systems (artificial intelligence) Degrees offered: MS

This interdisciplinary program focuses on in-depth theoretical knowledge and practical experience in the development and control of robotic platforms and autonomous systems. The artificial intelligence concentration facilitates the study of "intelligent agents" through in-depth courses on the algorithmic aspects of robotics.

Software engineering Degrees offered: BS, MS

Polytechnic campus and online

Our software engineering programs blend engineering, computing, project leadership and software construction. Students engineer software solutions in application areas such as web applications, mobile systems, embedded systems, or graphics and game development.

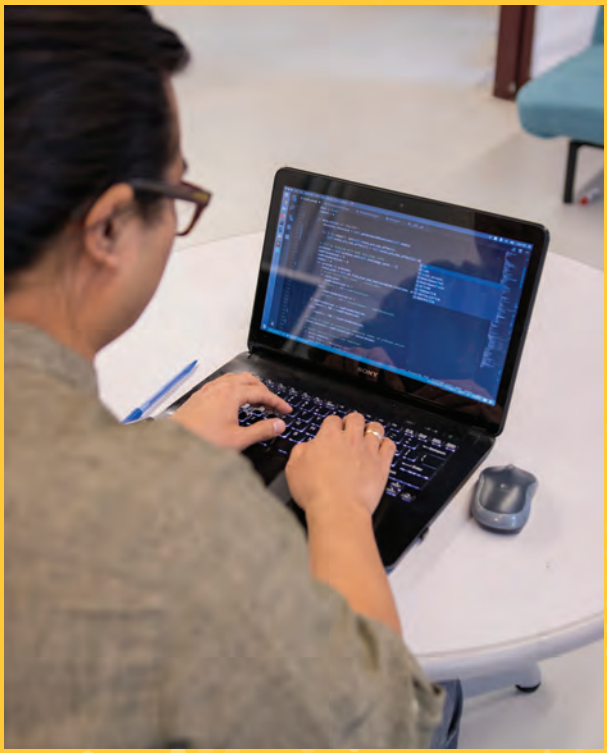
New master's program focuses on robotics and autonomous systems

The age of robotics and autonomous systems is upon us. These emerging technologies have the potential to increase the efficiency, productivity and safety of humans through manufacturing, transportation, aerospace, defense, health care and many other critical fields.

Within the last five years, these fields have seen tremendous growth. Despite the growth, industry and academia are in pressing need of qualified personnel to continue pursuing advancements in robotics and autonomous systems to positively affect people, the planet and future generations.

As people will interact more and more with intelligent machines in their everyday lives, the need for engineers who understand how to design, build and control the intelligent machines is becoming greater. The new program will overcome the current shortage of qualified personnel with a curriculum that spans the breadth of knowledge needed to create the next generation of technologies.

This new graduate program is among fewer than 10 in the country specialized in the field of robotics and autonomous systems. Students will gain in-depth theoretical knowledge and practical experience working across engineering specialties — such as mechanical systems, electrical systems, computation and intelligence — to develop and control robotic platforms and autonomous systems geared toward improving quality of life for all. ❖



ASU partners with Coursera to launch online master of computer science

The online master of computer science degree will help prepare a highly technical, highly competent global workforce for emerging technology careers at a time when information is expanding at a higher rate than ever before. Offering courses in foundations, systems and applications of computer science, the program will focus on four key competency areas: artificial intelligence and machine learning, cybersecurity, big data systems and software engineering.

The master of computer science has been offered at ASU for more than 20 years. The program's strong body of faculty, students and graduates have gone on to work for top domestic and international tech companies. Marking the first time ASU has hosted a degree program on a fully open-scale platform, thousands of students around the world will be able to access ASU's rigorous computer science education through courses and course content optimized for the Coursera platform.

The online master of computer science program is designed for students with undergraduate degrees in computing or related areas who seek a deeper understanding of computing fundamentals as well as practical experience through real-world projects. The program is 100% online, giving students flexibility to learn at their own pace and meeting their educational goals without disrupting their career. The average student will take 18 to 36 months to complete the degree program. ❖

The team of computer science and software engineering interns and program managers at the Starbucks Technology Center.

Serving digital innovation one cup at a time

For a team of 10 ASU students, an internship at the new Starbucks Technology Center is considerably more than becoming a connoisseur of coffee.

It means an opportunity to get hands-on, real-world experience at one of the country's top tech enterprises, now a leading force in digital engagement, providing consumers with seamless rewards, ordering and payment platforms supported by a state-of-the-art, enterprise-level "back end" that keeps it all running smoothly.

The ASU students worked as teams in three technology areas: information security, application development and business intelligence.

Information security

The information security team built a dashboard that details vulnerability across a range of systems, enabling data to be sorted by department rollup to determine instances of risk for specific teams, or the organization as a whole.

Application development

The interns supporting digital products worked on a variety of support projects for the Starbucks iOS app. A major project included improving the customer search function to return a more relevant list of items.

Business intelligence

The business intelligence team worked on adding and improving artificial intelligence and machine learning models across a variety of projects. This included wait time analysis predictions, outside temperature correlation to drink orders, and a chatbot interface that allows both customers and baristas to improve their experiences.

The teams participated in the Starbucks Innovation Expo Hack Day project — one of a series of events in which Starbucks Innovation Technology partners can create and demonstrate concepts that improve the partner-customer experience. The interns built an app add-on feature that will allow customers to collect "You are Here" digital mugs when they make purchases in different cities, ultimately redeeming them for a physical mug. This project, one of 13 company-wide, won the Best Customer Facing Project Award. ❖

Engineers and clinicians study headaches from traumatic brain injuries

Just a year after its launch, the ASU-Mayo Center for Innovative Imaging is off to a galloping start.

In its first 12 months, AMCII has reported 21 grant proposals in process, with nearly a quarter of them funded and more than half pending.

The funded projects include a $10 million grant from the Department of Defense to investigate persistent headaches following mild traumatic brain injuries.

AMCII is a collaboration between CIDSE researchers and faculty from the department of radiology at Mayo Clinic Arizona. Professor Teresa Wu says the relationship began when she started working with Rahmi Oklu of the Mayo Clinic to find ways to track patient radiation doses.

AMCII focuses its research on three overarching questions: how to use big data to achieve precision medicine, how to deliver effective, cost-efficient services to patients, and how to impact clinical practice with research findings.

Advanced imaging provides a large amount of data for each patient, enabling physicians and engineers to apply data analytics to their inquiries. There are many research centers based in clinical settings, but AMCII is among the first to partner engineering researchers with clinicians.

Traumatic brain injury is common in both civilian and military populations. In civilians, the injuries tend to occur during sports activities, falls or accidents, while mild TBI has been called the "signature wound" of the recent conflicts in the Middle East.

Wu and Associate Professor Jing Li will investigate post-traumatic headache for the Department of Defense. Other AMCII projects are funded by NIH and NSF. ❖

Associate Professor Rene Villalobos recently earned a nearly $1 million grant from the Foundation for Food and Agriculture Research to develop tools to help small farmers reduce food waste and efficiently meet customer demand.

Going FFAR with agricultural research

More than half of all produce goes to waste in the U.S., whether it is wasted before it even reaches consumers or after being purchased.

To help remedy the inefficient food production and delivery system, the Foundation for Food and Agriculture Research has awarded a $963,513 grant to ASU researchers to develop tools to help small farmers reduce food waste and more aptly meet consumer demand.

"I am excited to accept this grant on behalf of the research teams at Arizona State University, New Mexico State University and the several small businesses and grassroots organizations we are working with on this effort," says Rene Villalobos, the project lead and an associate professor of industrial engineering.

Villalobos and his research team are collaborating with researchers from New Mexico State University and several local Arizona businesses, including Local First Arizona, Stern Produce and Duncan Family Farms, to implement supply chain planning principles in local food production.

The research team is not only developing tools based on mathematical modeling of the market to enhance supply chain planning, but will also educate growers on how to use these tools to better anticipate consumer needs.

This information will help farmers minimize losses by not over-producing food and delivering it in a timely manner. These tools will enable growers to more successfully compete in emerging markets, including produce channels currently led by companies such as Amazon Fresh, Instacart and Walmart Grocery. ❖

iLux Lab amplifying positive impact

Can exercise improve your thinking abilities? An ASU lab aims to find out.

The experiments, part of the partnership that ASU has forged with adidas to explore the future of sport, are being done in the iLux Lab, which stands for "Innovative Learner and User Experience."

Robert Atkinson, an associate professor, leads the lab, which has a comprehensive biometric sensor suite that includes EEG, brain computer interface, eye tracking, facial coding and galvanic skin response. The researchers can measure a person's physical responses to different kinds of stimuli.

The work at iLux Lab is part of the adidas and ASU Global Sport Alliance, a strategic partnership aimed at shaping the future of sport and amplifying sport's positive impact on society. The partnership will bring together education, athletics and research to explore topics including race, sustainability and human potential.

Atkinson's team is now conducting two experiments to measure cognitive effects related to exercise. The ongoing experiments are using two groups of students, one that exercises regularly and one that doesn't. The exercisers were asked to skip their workouts for a few days, take a battery of tests, and then resume exercising and return to the lab within two hours to retake the tests.

Early results indicate that exercise has a significant impact on social and emotional intelligence. That may mean that before a big presentation or important meeting you may be better off going for a run than cramming or rehearsing a few more times.

The research projects conducted so far between adidas' Consumer Behavior Lab and ASU's iLux lab are just the beginning of planned research collaborations between adidas and ASU. Targeted areas of exploration include sport performance, consumer experience and product design. ❖

New ASU center helps secure the nation

Every day, the U.S. Department of Homeland Security faces complex challenges to ensure a safe, secure and resilient nation, from enhancing domestic defense to facilitating lawful travel across borders.

To help fulfill the department's national security mission, the homeland security enterprise's Science and Technology Directorate chose Arizona State University to lead the Center for Accelerating Operational Efficiency, one of nine DHS S&T Centers of Excellence.

Over the past year, the center has been conducting groundbreaking research to improve efficiency and security at national borders, seaports and airports by using multidisciplinary, customer-driven and practical solutions.

Improving efficiency at TSA checkpoints

When heading to the airport, most people dread going through Transportation Security Administration screenings. The challenge of keeping airports and flights safe has resulted in unpredictable wait times for passengers and constantly changing guidelines for screenings of passenger belongings. To raise passenger satisfaction and reduce wait times without compromising security, researchers are developing a decision-support tool to simulate and visualize TSA security screening checkpoint operations with ever-changing passenger demands.

"The problem is they never know exactly who is going to be coming to the airport and when they're going to come," says industrial engineering professor Ronald Askin. "Flight schedules are always changing so there's a constant flux of passengers arriving and going through security."

The decision-support tool will consist of three interacting modules: a passenger arrivals estimator, a multi-lane, multi-server dynamic queue analyzer and a transportation security officer scheduler. The tool is expected to benefit up to 900 million passengers per year by reducing wait times for passengers at U.S. airports.

Securing the border

U.S. Customs and Border Protection is a federal law enforcement agency of the homeland security enterprise tasked with the challenge of securing the nation's air, land and sea borders. On an average day, the agency welcomes nearly one million international travelers, inspects more than 67,000 cargo containers and confiscates nearly four to six tons of illicit drugs.

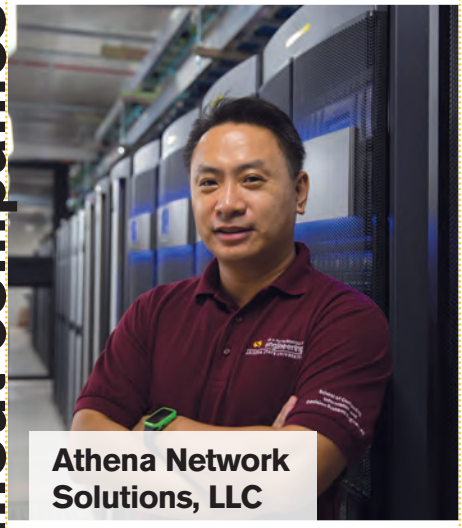
The agency also facilitates lawful travel between ports of entry. To help detect, deter and disrupt illegal passage into the country more efficiently, researchers are creating a simulation toolkit to identify probable pathways individuals might take to cross national borders.

The Center for Accelerating Operational Efficiency's strength in security research allows it to bridge the gap between academic research and agency needs to develop advanced tools that will improve operations in the homeland security enterprise.

The underlying technology is based upon the same modeling and algorithm approach Google Maps uses to get people from a point of origin to a destination. It's known as Dijkstra's algorithm, a mathematical graph theory for finding the shortest paths between nodes in a graph.

Each station or sector can change the modeling criteria and build its own customized profile for how individuals in a particular environment may act based on their knowledge of the border-area landscape, prior apprehension locations, sensor and security camera positions. ❖

Spinout companies



Athena Network Solutions, LLC

Founded by Dijiang Huang, Associate professor

Providing a hands-on Virtual Laboratory (VLab) service for E-learning

CYR3CON

Founded by Paulo Shakarian, Assistant professor

Specializing in identifying cyber-threats in the earliest stages.

Hoolest Performance Technologies

Co-founded by recent graduate Sami Mian, who holds a BSE computer systems engineering, BS in computational mathematical sciences and MS in computer engineering.

Developing non-invasive vagus nerve stimulation for anxiety treatment.

VeTeAS, LLC

Founded by Georgios Fainekos, Associate professor

Checking robustness of cyberphysical systems and assisting in system design.

The School of Computing, Informatics, and Decision Systems Engineering contributed seven patents in 2018, helping propel ASU into the top 10 worldwide for U.S. patents. These patents push the envelope of innovation — launching new startup companies, attracting venture funding and bringing vast economic benefits to the state of Arizona. "Dedication to entrepreneurially minded research is one of the pillars of our school," says Professor and School Director Sandeep Gupta, "It is through such patents that we are able to shine a light on our outstanding faculty as they work to move their inventions into commercial application."

CIDSE PATENTS

Method of Obfuscating Digital Logic Circuits Using Threshold Voltage
Joseph Davis, **Aykut Dengi,** Niranjan Kulkarni, **Sarma Vrudhula**
Patent #9,876,503

Method and Apparatus for Video Interpretation of Carotid Intima-Media Thickness
Jianming Liang, **Jae Shin,** Nima Tajbakhsh
Patent #9,924,924

Kidney Glomeruli Measurement Systems and Methods
Teresa Wu, Min Zhang
Patent #10,045,728

Real-Time Diet Assessment Using Thermal Image of Food and Gesture Analysis
Ayan Banerjee, Sandeep Gupta
Patent #10,074,028

Neuromorphic Computational System(s) Using Resistive Synaptic Devices
Yu Cao, Jae-sun Seo, **Sarma Vrudhula,** Shimeng Yu
Patent #9,934,463

Systems and Methods for Authenticating a User Through an Unobservable Re-Authentication System
Lingjun Li, **Guoliang Xue,** Xinxin Zhao
#Patent 9,996,803

Systems and Methods for Sustainable Self-Cooling of Central Processing Unit Thermal Hot Spots Using Thermoelectric Materials
Soochan Lee, Patrick Phelan, **Carole-Jean Wu**
#Patent 10,162,394

See **CIDSE's 37 available technologies** for licensing!

Above, beyond and always moving us forward, our staff contributions to the school are invaluable. Thank you for your efficiency, integrity and always getting things done.

Ellie **Ahmann**
Academic Success Specialist, Graduate

Betsy **Allen**
Student Support Specialist

Sharon **Amundson**
Business Operations Specialist

Stephen **Andrade**
Student Services Coordinator Associate

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Research Advancement Administrator, Sr.

Bulent **Bicer**
Program Manager, ATIC Staff

Susan **Borgers**
Manager, Academic Advising

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Student Services Coordinator, Sr.

Kassy **Buck**
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Academic Financial Specialist

Lisa **Christian**
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Abigail **Colquhoun**
Office Specialist

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Pamela **Dunn**
Dept. HR Specialist Sr.

Cherisse **Frizzel**
Academic Success Advisor

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Araxi **Hovhannessian**
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Arzuhan **Kavak**
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Executive Administrative Support Specialist

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Systems Support Analyst

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Academic Success Specialist

Blanca **Loera de Avilez**
Academic Success Advising Coordinator

Vanessa **Lucero**
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Academic Success Advisor Coordinator Sr.

Angie **Mondragon**
HR Specialist

Mark **Morales**
Research Advancement Manager

Beverly **Naig**
Assistant Director, Business Services

Denise **Odom**
Academic Success Coordinator

Rebekah **Padden**
Research Advancement Specialist

Tristan **Parker**
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Academic Success Advisor Sr.

Lindsey **Randolph**
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Greg **Raney**
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Program Coordinator

Shawn **Rudnick**
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Bernie **Sadauskas**
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Mayumi **Sato**
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Christina **Sebring**
Academic Success Advisor Coordinator Sr.

Ana **Sifuentes**
Academic Success Advisor

Segrid **Simms**
Academic Success Advisor

Lincoln **Slade**
IT Manager

Deborah **Smith**
Academic Success Advisor Coordinator Sr.

Yvette **Smith**
Academic Success Advisor Coordinator Sr.

Denise **Spisak**
HR Specialist

Peter **Templeton**
Systems Support Analyst Sr. (IT)

Tammarra **Walden**
Academic Success Specialist

Yang **Wen**
Research Advancement Administrator

Lynn **Whitby**
Research Advancement Pre-Award Manager

Christi **White**
Research Advancement Administrator, Sr.

IMPACT awards

2018 Mentoring
Ria Hermann

2018 Performance
Deborah Smith

2019 Performance
Leah Miller

2019 Teamwork
Computer Engineering Advising Team (CIDSE and ECEE)
Jamie Cluff
Allison Curran
Arzuhan Kavak
Sno Kleespies
Jaya Krishnamurthy
Toni Mengert
Lynn Pratte
Christina Sebring

The team (left to right)
Lincoln Slade, Facilities/IT manager

Peter Templeton, Windows management and Infrastructure

Nicholas Beck, Safety and lab oversight, Engineer Associate

Marc Shireman, Linux management

Brint MacMillan, Data center and the team's "MacGyver"

Fred Kreller, MacOS management

Better call Lincoln

Since 2016, the Facilities and IT team has closed more than 6,000 tickets from more than 100 faculty, 75 staff as well as more than 500 research and teaching assistants positions each semester. How does one team keep up? It all starts with Lincoln Slade, the team's manager.

"I rely on the team. We provide diverse support for one of the largest schools within ASU with roughly 7,600 students and our double-digit growth keeps us on our toes," he says.

The newest mission for this team is managing the ASU's Drone Studio, the largest indoor drone research lab in academia.

What was your first IT job?

Marc: I was a student worker for the IT Help Desk at the college I attended. I've worked in IT for higher education for more than 13 years.

Nick: This is my first real IT job! I previously worked as a product support engineer for a local company that manufactured physical therapy equipment. I have more than a decade of experience repairing various types of equipment, resolving software issues and providing customer support.

What is something that you thought you knew about IT support and later found out you were wrong about?

Brint: I used to think that we would be taking care of computers and servers. But now we seem to take care of all items that use electricity or the network.

How do you predict IT support will change in the future?

Fred: I think mobile computing is going to dominate the technology realm. We just have to look at the proliferation of smartphones and mobile devices in the last several years to see this trend in full effect.

What is it like to run IT support for the people who are driving the way computers and technology are used in society? Does it make things easier or harder?

Lincoln: I would say it is both exciting and challenging at the same time. Many times we are trying to create the wheel for something that doesn't exist yet or is in its infancy. We are always looking for ways to better support our researchers to accomplish more.

What's the best part about working for CIDSE?

Peter: In order to accomplish goals within budgets and time constraints we always have to be innovative. Lincoln's given us a lot of room to come up with inventive solutions for our school's specialized needs.

Fred: We are a pretty tight-knit community in spite of our size. Also, personally I am given lots of opportunities to learn something new and grow in ways I had never really thought about. I would not have believed you if you told me a year ago that I would be a Mac manager! ❖

Learn more about ASU's drone studio.
Scan the QR code or visit engineering.asu.edu/drone

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