

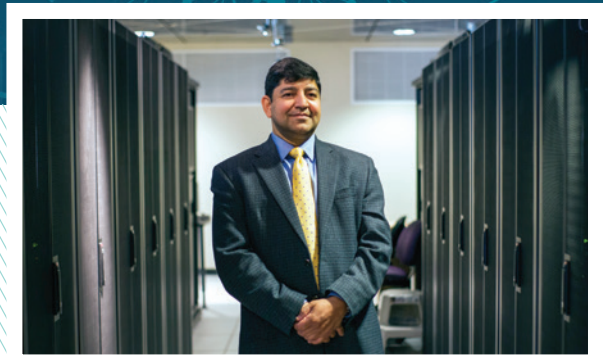


**2017-2018**  
**ANNUAL**  
**REPORT**

**PURDUE**  
UNIVERSITY

Department of  
Computer Science  
COLLEGE OF SCIENCE

# FROM THE DEPARTMENT HEAD



**IT REMAINS A THRILLING TIME TO BE A PART OF COMPUTER SCIENCE.** Demand for the major continues to grow – once again, we broke the record for number of applications for freshman admissions: we had more than 4,500 applications for this year. Each year, we receive 500-1,000 more applications than the last.

The quality of incoming students is at an all-time high, and our graduates continue to be in great demand. This year, our population of female students increased. I'm pleased to report that women will make up 25% of our freshman class.

## LEADERSHIP TRANSITION

I have been extremely fortunate to have had the honor of leading Purdue's CS department since September 2010. It has been an exhilarating experience and a transformative period for the department.

On July 1, 2018, I stepped down from my role as department head in order to assume the role of **Inaugural Director of Purdue's Integrative Data Science Initiative** (IDSI). Announced by Purdue in April, the IDSI focuses on applying data science research to pressing fundamental issues while establishing an educational ecosystem of data fluency to prepare students for the rapidly expanding future of a data-driven, knowledge economy. As I assume this new role, I will remain involved in the Department

of Computer Science as a faculty member.

**Professor Susanne Hambrusch** has agreed to serve as **interim head** of the Department of Computer Science. We will conduct a national search for a new department head.

Over the past seven years, the department has witnessed numerous firsts beyond the record-breaking enrollments, including: the best-prepared students ever; becoming the most selective major on campus; becoming the largest major on campus; introduction of a differential fee; two endowed professorships and five term professorships; a new major in data science; a new professional MS program; an online MS degree; an online MOOC for high school

students; the highest level of externally funded projects; a Sloan Fellowship; a TA training program; a summer internship program; and finally, numerous student support programs including the summer Bridge program, and the differentiated Black-Gold sections of CS 180.

I am extremely proud to have led this department through such a period of flourishing growth.

Sincerely,

**Sunil Prabhakar**  
Professor and Department Head

## SINCE 2010

The following departmental changes and accomplishments took place during Sunil Prabhakar's time as department head

**3x MORE UNDERGRADUATE STUDENTS**

**DEPARTMENT EXPANSION NAMED AS ONE OF 10 PURDUE MOVES**

**7 NEW PROFESSORSHIPS**

**2 EXPANSIONS TO THE DEPARTMENTAL BUDGET**

**NEW ONLINE MASTER'S DEGREE IN COMPUTER SCIENCE**

**CS 180 OFFERED ONLINE TO THE PUBLIC**

**NEW UNDERGRADUATE MAJOR IN DATA SCIENCE**

**5x MORE FEMALE STUDENTS ENROLLED**

**NEW PROFESSIONAL MASTER'S DEGREE IN INFORMATION SECURITY**

**BRIDGE SUMMER CODING COURSE FOR INCOMING FRESHMEN**

**CS 180 SEGMENTED BY EXPERIENCE LEVEL TO INCREASE RETENTION**

# INFORMATION SECURITY PROGRAM

Over the past few years, each of the top security conferences has consistently featured research from Purdue.

- » IEEE Symposium on Security and Privacy (S&P)
- » ACM Conference on Computer and Communications Security (CCS)
- » CRYPTO
- » USENIX Security Symposium (USENIX)
- » Networking and Distributed System Security Symposium (NDSS)
- » EUROCRYPT

## Security Highlights

The **Center for Education and Research in Information Assurance and Security (CERIAS)** is one of the world's leading centers for research and education information security. Unique among other national centers because of its multidisciplinary approach, CERIAS supports work in software and hardware security, security policy and ethics, risk management, computer crime, and information warfare.

### Information Security for Computing Professionals

(ISCP) Students graduate from this degree program ready to enter technical cybersecurity and privacy positions.

**Purdue's Capture the Flag team** meets weekly to learn new skills in system security, reverse engineering, cryptography and forensics.

## Areas of Specialization in Security

- » System Security
- » Cryptographic Research
- » (Database) Security and Privacy
- » Network Security and Privacy
- » Distributed Systems Security
- » Cryptocurrencies & Blockchain Technology

## Security Faculty Awards and Honors

### MIKHAIL ATALLAH

ACM CCS Test of Time Award

### GENE SPAFFORD and ELISA BERTINO

ACM SIGSAC Outstanding Contribution Award, Information Systems Security Association (ISSA) Hall of Fame

### DONGYAN XU and XIANGYU ZHANG

Best Paper Awards at USENIX Security '14, CCS '15, NDSS '16, and USENIX Security '17

### JEREMIAH BLOCKI

NSF CRII Award (2018)

### CHUNYI PENG

NSF CAREER Award (2018)

# CS researchers receive \$6 million to improve security for IoT devices

**A** research team at Purdue University has received a grant for \$6 million from the Office of Naval Research, a division of the United States Department of the Navy, to improve security of electronic devices in physical environments or industrial control systems. The research team consists of faculty members Dongyan Xu, Xiangyu Zhang, Mathias Payer and Byoungyoung Lee, and researchers at Intelligent Automation Inc.

Electronic devices are increasingly being produced with communication capability – everything from sensors to controllers. These devices communicate with each other, forming a network known as the Internet of Things (IoT). These “things” have their own localized communication patterns and use standard communication protocols to understand each other.

“It’s like a standard language that needs to be spoken by all the communicating devices,” said Xu. “There has been a lot of effort to standardize these protocols so that devices can communicate freely, but a side effect is that adversaries can also understand and speak the same language.”

Hackers can eavesdrop on or disrupt communications between devices by intercepting messages between endpoints. Electronic control units of a car, for example, need to communicate with each other for the vehicle to function properly. If a hacker was able to send malicious messages to the brakes, cruise control system or fuel sensors, the car could malfunction.

## CREATING DIALECTS FOR COMMUNITIES OF DEVICES

The team hopes that their research will make such attacks significantly harder to launch by creating dialects for “islands” of communicating devices.

“For example, an ‘island’ could be a vehicle or a power plant – some independent physical system – where its embedded devices communicate routinely amongst themselves, but less frequently to the outside world,” Xu said. “We want to create different dialects for each island, meaning that only the nodes or devices legitimately within the island could speak and understand that dialect.”

These dialects would still be based on the original, universally defined protocols. “A key research challenge,” said Professor Xiangyu Zhang, “is to formally define protocol mutation primitives and composition rules to make the dialects difficult for adversaries to understand, learn, and speak.”

## MINIMIZING VULNERABILITY BY REDUCING BLOAT

The research will also address the “bloat” in communication protocols. Protocols are sometimes implemented as a large and comprehensive program in order to accommodate a wide range of devices and functions.

“For a specific device, only a small portion of the protocol code will be used,” Xu said. “The rest, ironically, might be exploited by attackers.”

**Faculty members Dongyan Xu, Xiangyu Zhang, Mathias Payer and Byoungyoung Lee will create "dialects" for Internet of Things devices through a grant from the Office of Naval Research.**

The team aims to customize and minimize the portion of a protocol needed for a specific device. Not only would the protocol code be safer, but it would take up less space on devices with scarce memory.

“This work is addressing a problem that we’ve seen play out several times over the last two decades – new technologies are introduced by product designers who focus on building easy-to-use, feature-laden products, but overlook security principles. We often end up with useful products, but ones that leave us dealing with privacy gaps and security vulnerabilities in the future,” said Tomás Díaz de la Rubia, chief scientist and executive director of Purdue’s Discovery Park. “This IoT dialect research is showing that products do not have to lose capabilities or efficiency to uphold security for both the individual device as well as its interconnected system or network.”

The five-year project, entitled “IoT-D: Towards Internets of Dialect-Speaking Things,” was awarded through the Total Platform Cyber Protection program in the Office of Naval Research.

# INTEGRATIVE DATA SCIENCE INITIATIVE (IDSI)

Announced by Purdue in April, the Integrative Data Science Initiative focuses on applying data science research to pressing fundamental issues while establishing an educational ecosystem of data fluency to prepare students for the rapidly expanding future of a data-driven, knowledge economy. Sunil Prabhakar, professor and head of the computer science department, is leading this rapidly advancing initiative as the inaugural IDSI director.

## IDSI Projects

Purdue's IDSI called for faculty members to submit project proposals that use Purdue's research power to tackle socially relevant issues. More than 50 resulting project proposals explore data science questions at the nexus of health care, defense, ethics, society and algorithms. Eight projects were selected from this group. Seven computer science faculty members are involved with five of the eight accepted proposals, highlighting the centrality of computer science to the data science field.

### Causally-Driven Healthcare Science – From Observational and Experimental Studies to Personalized and Improved Patient Outcomes

**PI:** Elias Bareinboim (Computer Science)

**Co-PIs:** Pavlos Vlachos and Mohammad Adibuzzaman

### Quantum Machine Learning for Data Analytics and Optimization

**PI:** Sabre Kais

**Co-PIs:** Alex Pothén (Computer Science), Yong P. Chen and Muhammad A. Alam

### Formal Methods for Robust Machine Learning

**PI:** Jennifer Neville (Computer Science)

**Co-PIs:** Dan Goldwasser, Bruno Ribeiro, Roopsha Samanta and Tiark Rompf (all assistant professors in the Department of Computer Science)

### Blazing Fast Chemical Sensing

**PI:** Bruno Ribeiro (Computer Science)

**Co-PI:** Muhammad A. Alam

### A Relational-Based Measure of State Legislator Consequence

**PI:** Eric Waltenburg

**Co-PI:** Dan Goldwasser (Computer Science)

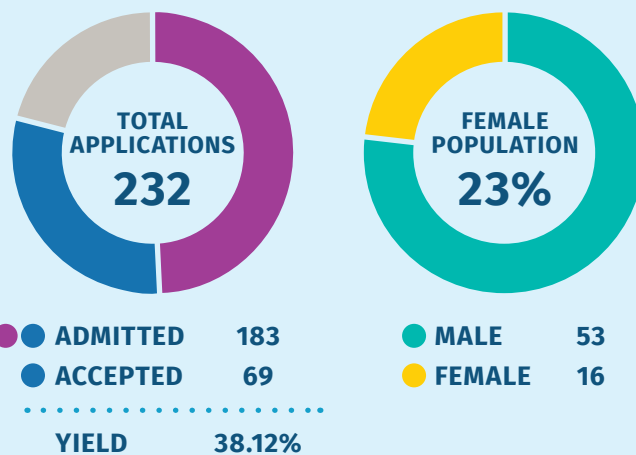


Assistant professor Bruno Ribeiro presents "Blazing Fast Chemical Sensing," one of eight accepted IDSI project proposals.

## DATA SCIENCE MAJOR

The new data science major admitted its first cohort of 69 directly admitted students. These students will join the 19 students that moved into this major last year, as well as 17 dual-major/CODO students who were just accepted into the major. The program is off to an excellent start.

### Data Science Enrollment



# Atallah wins Purdue's highest research honor

**M**ikhail Atallah, distinguished professor of computer science, has been chosen as the 2017 Arden L. Bement Jr. Award recipient. One of Purdue University's top three research honors, the Bement Award is the most prestigious award the university bestows in pure and applied science and engineering. Atallah is being honored for his significant contributions in the design and implementation of efficient processing and security protections for computer-based technologies.

"Dr. Atallah's world-renowned work in algorithms, access hierarchies and information security combines deep theoretical approaches with solutions-based efficient designs to address the most challenging computer processing and security issues," said Suresh Garimella, Purdue's executive vice president for research and partnerships, in announcing the winner. "His highly creative and innovative ideas and fresh viewpoints have had a major impact on the fields of distributed computing and cyber security."

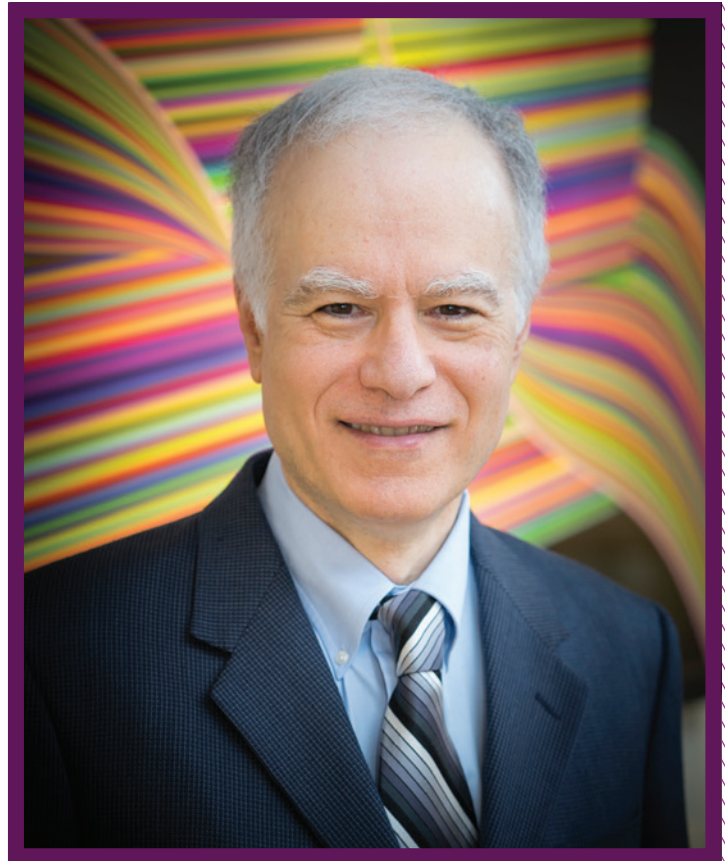
Atallah settled longstanding open problems in data structuring for range-minimum queries and in data filtering with running-max filters. He designed an influential and award-winning technique for key management in access hierarchies and developed a divide-and-conquer technique to parallelize sequential algorithms, resulting in numerous optimal algorithms for solving complex geometric

and combinatorial problems.

He also co-founded Arxan Technologies Inc., to commercialize a software protection technology, developed jointly with his doctoral student, Hoi Chang. Used in more than 500 million computing devices today, the technology consists of injecting self-protective mechanisms in software that make it harder to hack.

The Arden L. Bement Jr. Award was

established in 2015 by Purdue professor emeritus Arden Bement and his wife, Mrs. Louise Bement. The Bement Award recognizes Purdue faculty for outstanding and widely recognized contributions in the areas of pure and applied science and engineering. Winners of the Bement Award are nominated by colleagues, recommended by a faculty committee and named by the university president.



# Algorithm leads to discovery of new melanoma subtypes



DAVID GLEICH



ANANTH GRAMA

Cells have traditionally been categorized into different types, such as T-cells and B-cells, based on observable features. But new research from the Department of Computer Science shows cells are far more complex.

Faculty members Ananth Grama and David Gleich and graduate students Shahin Mohammadi and Vikram Ravindra created an algorithm called ACTION to group cells based on their primary function and pinpoint the genes responsible for those functions. They also discovered a new subtype of melanoma, a form of skin cancer, which could lead to opportunities for more personalized therapies. Their work was recently published in Nature Communications.

“We can interpret cells as types, but we should really think of them in terms of their functions,” said Gleich. “They’re not all purely one type. For example, our measurements can tell us if a cell is performing 80 percent one function and 20 percent another.”

Not only is there variation in tasks performed by individual cells in one region, but cells also behave differently in different scenarios. Cells behave differently around a tumor than they would other places in the body, Gleich said. This information can be measured with high-resolution gene expression readings of individual cells.

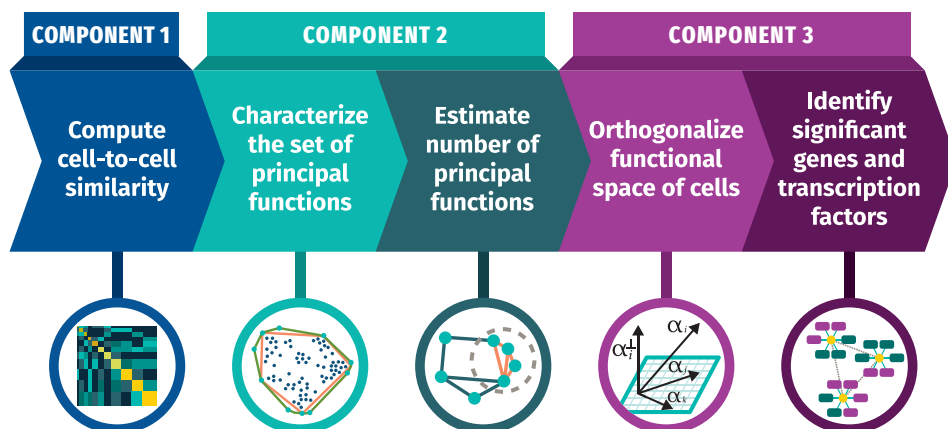
The ACTION framework helps break down this information and fully characterize the functional profile of

a cell. It has three major components: identifying the functional identity of cells, classifying them based on their dominant function, and reconstructing regulatory networks responsible for mediating their identity.

The newly uncovered subtypes of melanoma have different survival rates and therapeutic responses than standard melanoma. Factors that mediate cell function and switches that turn functions on and off were identified for these new subtypes, providing new biomarkers and potentially targets for future drugs.

“Our understanding of how human biology works is continuously evolving, and every time we get access to more refined data, we need new methods to help us refine our understanding,” Gleich said. “Using a program like ACTION, we could acquire a functional landscape of cells for each person, which would allow us to do micro-targeting and really embrace the idea of precision medicine.”

Funding was provided by the National Science Foundation and the Center for Science of Information, the DARPA SIMPLEX Program, the Sloan Foundation and the National Institutes of Health.



# New technology lets surveillance cameras “talk” to you through your smartphone



▲ New research from Assistant Professor He Wang and Ph.D. student Siyuan Cao allows public cameras (like grocery store security cameras) to send personalized messages (like coupons) to individuals without compromising their privacy. Governments could also use this technology to alert distracted pedestrians to the approach of an oncoming car.

**H**e Wang (assistant professor in the Department of Computer Science) and Ph.D. student Siyuan Cao have created a technology that allows public cameras to send personalized messages to people without compromising their privacy.

The system they developed to allow this process – known as private human addressing – is called PHADE. Although traditional data transmission protocols need to first learn the destination’s IP or MAC address, PHADE uses motion patterns as the address code for communication. The smartphones then make their own decisions on whether to accept a message.

“Our technology enables public cameras to send customized messages to targets without any prior registration,” said Wang. “Our system serves as a bridge to connect surveillance cameras and people and protects targets’ privacy.”

PHADE protects privacy in two key ways – it keeps the users’ personal sensing data within their smartphones and it

transforms the raw features of the data to blur partial details. The creators named the system PHADE because the blurring process “fades” people’s motion details out.

PHADE can be used in places such as at a museum, where visitors can receive messages with information about the artifacts or exhibits they are viewing. The technology also could be implemented in shopping malls to provide consumers with digital product information or coupons. In a similar way, PHADE could be valuable for new store prototypes such as Amazon Go, which uses phone technology instead of traditional checkout registers.

“PHADE may also be used by government agencies to enhance public safety,” Cao said. “For example, the government can deploy cameras in high-crime or high-accident areas and warn specific users about potential threats, such as suspicious followers.”

Wang said surveillance camera and security companies would also be able to

integrate the technology into their products directly as a key feature. He also said this technology has advantages over Bluetooth-based beacons, which have difficulties in adjusting for ranges of transmission and do not allow for context-aware messaging.

PHADE uses a server to receive video streams from cameras to track people. The camera builds a packet by linking a message to the address code and broadcasts the packet. Upon receiving the packet, a mobile device of each of the targets uses sensors to extract its owner’s behavior and follow the same transformation to derive a second address code. If the second address code matches with the address code in the message, the mobile device automatically delivers the message to its owner.

The work appears in the June issue of **Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT)**, a premier journal for research relevant to the post-PC era, and will be presented during a conference in October in Singapore.



# FACULTY AWARDS

## WALID AREF

Professor of Computer Science



Named a **2017 Fellow of the Institute of Electronic and Electrical Engineers (IEEE)**.

## MIKHAIL ATALLAH

Distinguished Professor of Computer Science



Received the **2017 Arden L. Bement Award**, the most prestigious award the university bestows in pure and applied science and engineering.

## ELIAS BAREINBOIM

Assistant Professor of Computer Science



Received the **NSF CAREER Award** and the **IBM Open Collaborative Award**.

## ELISA BERTINO

Samuel Conte Professor of Computer Science



Elected to the **Information Systems Security Association (ISSA) Hall of Fame**. Her paper was named **Best Paper at the ACM Conference on Data and Application Security and Privacy (CODASPY 2017)**.

## JEREMIAH BLOCKI

Assistant Professor of Computer Science



Received an **NSF CRII Grant**.

## CHRIS CLIFTON

Professor of Computer Science



Recognized as a **distinguished member of the Association for Computing Machinery (ACM)**.

## BEN DELAWARE

Assistant Professor of Computer Science



Received an **NSF CRII Grant**.

## DAVID GLEICH

Jyoti and Aditya Mathur Associate Professor of Computer Science



Won the **2018 SIAM Outstanding Paper Prize**.

## ANANTH GRAMA

Samuel Conte Professor of Computer Science



Received the **College of Science Research Award**.

## SUSANNE HAMBRUSCH

Professor of Computer Science



Named as a **member of the board** and as **vice chair of the Computing Research Association**.

## NINGHUI LI

Professor of Computer Science



Won the **2017 Test of Time (10-Year Award)** at the **IEEE International Conference on Data Engineering (ICDE)**.

## CHUNYI PENG

Assistant Professor of Computer Science



Received an **NSF CAREER Award**. She received the **Best Community Paper Award at ACM MobiCom 2017**.

## ALEX POTHEN

Professor of Computer Science



Named a **Fellow of the Society for Industrial and Applied Mathematics (SIAM)**.

## TIARK ROMPF

Assistant Professor of Computer Science



Received the **U.S. Department of Energy Early Career Achievement Award** and **Google's Faculty Research Award**.

## GENE SPAFFORD

Professor of Computer Science



Received the **Quora Best Writer (2018) Award**.



## DONGYAN XU & XIANGYU ZHANG

Professors of Computer Science

Received a **Distinguished Paper Award** at the **USENIX Security Symposium 2017**.

## PROMOTIONS AND NAMED PROFESSORSHIPS



### David Gleich

was named the **Jyoti and Aditya Mathur** associate professor of computer science.



### Elena Grigorescu

was promoted to associate professor.



### Suresh Jagannathan

was named the **Samuel Conte Professor** of Computer Science.

# 2017-2018 FACULTY

## COMPUTATIONAL SCIENCE & ENGINEERING



Petros Drineas



David Gleich



Ananth Grama



Alex Pothen

## DATABASES & DATA MINING



Walid Aref



Bharat Bhargava



Chris Clifton



Sunil Prabhakar

## THEORY OF COMPUTING & ALGORITHMS



Saugata Basu



Simina Branzei



Elena Grigorescu



Susanne  
Hambrusch



Wojciech  
Szpankowski

## BIOINFORMATICS & COMPUTATIONAL BIOLOGY

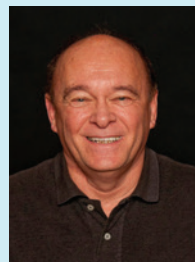


Daisuke Kihara



Majid Kazemian

## SOFTWARE ENGINEERING



Buster Dunsmore



Aditya Mathur



Vernon Rego

# 2017-2018 FACULTY

## INFORMATION SECURITY & ASSURANCE



Mikhail Atallah



Elisa Bertino



Jeremiah Blocki



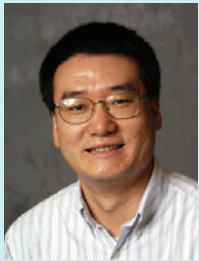
Christina Garman



Aniket Kate



Byoungyoung Lee



Ninghui Li



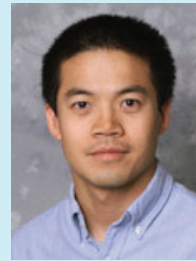
Hemanta Maji



Eugene Spafford



Samuel Wagstaff



Dongyan Xu

## MACHINE LEARNING & ARTIFICIAL INTELLIGENCE



Elias Bareinboim



Dan Goldwasser



Jean Honorio



Jennifer Neville



Bruno Ribeiro

## NETWORKING & OPERATING SYSTEMS



Doug Comer



Sonia Fahmy



Kihong Park



Mathias Payer



Chunyi Peng



He Wang

# 2017-2018 FACULTY

## PROGRAMMING LANGUAGES & COMPILERS



Ben Delaware



Suresh  
Jagannathan



Zhiyuan Li



Tiark Rompf



Roopsha Samanta



Xiangyu Zhang

## GRAPHICS & VISUALIZATION



Daniel Aliaga



Christoph  
Hoffmann



Elisha Sacks



Xavier Tricoche



Voicu Popescu

## PROFESSORS OF PRACTICE



George Adams



Gustavo  
Rodriguez-Rivera



Jeff Turkstra

## NEW FACULTY



Pedro Fonseca  
Assistant Professor



Yexiang Xue  
Assistant Professor



Ming Yin  
Assistant Professor

# 2017 OUTSTANDING ALUMNI



Left to right: Outstanding Alumnus Max Bogue, Department Head Sunil Prabhakar, Outstanding Alumna Shahani Markus and Shahani's mother, Manel Markus.

## Max Bogue

Max Bogue (BS '04) is the co-founder and CEO of WobbleWorks, the maker of the 3Doodler.

Max launched the 3D printing pen industry in 2013 when he launched the 3Doodler on Kickstarter. He wanted to design a 3D printing device that could be used within minutes, without needing any technical knowledge, software or computers. He also wanted it to be affordable and fun.

The 3Doodler lets you literally draw in the air – whether freestyle 3D sketching or

tracing shapes to make larger structures and objects.

Today, the 3Doodler is available in 64 countries. The 3Doodler Kickstarter project remains one of the top 10 most-funded technology projects ever.

Before founding WobbleWorks, Max worked in R&D for robotic toy company WowWee, where he launched Rovio, a robotic webcam — with wi-fi — on wheels, as well as other robots and toys. He later served as the CTO of Handy Robotics, a consumer robotics startup.



## Shahani Markus

Shahani Markus is an IT entrepreneur with a professional career that spans the IT industry, government and academia.

She is the founder, chair and CEO of Emojot. Emojot helps businesses understand and improve their customer interactions in real-time by capturing customer perceptions through emojis.

It enables conversations with client segments across a multitude of scenarios, ranging from events and reality TV shows to political campaigns and news programs.

Shahani was the Founding CTO and President of Auxenta. She also served as head of engineering at Virtusa Sri Lanka. At Virtusa, she led more than 600 IT professionals, with overall responsibility for software development and software

quality assurance practices. Among many other roles, she has also worked in e-government for the country of Sri Lanka, where she served as de facto CTO.

In the humanitarian arena, Shahani was a pioneer and architect of the initial version of Sahana – the world's first open source disaster management system. Shahani has more than 50 academic publications.

She received her bachelor's, master's and Ph.D. from Purdue.



# 2018 DISTINGUISHED ALUMNUS

## Alan Hevner

**S**ince 1994, Alan Hevner has been on the faculty of the University of South Florida. In 2017, he was named Distinguished University Professor. He also holds the Citigroup/Hidden River Chair of Distributed Technology.

### RESEARCH

His areas of research interest include design science research, information systems development, software engineering, distributed database systems, healthcare systems, and Internet of Things computing.

He has published more than 200 research papers on these topics, and his work has been cited more than 18,000 times.

### DESIGN SCIENCE

One of his major areas of interest is design science research, which seeks to increase the capabilities of humans and organizations through new and innovative creations. He has co-authored a book on the topic, and has co-created a conceptual framework with guidelines for understanding, executing, and evaluating the research.

He has presented numerous seminars internationally on the topic. In 2006, he co-founded an international conference, Design Science Research in Information Systems and Technology (DESRIST). He is a recipient of the Design Science Research Lifetime Achievement Award.



▲ Faculty members Walter Gautschi, Buster Dunsmore, and Susanne Hambrusch with Distinguished Alumnus Alan Hevner.

### HONORS

Alan is a fellow of the American Association for the Advancement of Science (AAAS) and a fellow of the Association for Information Systems (AIS). He was inducted into the Purdue University ROTC Hall of Fame in 2001 and in 2017, he was named a Parnas Fellow at Lero, the Irish software research center. He was also named a Schoeller Senior Fellow at Friedrich Alexander University in Germany.

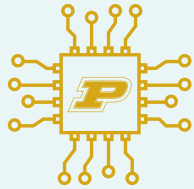
### PURDUE

Alan earned his bachelor's degree, master's degree and Ph.D. from Purdue in computer science between 1969 and

1979. As an undergraduate, he was a dual major in computer science and math. After graduating, he spent two years in the military before returning to Purdue to complete the doctoral program in Computer Science.

He has previously held faculty positions at the University of Maryland and the University of Minnesota. He was a program manager at the National Science Foundation from 2006 to 2009 in the Computer and Information Science and Engineering (CISE) Directorate. He is an active tennis player and he and his wife, Cindy, enjoy traveling.

# BY THE NUMBERS



**WORLD'S OLDEST EXISTING CS DEPARTMENT**



**PROGRAM RANKING #20**



**90% UNDERGRAD RETENTION**



**80% GRADUATION RATE**



**500-1,000 MORE APPLICATIONS EACH YEAR**



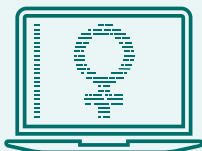
**4,500+ APPLICATIONS FOR FALL 2018**



**132% GROWTH IN UNDERGRAD POPULATION SINCE FALL 2012**



**FEMALE FACULTY DOUBLED SINCE 2012**



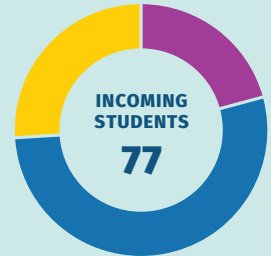
**FROM 9-10% INCOMING FRESHMEN WOMEN TO 25% INCOMING FRESHMEN WOMEN IN THE PAST FOUR YEARS**

## GRADUATE STUDENTS

FALL 2018



● MS 1,157  
● PhD 445



● MS 16  
● PhD 41  
● Professional MS (ISCP) 20

## UNDERGRADUATE STUDENTS

FALL 2018



## UNDERGRADUATE TRACK POPULATION

FALL 2018



● Computational Science and Engineering	15
● Computer Graphics and Visualization	41
● Database and Information Systems	53
● Foundations of Computer Science	11
● Machine Intelligence	309
● Programming Language	21
● Security	156
● Software Engineering	455
● Systems Programming	69

\*tracks begin after students complete CS core courses



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COLLEGE OF SCIENCE

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Computer Science Building  
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West Lafayette, IN 47907

**284% GROWTH**  
IN THE NUMBER OF FEMALE  
**COMPUTER SCIENCE MAJORS**  
AT PURDUE SINCE 2012



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