



Donald Bren School of  
Information & Computer Sciences

A topographic map of California, showing elevation with a color gradient from light green (low elevation) to brown and white (high elevation). Numerous small red dots are scattered across the state, with a higher concentration in the Central Valley and Sierra Nevada regions. The map is set against a light blue background representing the ocean.

**2017 YEAR IN REVIEW**

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## ON THE COVER

Burned areas (in red) shown over land cover types from NASA MODIS satellite data from Alaskan fires in 2015. To explore the question of how best to allocate resources for wildfire breakouts such as this, a cross-discipline research team advised by Chancellor's Professor of Earth System Science Jim Randerson and Computer Science Professor Padhraic Smyth is working to improve fire prediction in the boreal forests of Alaska. Part of the Machine Learning and Physical Sciences (MAPS) program, a new NSF-funded initiative at UCI that sponsors collaborations between the School of Physical Sciences and ICS, the research team incorporates large datasets on weather patterns, vegetation and topography to model fire spread and growth in real time. This research carries immediate implications for resource management, decision-making and public health in Alaska.

## 2017 YEAR IN REVIEW

The Year in Review is published annually in the fall by the Donald Bren School of Information and Computer Sciences' Office of Communications.

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Almost 50 years since its founding as a department and 15 years since its establishment as an independent school, the Donald Bren School of Information and Computer Sciences at UC Irvine continues on a path of unprecedented growth.

As of fall 2017, undergraduate enrollment exceeds 3,000 students, more than doubling within five years. Our computer science major is one of the five largest programs on campus, and our data science major is the fastest-growing program in the school with an incoming cohort of about 70 students. Graduate enrollment exceeds 600 students, with our professional master's programs in computer science and human-computer interaction and design enrolling close to 150 new students.

Despite their rapid growth, our programs are more selective than ever and continue enrolling exceptional students, with five of them receiving National Science Foundation Graduate Fellowships in academic year 2016-17.

**“The pages of this 2017 Year in Review are filled with stories that highlight our strategic priorities in the areas of data science, cybersecurity, health, and digital media and learning, as well as our continued commitment to diversity and community engagement.”**

Mirroring student growth, our faculty has grown to record levels, with the number of tenured/tenure-track faculty and lecturers in the school surpassing 95 in fall 2017. Hiring in the departments of computer science and statistics has emphasized the broader space of data science, leveraging the school's traditional strengths in machine learning to expand in the areas of data integration, information extraction, natural language processing, Bayesian modeling and nonparametric Bayesian methods. Informatics has been investing in the space of digital media and learning, advancing a new area of excellence for the school.

The pages of this 2017 Year in Review are filled with stories that highlight our strategic priorities in the areas of data science, cybersecurity, health, digital media and learning, as well as our continued commitment to diversity and community engagement. They showcase the groundbreaking work of our faculty, students and alumni who continue to lead in the exploration of computing technologies and the ways in which they revolutionize the world around us.

As always, I welcome your thoughts, feedback and insights as we continue on this tremendous path of growth, and I look forward to bringing our ICS community together to celebrate our 50th anniversary in 2018.

Marios C. Papaefthymiou

*Professor of Computer Science*

*Ted and Janice Smith Family Foundation Dean*



The Department of Statistics continues to grow, expecting to add up to five new faculty members in the next two years.

## The Future of Data Science

Interdisciplinary collaboration has been fundamental to the continued growth of both the Department of Statistics and the Data Science Initiative at UCI.

In just two years, the new undergraduate data science program, housed in the Donald Bren School of Information and Computer Sciences, has grown from five to 116 students. Part of the reason for this growth is an emerging understanding of what data science is here at UCI, where statistics and computer science are at its core. As Dan Gillen, professor and chair of the Department of Statistics, explains, “Everybody has a different definition of what data science is. ... We’re pretty unique at UCI in that statistics, computer science and informatics lie within the same school, and we have a very strong machine learning and artificial intelligence subset of the faculty within computer science that ties us all together.”

According to Gillen, people often try to “piece together their own data science curriculum through electives.” For example, he majored in math and overloaded on courses in both computer science and statistics. But he says the beauty of UCI’s data science program is that it has faculty and researchers who are in the field, know exactly what’s important and have developed a specialized program specifically for undergraduates. As the program website notes, the curriculum “teaches students how to utilize their knowledge of statistical and computing principles to analyze and solve real-world data analysis problems.”

In the near future, UCI plans to offer a professional master’s degree in data science. Gillen is currently putting together a committee to develop the proposal. He views UCI as being uniquely positioned to offer such a program because of its prime location; given the amount of industry around for this type of degree; and because informatics, computer science and statistics all reside in the same school. Gillen expects the program to fill a gap by providing a “higher-level combination of computer science and statistics as a well-defined degree.”

### A SOLID FOUNDATION

In fact, interdisciplinary collaboration is fundamental to statistics, which Gillen explains “has always been a field where you’re developing it as a core discipline, but you’re also developing it in order to apply it to other areas.” To support this goal, the Department of Statistics is growing. It recently added two new faculty members and plans to add another four to five in the next two years. “We want to hire both in the core foundations of statistics, but then also hire faculty who can speak to the computer science and data science communities to cross collaborate with individuals,” says Gillen. Both new hires in the statistics department meet this requirement.

“The way science moves now is not in a silo. You need to have collaborative scientific endeavors in order to make real progress.” —DAN GILLEN

Professor Bin Nan, who joined the statistics faculty in September 2017, focuses on developing methodology in the fields of survival analysis and longitudinal data analysis. He then applies this work to health-related problems — in particular, Alzheimer’s disease, cancer and HIV. Professor Vladimir Minin, who joined the statistics faculty in July 2017, is an expert in stochastic modeling in the areas of disease modeling and biogenetics. Well-known in the field of Bayesian statistics, Minin has strong ties in evolutionary biology and biological systems.

“The way science moves now is not in a silo,” says Gillen. “You need to have collaborative scientific endeavors in order to make real progress.”

### THE DATA SCIENCE INITIATIVE

An important part of this push for collaboration is UCI’s Data Science Initiative ([datascience.uci.edu](http://datascience.uci.edu)), which started three years ago to “spur synergy with other disciplines,” according to Gillen. The initiative now envelopes one- to two-day training “boot camp” sessions — short courses on topics such as data analysis software and predictive modeling — as well as competitions such as the Climate Science Hackathon that took place in April 2017.

The Data Science Initiative also catalyzes large multi-investigator grants related to data science. As part of this effort, UCI is receiving \$2.9 million under the National Science Foundation Research Traineeship (NRT) program. The grant was awarded in fall 2016 to a team led by Computer Science Professor Padhraic Smyth, director of the UCI Data Science Initiative,

and includes Chancellor’s Professor of Computer Science Pierre Baldi, Chancellor’s Professor of Earth System Science Jim Randerson, Assistant Professor of Organization and Management Maritza Salazar Campo, and Associate Professor of Physics and Astronomy Daniel Whiteson.

The goal is to offer integrative training for graduate students studying data science and physical science, bringing together researchers from UCI, national laboratories and the private sector with expertise in the emerging field of the “Science of Team Science,” which is building the evidence base for how to conduct, manage and support effective and efficient team-based research. In this way, the Data Science Initiative is not only training ICS graduate students, but also helping students in other scientific fields, including physical science, political science and econometrics “learn more about the quantitative methodologies they’re likely to apply and how to interpret them,” says Gillen.

Currently, the Data Science Initiative is in the process of becoming a campuswide institute, reflecting an elevated and multiyear commitment from ICS and UCI. With participation from multiple schools, the Data Science Institute will serve as the locus for cross-disciplinary data-driven research, enabling large-scale projects that bring together “big data” experts from ICS with domain experts in the life sciences, physical sciences, social sciences and engineering to address grand challenges related to health and the environment and expand the frontier of scientific knowledge. The Data Science Institute is also expected to engage industry as a key partner and serve as a powerful tool for recruiting outstanding new faculty and students to our campus.

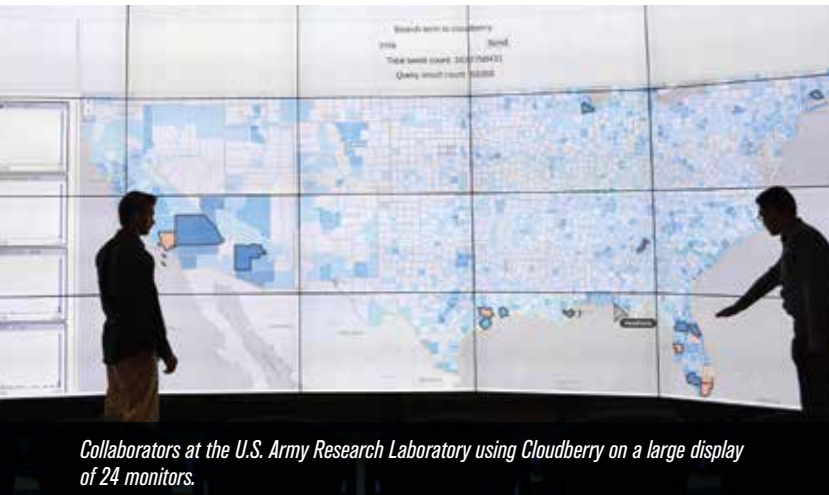


The Data Science Initiative hosted a Climate Science Hackathon in April that brought together 40 students from different backgrounds to investigate topics related to earth system science.

# Analyzing and Visualizing 1 Billion Tweets Using Cloudberry

Cloudberry is a general-purpose software solution that supports real-time analytics on big data sets to produce a unique way of visualizing and interpreting the data. It has been used by researchers from UCI and UCLA to analyze more than 1 billion tweets to conduct multidisciplinary research related to various topics, including Zika, HIV, climate change, authoritarianism, hurricanes and the recent Las Vegas shooting.

UCI Computer Science Professor Chen Li first conceived the idea while watching election results roll in back in 2012. Li took particular notice



Collaborators at the U.S. Army Research Laboratory using Cloudberry on a large display of 24 monitors.

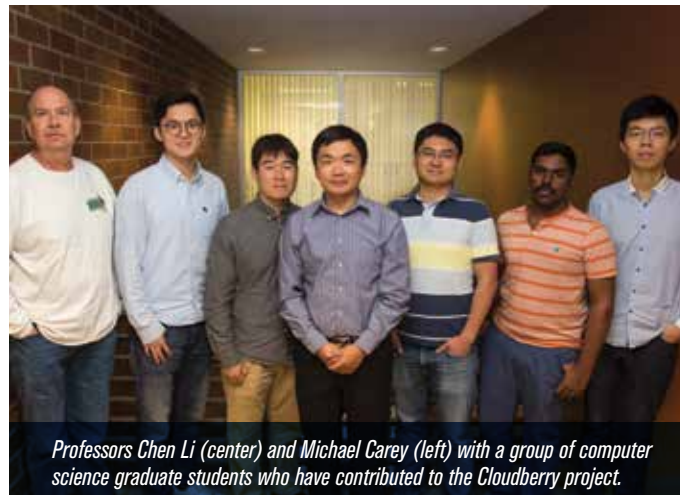
of the way news agencies displayed real-time data on a simple binary red-and-blue U.S. map.

"I wanted to develop a system that not only allows for interactive analysis and visualization on any user-specified topics, but that would also offer numerous ways to comprehend the data," says Li.

He then worked to create Cloudberry, building it on top of Apache AsterixDB, a scalable big data management system he started co-developing in 2009 with fellow UCI Computer Science Professor Michael Carey and contributors from UCI, UC Riverside and other organizations. Using AsterixDB as the back-end database system, Li's team finalized the Cloudberry platform in 2015 with support from the National Science Foundation, National Institutes of Health and the U.S. Army Research Laboratory. Computer Science Ph.D. students Jianfeng Jia, Taewoo Kim and Te-Yu Chen have been lead contributors on the project.

"Our scalable solution supports parallel computing, which is very suitable for big data settings," says Li. "At present, we have five machines with limited computing power in a minicluster, but if we needed to analyze more data, we could simply add more hardware. That is the beauty of our parallel solution."

As a way of demonstrating the power of Cloudberry, the team built a live demo called TwitterMap using tweets collected since November 2015. From the user perspective, TwitterMap is a simple interactive U.S. map



Professors Chen Li (center) and Michael Carey (left) with a group of computer science graduate students who have contributed to the Cloudberry project.

with a live display of the number of tweets it is tracking — to date, more than 1 billion tweets. Using the search function, users can instantly view updates with colors representing the number of tweets per state related to a keyword. To dive deeper, users can click on a specific state to see the number of tweets per county or even per city. TwitterMap also has a menu bar that lets users see a sampling of hashtags used for the keyword and sample tweets.

This is just one example of what's possible. Researchers could, for example, use Cloudberry to visualize cell-phone generated data, such as signal strengths and app usage. As Li explains, "The system works for many other domains." Researchers in a variety of fields could exploit this software to analyze big data in novel ways.

*For more information on Cloudberry and to test out the TwitterMap demo, visit [cloudberry.ics.uci.edu](http://cloudberry.ics.uci.edu).*

# Making Powerful Discoveries

Statistics Professor Hernando Ombao collaborates with researchers around the world on time-series analysis and the emerging area of neurostatistics.

Hernando Ombao's research on time-series analysis is motivated by studies on brain signals. At UCI, he and his students in the Space-Time Modeling Group collaborate with neuroscientists on campus to understand changes in brain functionality and connectivity following an induced stroke in rats, during a learning experiment in rats and in humans as they watch a movie. He collaborates with various neuroscience

researchers on campus, including Norbert Fortin and Ron Frostig in neurobiology and Steven Cramer and Steven Small in neurology. All of his research contains the common thread of collaboration — Ombao has the ability not just to use data and mathematical sciences to generate advances in neuroscience, but also to bring researchers with different areas of expertise together to make powerful discoveries.

Currently, Ombao is working on two active three-year grants on time-series analysis funded by the National Science Foundation (NSF). The first, funded by the Division of Mathematical Sciences, involves developing methods to summarize high-dimensional signals and model the evolution of these signals over time. These methods are being used to investigate changes in brain responses over the course of a learning experiment. The second, awarded by the Division of Social and Economic Sciences, focuses on developing new models for studying the relationship between brain signals and animal behavior. In this project, Ombao and collaborators identify features from brain signals that could predict behavior and decision-making. In addition to making statistical contributions, Ombao and his group aim to make a scientific impact by developing software that implements their novel methods.



Hernando Ombao with, from left to right, current Ph.D. student Duy Ngo, and former students Yuxiao Wang (now with Google) and Zhe Yu (now with Apple).

Ombao co-founded the joint UC Irvine/UC Santa Cruz Space Time Modeling Group with Raquel Prado. "Dr. Prado and I have had a joint NSF-funded grant for six years or so now," Ombao says. "This allows for shared resources between campuses; students have the benefit of working with faculty in both groups with different expertise." The Space-Time Modeling Group has expanded its borders to include collaborators from the University of Minnesota, Rice University and fellow researchers in Malaysia, Mexico, the UK and Belgium.

The emerging area of neurostatistics deals with challenges, including computation due to massive data size; the inherent complexity of brain processes; and the integration of data from various modalities such as genetics, economics, clinical and behavioral. At UCI, Ombao collaborates with Statistics Professor Babak Shahbaba on the computational aspects of modeling such complex data. With Statistics Professor Zhaoxia Yu, he is developing new models that integrate genetics with brain physiology and behavior. Ombao also greatly enjoys working with such "hard-working and highly motivated" students, most of whom have won awards in student paper competitions in statistics and biostatistics.

*For more information on Ombao's research, visit [hombao.ics.uci.edu/hernando.html](http://hombao.ics.uci.edu/hernando.html).*

# Ensuring Cybersecurity Through Interdisciplinary Efforts

UCI's Cybersecurity Policy & Research Institute launches new initiatives to address cyber threats.

Launched in August 2016, UCI's Cybersecurity Policy and Research Institute (CPRI, [cpri.uci.edu](http://cpri.uci.edu)) is an interdisciplinary effort that unites academia, a broad range of critical infrastructure businesses, law enforcement and other government agencies, and the privacy and civil liberties community in a unified effort to combat cyber threats. It hopes to accomplish this by tackling four areas: research, training and education, community outreach, and policy analysis and development.

"Incorporating all relevant perspectives, world-class expertise and shared knowledge, CPRI is building consensus around cybersecurity solutions at the intersection of technology, law and policy," says CPRI Executive Director Bryan Cunningham, a cybersecurity and privacy lawyer who is also a former deputy legal adviser to the White House National Security Council.

Pulling together more than 80 participants, CPRI is generating comprehensive technical and policy-driven strategies to address cybersecurity's technical, legal, policy and human challenges. CPRI is under the guidance of the deans of the six UCI founding schools — ICS,

law, engineering, physical sciences, social sciences and social ecology — as well as a faculty advisory council. The institute is also supported and advised by a committee with leaders from organizations such as Qualcomm, Rockwell Collins, Verizon, Cylance, the LAPD and IBM.

"The Donald Bren School, in particular, is one of our strongest supporters," says Cunningham. "They've provided me with access to the world-class cybersecurity faculty that we have here at ICS." These key faculty members include ICS Chancellor's Professors Michael Franz, Paul Dourish and Gene Tsudik, who are breaking new ground in security and privacy research.

In July, CPRI launched six initiatives to help combat vulnerabilities and attacks in cyberspace:



The first Cybersecurity Workforce 2020: An Employer-Student Dialogue event took place in October, connecting UCI students with cybersecurity professionals from organizations such as the CIA, the LAPD and Obsidian Security.

- ▶▶ **Cyber-Attack Attribution:** Investigating the feasibility of a holistic approach to cyber-attack attribution with the goal of enhancing the ability of government and private-sector actors to learn and prove the origin of such attacks, enabling better deterrence and justice for victims.
- ▶▶ **Supply-Chain Security:** Exploring the use of blockchain — a distributed virtual-ledger technology offering security, transparency, immutability and authenticity — to better secure software and other vital supply chains.
- ▶▶ **Enhanced Cyber Threat Information Sharing:** Working to improve the sharing of private-sector and government cyber threat information.
- ▶▶ **Law Enforcement Training:** Working with the UCI Division of Continuing Education and premier Southern California law enforcement agencies to support cybersecurity and digital evidence handling training for police officers and, potentially, other participants in the criminal justice system.
- ▶▶ **Cyber Victims Defense Clinic:** Providing pro bono legal and technical assistance to victims of cyber attacks, while also helping prepare the next generation of cybersecurity-savvy lawyers.
- ▶▶ **Curriculum Development to Boost Future Cyber Experts:** Working with the Anaheim Union High School District, Santa Ana Unified School District, Cypress College and local experts to help develop cybersecurity curricula for high school students.



Executive Director of CPRI Bryan Cunningham (center) with cybersecurity professionals from Lawrence Livermore National Laboratory and First American Financial Corp. at the Cybersecurity Workforce 2020 event.

# Fighting for Net Neutrality

Computer Science Professor Scott Jordan discusses his time as chief technologist for the FCC.

In 2014, Computer Science Professor Scott Jordan was selected to serve as the chief technologist for the Federal Communications Commission ([bit.ly/ICSJordanFCC](http://bit.ly/ICSJordanFCC)). The chief technologist position is traditionally filled by a member of academia who serves for approximately two years, advising on issues across the FCC regarding the impact of technology on the FCC's work, including regulations related to telecommunications and the internet.

Jordan moved to Washington, D.C., for two years, where he worked full time at the FCC. One of the biggest issues he advised on was the development of net neutrality regulations. Wikipedia defines net neutrality as "the principle that internet service providers (ISPs) and

Most of Jordan's first year at the FCC was dedicated to helping the FCC create a new set of net neutrality regulations prohibiting ISPs from blocking, throttling or prioritizing traffic against consumer wishes ([bit.ly/ICSTheOpenInternet](http://bit.ly/ICSTheOpenInternet)). After the Open Internet Order ([bit.ly/ICSOpenOrder](http://bit.ly/ICSOpenOrder)) was issued in a majority vote in February 2015, the ISPs sued again. So the next part of Jordan's work was

**"The current FCC's attempt to repeal the Open Internet Order misconstrues both the architecture of the internet and the history of regulation of telecommunications."**

—SCOTT JORDAN

helping the attorneys at the FCC prepare the court case to defend the regulations. "The case was argued before the Court of Appeals for the D.C. Circuit in December 2015, and the FCC won on all counts in 2016," says Jordan.

Where does net neutrality stand today? The Open Internet Order passed with the three Democratic Commissioners supporting it and the two Republican Commissioners opposing it. However, a Republican FCC chairman was appointed by President Donald Trump earlier this year, and the new FCC has started the process of repealing much of the net neutrality regulations.

Jordan strongly opposes this effort and encourages the public to file their comments about an "open internet" with the FCC while the proposal is still out for public comment at [bit.ly/ICSInternetFreedom](http://bit.ly/ICSInternetFreedom). He says: "The current FCC's attempt to repeal the Open Internet Order misconstrues both the architecture of the internet and the history of regulation of telecommunications. If successful, it will remove the ability of the federal government to effectively curtail ISP practices that harm consumers."



Professor Scott Jordan advised on the development of net neutrality regulations while serving on the FCC.

governments regulating the internet must treat all data on the internet the same, not discriminating or charging differentially by user, content, website, platform, application, type of attached equipment or mode of communication."

According to Jordan: "The timing for me was really good. Net neutrality had been debated for the previous 10 years, and I had been doing research on it since 2006 when I spent time working in the U.S. Senate. The FCC had issued a set of regulations in 2010 attempting to give consumers control over how their internet traffic is treated by their ISPs. But the ISPs sued, and in early 2014 the Court struck down part of those regulations. So it was clear that the FCC would take up net neutrality again."

# Protecting Millions of Mobile Users Behind the Scenes

ICS cybersecurity startup Immutant has developed a suite of probabilistic defenses that automatically changes the attack surface of an application on every run while preserving peak performance and functionality.

A tiny computer security company has been working quietly at UCI Applied Innovation's The Cove to develop ways of protecting mobile systems against hackers. Immutant (*immutant.com*) builds specialized tools for

Immutant is commissioned mostly by large government agencies, including the Defense Advanced Research Projects Agency (DARPA), the National Science Foundation (NSF) and the Air Force Research Laboratory.

"The security community is small," Larsen says. "We had a strong relationship with DARPA. We happened upon other opportunities in the private sector."

## IMMUTANT PURSUES A NICHE STRATEGY

Immutant's founders characterize the company as "hyper-specialized." They have an unconventional business model. "We give away our software," Crane says. "A lot of our work product is released to the public as open-source software. Government contracting has been funding a substantial part of the research and development of the tools we have been building." Immutant's researchers have published

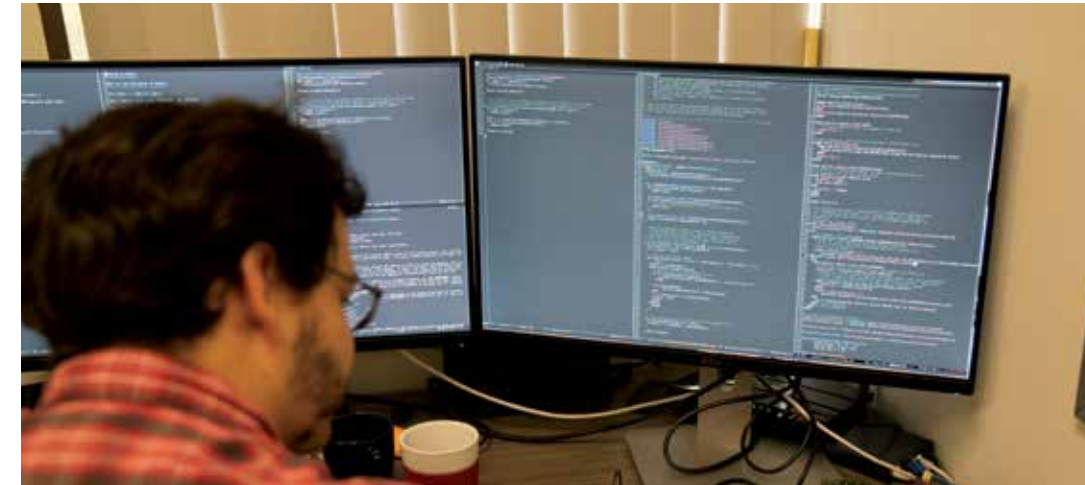
extensively on their security technology. However, any organization seeking to customize the company's security software to their particular organization will need custom integration.

"Our path out of research and into a startup was extremely gradual," Larsen recalls. At UCI, the Immutant co-founders developed a security platform and published multiple papers. Meanwhile, Larsen and Franz participated in the NSF-sponsored Innovation Corps (I-Corps) program, an intensive entrepreneurship boot camp to help academic scientists and engineers commercialize their research. I-Corps participants attend lectures and training, and have to make dozens of calls and meetings with potential customers to gain a clear understanding of the potential market for their inventions. In the course of months of market research, Larsen confirmed the company's strengths in this niche market.

"We are working on tools for the people who make software, not necessarily for consumers," Crane says. It is easier to insert these tools

developers. The company's software transforms the way code is compiled, linked and loaded by a host operating system. This three-person company's reputation in the security community belies its actual size. "Our industry is relationship-heavy," says Stephen Crane, Immutant's CTO. "We have built up credibility over years of collaborations. This is a premium advantage in a field with a huge amount of snake oil. A lot of companies promise more security than they can deliver on." Meanwhile, the tools Immutant is developing could improve system security for hundreds of millions of mobile network users by safeguarding the computers that act as the nodes of communications networks from hacking incursions.

Immutant was co-founded by three graduate and post-doctoral researchers at the Donald Bren School of Information and Computer Sciences: Per Larsen, Andrei Homescu and Crane. Their adviser, Chancellor's Professor of Computer Science Michael Franz, also has a stake in the startup.



## RESHUFFLING THE DECK TO KEEP HACKERS OFF BALANCE

"Ideally, you want to fix these bugs," Crane says. "We are putting in an automatic layer that makes it harder for a hacker to know how to exploit." Since finding and fixing individual bugs is currently very labor-intensive, Immutant is using a concept called fine-grained randomization to reshuffle the program representation inside

the computer. Crane uses the analogy of a bookshelf of encyclopedias filled with articles. While the location of the encyclopedias may be randomized, the contents of the encyclopedias are not.

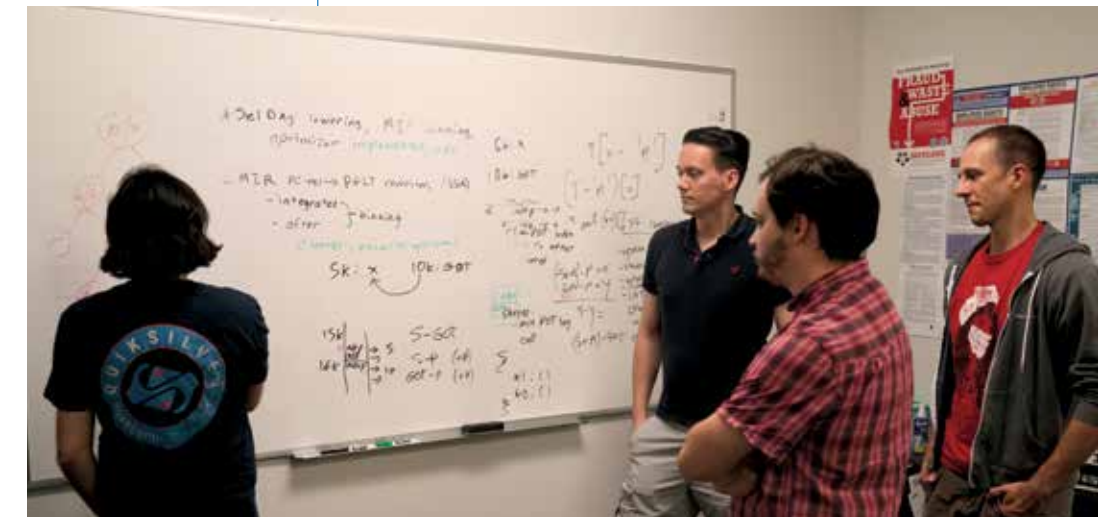
Immutant is going a step further by randomizing the internal structure of the encyclopedias, i.e., the individual articles. "Since a

when the software is being built, rather than having to retrofit it, according to Crane, who adds that DARPA and NSF are invested in the long-term success of the research they fund as their role is to foster innovation for public benefit.

## STRENGTHENING SECURITY FOR GOVERNMENT AND R&D CUSTOMERS

Immutant has developed a suite of probabilistic defenses that automatically changes the attack surface of an application on every run while preserving peak performance and functionality. "It goes back to the fact that a lot of modern software is buggy and unsafe," Larsen says. "There is a specific class of attack that modern software is vulnerable to called 'memory corruption.' An intruder can break in. We pursue a mitigation strategy that presents adversaries with a moving target."

System security has certain holes because of how computer operating systems evolved. Computers have become smaller, faster and more powerful over the years, but swathes of legacy software are still present in their operating systems. "We are still running code that was written in the '80s," Crane says. "For example, the code in Firefox descends from Mosaic, the first web browser." According to Crane, at this point most of the code has been rewritten, but in a piecemeal and partial fashion.



computer uses an index, it doesn't care where things are," Crane says. "If an attacker wants to use a particular piece of the software, but its placement is randomized every time, the attacker has to locate the relevant piece. This security layer is invisible to the end user, as it does not interfere with speed of processing. We are making it harder to attack, not impossible. Anybody who is selling you security and telling you it is impossible to hack is selling you snake oil."

*Story courtesy of Wendy Wolfson, UCI Applied Innovation*



The team behind Immutant (from left to right): Andrei Homescu, Per Larsen, Stephen Crane, Chancellor's Professor of Computer Science Michael Franz and Immutant's summer intern, Julian Lettner.

## Digital Do-Gooders

New Informatics Professors Constance Steinkuehler and Kurt Squire plan to take beneficial gaming to the next level.

Since moving to Irvine from Wisconsin, early this year, Constance Steinkuehler and Kurt Squire have found themselves spoiled for recreational choices. Do they and their two teenage sons take advantage of the Southern California climate and engage in outdoor activities, or do they stay home to battle “deathclaws,” feral ghouls and mole rats?

“We’ve been playing *Fallout 4* and spending a lot of time at the beach,” says Steinkuehler, a professor of informatics in UCI’s Donald Bren School of Information and Computer Sciences. “It’s a great juxtaposition to be

been internationally recognized researchers in the fields of technology and education for a decade and a half. Driven by the compelling, all-encompassing characteristics of modern computer games, they’ve come to UCI at a time when this relatively new form of entertainment has blossomed in terms of commercial appeal, cultural significance and academic interest.

“It does feel a lot like moving to the very heartbeat of where games are done,” says Steinkuehler, who has conducted in-depth studies on how games affect students’ reading, cognitive and quantitative abilities. “UCI

has a long-standing computer game science program that’s been successful, so coming here has been a way of vitalizing our own research.”

In contrast to media reports about isolated youths playing violent video games, Steinkuehler believes we’re in a “golden age” in which some of the most commercially successful releases have educational, social and cognitive benefits. She says the move to UCI is enabling her to shift focus from a narrow niche of educational technologies to a more expansive realm where many popular titles are also what she calls “games for impact.”

“These are games that are about more than just the high score,” Steinkuehler says. “In

high-tech on one end and on the other end have this incredible environment where you can go out and play.”

Steinkuehler and Squire, who most recently taught at the University of Wisconsin-Madison, know their stuff when it comes to video games. They’ve

in addition to providing entertainment, they get kids moving or help them learn history, geography or almost any subject you can imagine.”

Also a professor of informatics at UCI, Squire got his start in the field as a computer game journalist in the late 1990s. He’s on a quest to make the



New UCI Informatics Professors Constance Steinkuehler and Kurt Squire, internationally recognized educational gaming experts, believe they’re at the right place at the right time, when their field is experiencing a “golden age.” Photo courtesy of Steve Zylius (UCI)

“UCI has a long-standing computer game science program that’s been successful, so coming here has been a way of vitalizing our own research. ... The capacity we have here — given the number of faculty we have in one place and leadership that’s actually excited about the potential of games — is really a catalyst for a lot of what we’re doing.” —CONSTANCE STEINKUEHLER

“next generation of cutting-edge, breakthrough games that promote learning” and has trained hundreds of students in game design and software development. Many of his protégés have started their own companies.

A major goal for Squire now that he’s at UCI will be to explore new frontiers in virtual reality and mobile gaming.

“I think we’re very close to having interactions with virtual characters that are much more meaningful and much more about exploring relationships and ideas,” he says. “You’re also going to see a lot of games where you have some sense of where you are geographically. I think *Pokémon Go* was exciting in that it introduced an entire generation to that idea.”

The couple believe UCI is uniquely positioned as a hub of computer gaming activity. It encompasses several labs and centers focused on games research and education, including the Connected Learning Lab, the Institute for Virtual Environments and Computer Games, and the Transformative Play Lab.

The university was one of the earliest in the nation to offer a computer game science major; since being launched in 2011, it has grown into the largest such program in the United States. Graduates are often snapped up by local computer game behemoths such as Blizzard Entertainment, Amazon Game Studios and Riot Games.

UCI was also the first public university to establish an eSports scholarship and a video game training and tournament arena, which is home turf to a varsity *League of Legends* team. In addition to being a major draw for students from around the world (many have reported choosing UCI over other institutions because of its dominance in computer gaming), the arena serves as a data-rich laboratory in which Steinkuehler herself plans to explore the effects of electronic gaming on student life, attitudes toward the campus and academic outcomes.

When she and her husband are not teaming up to fight super mutants in the *Fallout 4* play space, they’ll be working together on various research projects at UCI, including one to develop wearable mindfulness technologies. “Think of it as a Fitbit for mental and emotional well-being,” Squire says. Another collaboration involves developing games to spur young students’ interest in science, technology, engineering and math.

“The capacity we have here — given the number of faculty we have in one place and leadership that’s actually excited about the potential of games — is really a catalyst for a lot of what we’re doing,” Steinkuehler says.

*Story courtesy of Brian Bell, UCI’s Strategic Communications & Public Affairs Office*

### STEINKUEHLER, SQUIRE NAMED HEVGA FELLOWS

Informatics Professors Constance Steinkuehler and Kurt Squire have been appointed Fellows of The Higher Education Video Game Alliance (HEVGA). Steinkuehler, who was recognized as a Founding Fellow and serves as president for the organization’s executive committee, and Squire were among 30 scholars inducted into HEVGA’s inaugural cohort of higher education game leaders. The HEVGA Fellows Program was established in 2017 to recognize senior scholars in the games domain who have made significant contributions to the field in design, theory or research. Fellows are peer-elected based on their outstanding contributions to games-based research and design, and are expected to serve as ambassadors for HEVGA.

# Leveling the Playing Field in Computing

Founding ICS Dean Debra Richardson works hard to bring diversity to ICS while shaping the next generation of computing technology.

Debra J. Richardson, founding dean of the Donald Bren School of Information and Computer Sciences, might be retired these days, but she's doubled down on her commitment to diversity in computing, which began

In 2007, 12 percent of ICS undergraduates were women. In 2016, that number rose to 25 percent, and this year's incoming freshman class is 30 percent female.

Richardson believes that for the percentage of women and underrepresented minorities in the ICS program to continue to rise, it's necessary to improve and increase K-12 computer science learning. To that end, she's currently working as the principal investigator on three grants to train K-12 teachers (in partnership with UCI's School of Education).

A \$1 million dollar grant from the National Science Foundation (NSF) supports the teaching of two high-quality computer science courses — "Exploring Computer Science" and "Computer Science Principles" (a new Advanced Placement course) — by preparing 100 Orange County in-service teachers to teach those courses.

The goal of spreading these courses

throughout the county is to broaden participation in computer science in high schools, specifically targeting lower socioeconomic and mostly Hispanic/Latino districts (though not solely limited to these demographics). The first cohort of teachers is currently going through the CS1C@OC program, which includes a four-course sequence of classes with continuing-education credits that Richardson's team is developing to satisfy California's new Computer Science Supplementary Authorization, which she worked with the Commission on Teacher Credentialing to establish.

For the second grant, funded by Google, Richardson is working with UCI's CalTeach program. Students who complete CalTeach graduate from UCI in four years with either a math or science degree along with

in 1995. She explains, "I walked into an ICS classroom of more than 100 students, looked around and didn't see more than five or six women, and thought, 'This has got to change.'" Soon thereafter, Richardson helped found the Women in Information and Computer Sciences club, which she continues to advise and is still going strong today. In the ensuing years, Richardson worked to create an environment in ICS classrooms that is more welcoming to women and other underrepresented minorities. She also helped create mentoring programs that support diversity, as well as award ceremonies that recognize and support young women with aspirations in computing. "Our goal is to get women through the door and keep them engaged," says Richardson. Her efforts have had measurable results.



Debra Richardson is the principal investigator on three grants that are providing computer science training for teachers.



## DR. RICHARDSON GOES TO WASHINGTON

In September 2016, Debra Richardson (pictured here in the Harry S. Truman Bowling Alley with actress Kerry Bishé) traveled to the White House for the first CSforAll Summit, a progress report on former President Barack Obama's call for greater resources and actions to encourage more students to learn about computing. Richardson heads UCI's CS1C@OC program, which was created with funding from the National Science Foundation to produce 100 well-trained computer science teachers in Orange County by 2020. UCI is offering teachers summer courses in computer science principles and instruction, and is working toward developing a hybrid professional learning community in which participants can share information and experiences to grow personally and professionally throughout the school year.

a teaching credential. The CalTeach-CS project is working to infuse computational thinking and computer science into the courses that the CalTeach students take to become middle or high school math or science teachers. The revised CalTeach courses explore how to bring computer science into the math and science courses taught at the elementary, middle and high school levels. During their studies, the CalTeach students complete 600 hours of field experience in middle school and high school classrooms, delivering lessons that involve computational thinking or computer science. "Google really sees,

follows: "We strive to develop effective instructional materials that will engage a larger and more diverse group of students in computational thinking, providing them with the exposure and knowledge to make choices to further pursue computer science. Engaging kids while they're young is the only chance we have to close the gap between skilled CS graduates and the jobs open to them."

For many people, retirement means more free time and relaxation. For Richardson, it means more time to help level the playing field in computing. "The end goal is a more diverse set of people creating the

**"Computing has become so pervasive to all aspects of our lives that we need broad perspectives brought to the table so that future technologies will meet everyone's needs." —DEBRA RICHARDSON**

and I agree, that the only way we will expose kids to enough real computer science knowledge is if new teachers are learning it in their own education programs, and are actually able to deliver it in the classroom," says Richardson.

A third grant, recently funded by the NSF, is to form a collaborative network of university and K-12 researchers and practitioners to promote computational thinking for students in third through fifth grades. The CONECTAR project is a partnership with the Orange County Department of Education and Santa Ana Unified School District, whose demographics include low-income, Hispanic/Latino and English language learners. Richardson summarizes the project's goals as

next generation of computing technology, whether that is software or hardware. Computing has become so pervasive to all aspects of our lives that we need broad perspectives brought to the table so that future technologies will meet everyone's needs," says Richardson. "The only way we can do that is by ensuring that the next generation of students is interested in and educated about computer science. We need a wide array of students ready to study computer science; for that, we need teachers who are able to engage all kinds of students. This will lead to a much more diverse population of students pursuing computer science and using computing in other fields."



# Faculty Highlights



## Gillen Furthers Healthcare Research With Two NIH Grants

**DAN GILLEN**, professor and chair of the Department of Statistics, recently collaborated on two multiple-principal investigator National Institutes of Health (NIH) grants. The first, "Neuroimaging Biomarkers for Cognitive Decline in Elderly with Amyloid Pathology," with Michael Yassa, associate professor and Chancellor's Fellow in UCI's Department of Neurobiology and Behavior, is a \$3.6 million grant that aims to develop and assess neuroimaging biomarkers for predicting cognitive decline. As co-PI, Gillen will develop novel statistical methods for predicting cognitive decline and will apply the work to subject data obtained as part of the grant. For the other grant, "The Study Partner Requirement in Preclinical Alzheimer's Disease Trials," Gillen serves as co-PI with Joshua Grill, associate professor of psychiatry and human behavior in the School of Medicine, focusing on the Food and Drug Administration's study-partner requirement for patients undergoing neuro-cognitive tests, which states that a partner of the patient (such as a spouse, child or caretaker) must also supply responses to the test. Using historical data from two large and well-known studies in Alzheimer's disease, Grill and Gillen aim to provide empirical evidence to either justify or refute the study-partner requirement by assessing how much additional information and accuracy is gained from the responses of study partners.

## Bietz Leads \$3 Million Project to Study Big Data Ethics

UCI is one of six institutions involved in a four-year Pervasive Data Ethics for Computational Research project, which recently received \$3 million from the National Science Foundation (NSF). Collaborators are from the University of Maryland, College Park; the University of Colorado, Boulder; the Data & Society Research Institute; Princeton University; and the University of Wisconsin, Milwaukee. UCI principal investigator **MATTHEW BIETZ**, assistant research professor in the Department of Informatics, will lead a team exploring how those who create pervasive data — through social media, fitness trackers, etc. — feel about it being used in research. The group will also focus on how vulnerable populations are affected. "Big data has the potential to transform our understanding of human behavior and health," says Bietz. "We want to ensure that this research is conducted ethically and in line with individuals' expectations."



## Three ICS Faculty Named AAAS Fellows

Bren Professor **RAMESH JAIN**, Statistics Professor **HAL STERN** and Chancellor's Professor of Computer Science **GENE TSUDI**K were named fellows of the American Association for the Advancement of Science (AAAS), the world's largest general scientific society, for 2017. Jain is noted for his contributions to the fields of computer vision, multimedia information management and experiential computing resulting in transforming the multimedia community with multiple successes in innovation and entrepreneurship. Stern is recognized for his high-impact contributions to statistical methodology, for development and application of Bayesian methods, and for high-leverage national service and university administration. Tsudik is noted for his contributions to security and privacy of the internet. They join five other ICS colleagues who have previously been named AAAS Fellows: Eric Mjolsness, Geoffrey Bowker, Pierre Baldi, Michael Goodrich and Jessica Utts.

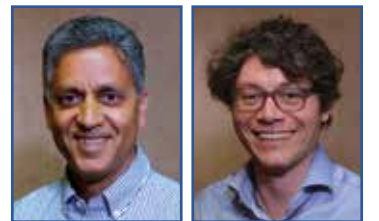


## Lopes Receives 2017 AITO Test of Time Award

Informatics Professor **CRISTINA LOPES**, interim director for UCI's Institute for Software Research, was honored with the 2017 Association Internationale pour les Technologies Objets (AITO) Test of Time Award in recognition of her enduring contributions to the fields of computer programming and software development. Lopes was recognized alongside co-authors Gregor Kiczales, John Lamping, Anurag Mendhekar, Chris Maeda, Jean-Marc Loingtier and John Irwin for their 1997 paper "Aspect-Oriented Programming" at the 31st European Conference on Object-Oriented Programming (ECOOP) that took place in June.

## Dutt, Levorato Awarded NSF Grant for Healthcare IoT Research

Chancellor's Professor of Computer Science **NIKIL DUTT** (left) and Assistant Professor of Computer Science **MARCO LEVORATO** have received a \$300,000 NSF research grant for designing a personalized ubiquitous healthcare framework using IoT. Dutt and Levorato are leading the research project "IoT-CARE: Internet of Cognitive Things for Personalized Healthcare" jointly with Finnish partners at the University of Turku, the Turku University Central Hospital and VTT Finland. The two-year project investigates a self-aware cognitive IoT architecture for ubiquitous health monitoring that can predict the early onset of critical health conditions such as heart attacks. The project is funded as part of the NSF Wireless Innovation between Finland and the U.S. (WiFiUS) program, which is jointly managed by the Academy of Finland and the NSF, and aims to expand research collaboration between Finland and the United States in new areas of wireless telecommunications research.



## Tsudik Awarded NSF Grant for IoT Security Research

The NSF has awarded Chancellor's Professor of Computer Science **GENE TSUDI**K a grant to conduct research in security of the emerging Internet of Things. Tsudik is the principal investigator of "SELIOT: Securing Lifecycle of IoT" — a research project funded by the WiFiUS program, which supports collaborations between U.S. and Finnish researchers in the area of wireless and mobile networks. The total grant amount is approximately \$600,000, with \$150,000 awarded to UCI. The Finnish portion of the project is funded separately by the Academy of Finland.



## Kobsa to Lead International Study on Household IoT Users' Privacy Decisions

Informatics Professor **ALFRED KOB**SA is part of an international team that received a \$900,000 grant in a joint competition of the NSF and the Netherlands Organisation for Scientific Research (NWO). The award will fund research on "Using Process Tracing to Improve Household IoT Users' Privacy Decisions," which will investigate how, why and when privacy decisions of household IoT users are suboptimal. The team will then use this research to create and test a simple single-user interface that integrates privacy settings across all household devices.

## Mark Elected to ACM CHI Academy for 2017

Informatics Professor **GLORIA MARK** has been elected to the 2017 ACM CHI Academy, an honorary group of influential individuals who have made substantial contributions to the field of human-computer interaction and have been active participants in the ACM SIGCHI (special interest group on computer-human interaction) community. Mark's primary research interest is in understanding the impact of digital media on people's lives. Mark is the fifth informatics professor to be elected to the CHI Academy, joining fellow faculty members Paul Dourish, Bonnie Nardi, Gary Olson and Judy Olson.



# Introducing Our New Faculty for 2017

The Donald Bren School of Information and Computer Sciences is pleased to introduce the following nine faculty who joined ICS in calendar year 2017. Emphasizing the school's strategic priorities in the areas of data science and digital media and learning, these outstanding researchers and educators will be instrumental in moving ICS forward as it continues to lead in the exploration of computing technologies and the ways in which they revolutionize the world around us.

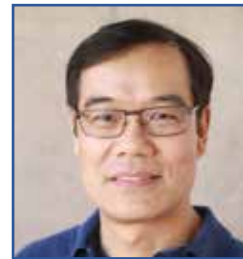


## RAY KLEFSTAD

*Professor of Teaching, Computer Science*  
*Ph.D., Information and Computer Science, 1988, UC Irvine*

Klefstad's research is in the areas of compilers, operating systems, distributed computing, real-time computing, embedded systems, middleware, object-oriented design, design patterns and object-oriented programming

languages. He has served as a full-time lecturer, assistant adjunct professor and researcher at UCI for more than 20 years. As a proud alumnus of the Donald Bren School of Information and Computer Sciences, Klefstad was recently recognized as UCI's 2017 Lecturer of the Year before advancing to the position of professor of teaching, which he began in September 2017.



## BIN NAN

*Professor of Statistics*  
*Ph.D., Biostatistics, 2001, University of Washington*

Nan's research interests are in various areas of statistics and biostatistics, including semiparametric inference, failure time and

survival analysis, longitudinal data, missing data and two-phase sampling designs, and high-dimensional data analysis. He is collaborating in many studies in areas of epidemiology, bioinformatics and brain imaging, particularly in cancer, HIV, women's health and neurodegenerative diseases. He is a fellow of both the American Statistical Association and the Institute of Mathematical Statistics, and is an elected member of the International Statistical Institute. He joined the ICS faculty in September 2017.

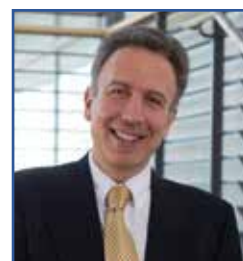


## VLADIMIR MININ

*Professor of Statistics*  
*Ph.D., Biomathematics, 2007, UCLA*

Minin is interested in developing rigorous solutions to problems that arise in biological sciences. These solutions often involve formulating stochastic models that can describe complex dynamics of biological systems and

devising computationally efficient algorithms to fit these models to data. Minin is currently most active in infectious disease epidemiology, working on Bayesian estimation of disease transmission model parameters, and in computational immunology, working on statistical methods to analyze high throughput sequence data of B-cell receptors. His other interests include phylogenetics, population genetics and systems biology. He joined the ICS faculty in July 2017.



## MARIOS C. PAPAETHYMIU

*Professor of Computer Science & Dean*  
*Ph.D., Electrical Engineering and Computer Science, 1993, MIT*

Papaefthymiou's research interests are in design technologies for energy-efficient computers. He holds 21 U.S. and international

patents on energy-efficient computing, and is co-founder and chief scientist of Cyclos Semiconductor, a Michigan spin-off commercializing energy-efficiency solutions for high-performance microprocessors. He joined ICS as the third dean of the school in January 2017 after more than 20 years on the faculty at the University of Michigan, where he served as chair of computer science and engineering from July 2011 to December 2016.



## KURT SQUIRE

*Professor of Informatics*  
*Ph.D., Instructional Systems Technology, 2004, Indiana University*

Squire runs the participatory learning lab and his team investigates how video game-based technologies might create systemic change in education. Squire's research

has been supported by nearly \$10 million in grants and gifts from the MacArthur Foundation, NSF, NIH, the Gates Foundation, the Department of Education, the AMD Foundation and Microsoft. His work has led to the development of learning games, augmented reality learning platforms and tools used by hundreds of thousands of learners around the world. He is a fellow of the Higher Education Video Game Alliance. He joined ICS in January 2017.



## CONSTANCE STEINKUEHLER

*Professor of Informatics*  
*Ph.D., Literacy Studies, 2005, University of Wisconsin-Madison*

Steinkuehler's research is on video games, culture and cognition in the context of commercial, educational and esports titles. Her work has been funded by the

MacArthur Foundation, the National Academy of Education/Spencer Foundation, the Gates Foundation and NSF. From 2011-12, she served as senior policy analyst in the White House Office of Science and Technology Policy (OSTP) where she advised on national initiatives related to games. Steinkuehler is a founding fellow and president of the Higher Education Video Game Alliance. She joined the ICS faculty in January 2017.



## ERIK SUDDERTH

*Associate Professor of Computer Science*  
*Ph.D., Electrical Engineering and Computer Science, 2006, MIT*

Sudderth's research interests include probabilistic graphical models, nonparametric Bayesian methods, and applications of statistical machine learning in computer vision and

the sciences. He has received an NSF CAREER Award, the ISBA Mitchell Prize, and was named one of "AI's 10 to Watch" by *IEEE Intelligent Systems* magazine. His Learning, Inference & Vision Group develops statistical methods for scalable machine learning, with applications in AI, vision and the natural and social sciences. Sudderth joined the ICS faculty in January 2017 after spending seven years at Brown University, where he remains an adjunct associate professor of computer science.



## KATIE SALEN TEKINBAŞ

*Professor of Informatics*  
*MFA, Graphic Design, 1992, Rhode Island School of Design*

Salen Tekinbaş' research interests are in the connections between game design, learning and transformative modes of play. She has worked

as a game designer for more than a decade and was the founding executive director of Institute of Play, an education nonprofit focused on games and learning. She is also co-founder and chief designer of Connected Camps, an online learning platform powered by youth Minecraft experts. She has worked on a range of projects for Microsoft, FreemantleMedia, Gamelab and The Design Institute. Salen Tekinbaş joined the ICS faculty in September 2017.



## VIJAY VAZIRANI

*Distinguished Professor of Computer Science*  
*Ph.D., Computer Science, 1983, UC Berkeley*

Vazirani has made seminal contributions to the theory of algorithms, in particular to the classical maximum matching problem, approximation algorithms and complexity theory. He has

also contributed widely to an algorithmic study of economics and game theory for more than 15 years. In 2001, Vazirani published *Approximation Algorithms*, which is widely regarded as the definitive book on the subject. He also co-edited a comprehensive volume on *Algorithmic Game Theory* in 2007. Vazirani is a Guggenheim Fellow and an ACM Fellow. He joined the ICS faculty, coming from Georgia Tech, in September 2017.

## ICS FACULTY RECRUITING

The Donald Bren School of Information and Computer Sciences is seeking exceptional candidates for multiple tenured/tenure-track positions in the Professor and Professor of Teaching series. In the Professor Series, there are openings in the areas of Cybersecurity, Data Science in Computer Science, Data Science in Statistics, Computer Systems, Human-Computer Interaction and Software Engineering. In the Professor of Teaching Series, there are openings in the areas of Computer Science, Informatics and Statistics. For more information on ICS faculty recruiting, visit [bit.ly/ICSFacultyRecruiting](http://bit.ly/ICSFacultyRecruiting).

# An All-Inclusive IoT Experience

The NSF-funded IoT-SITY helps cultivate a new generation of undergraduate scientists and engineers who are doing IoT research.

Nalini Venkatasubramanian, a computer scientist and professor in the Donald Bren School of Information and Computer Sciences, and Sharnnia Artis, an engineer and assistant dean for UCI's Office of Access and Inclusion,

To accomplish this, the program simulated the graduate student experience in a controlled environment, while also offering real-world support. In addition to research, students learned how to apply to graduate



Professor Nalini Venkatasubramanian (left) led the first cohort of nine IoT-SITY students for the eight-week summer program.

understand the massive potential of IoT and have pledged to help UCI position future researchers to be leaders in this emerging, interdisciplinary field through a new IoT-SITY program ([sites.uci.edu/iotsity](http://sites.uci.edu/iotsity)) funded by the National Science Foundation (NSF).

IoT-SITY began recruitment in March 2017 and established a new Research Experiences for Undergraduates (REU) Site at UCI. Under the supervision of faculty mentors, participants came from across the United States to conduct research related to IoT-enabled smart communities (hence the name IoT-SITY), bringing their own innovative, personal ideas with them.

Nearly 200 applications were received, but only nine were chosen based on the merits of their online applications, transcripts and letters of recommendation. The selected students received a \$4,000 stipend, plus room and board, and a travel allowance of up to \$600 to participate in the REU program.

The first cohort successfully advanced through the eight-week IoT-SITY program over the summer. During their time at UCI, the undergraduate researchers worked on the current projects of UCI graduate students, postdoctoral researchers and faculty. "IoT-SITY is about exposing students to IoT and increasing their awareness about the field, as well as allowing the students to experience firsthand what IoT research is all about," says Artis.

school, completed a GRE course and even received help with fellowship applications. Artis and Venkatasubramanian refer to IoT-SITY as an "all-inclusive experience" for the students.

While research was a large part of the IoT-SITY objective, another important goal was to bring in a broader, more diverse population of students who reflect society as a whole. "We're extremely proud that our students come from a wide range of backgrounds, including underrepresented groups like women and students of color," says Artis.

Before the start of the program, students were acclimated via a weeklong boot camp to understand embedded systems using a Raspberry Pi and the Arduino open-source electronic prototyping platform. Helping them along the way were their UCI graduate student mentors.

With the pilot year over, Artis and Venkatasubramanian are looking forward to making improvements for next year while sticking to the parts that worked, especially their successful recruitment strategy for underrepresented populations.

"It was an eye-opening experience for all of us," says Venkatasubramanian. "There are a number of reasons why you don't see diversity in graduate student populations, but if we want to make future technology relevant and exciting we need to break down these barriers — everyone should be engaged in creating these new technologies."

# The Future of UX

Devon Singh was part of the first MHCID graduating class and recently left Facebook for his dream job as a UX researcher at Honeywell.

Devon Singh ([devonsingh.com](http://devonsingh.com)) — member of the inaugural class of students in UCI's professional master of human-computer interaction and design (MHCID) program — recently left his job as a content specialist at Facebook to take his dream job as a UX researcher at Honeywell. But his path to success in the UX field has been anything but linear.

Singh started medical school in Florida when he was 21, but ended up dropping out to attend the police academy. During that time, he also began programming video games on the side. "One of my mods from this game that was popular at the time was really successful. It was the first time I'd done anything in tech and it had over 40,000 downloads,"

he says. When he was accepted into the master of interactive technology program at Southern Methodist University in Dallas, he left the police academy to learn game development skills. After graduation, he moved to New York to work as a products manager for High 5 Games, a casino company, where he created more than 80 games.

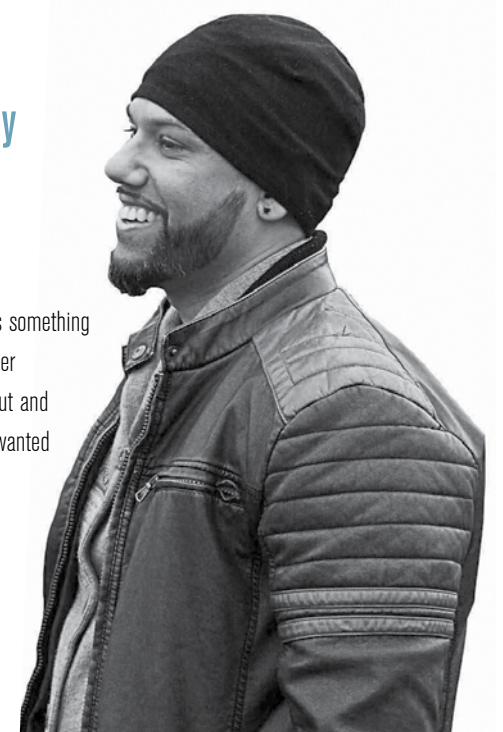
Singh became interested in UX and content strategy and next worked for a marketing company before moving to the content team of Facebook. At Facebook, he met Paul Derby, who has a

Ph.D. in human-computer interaction and became his friend and mentor. When Singh realized he'd fallen in love with product development, Derby helped him handpick UCI's MHCID program. It would allow him to continue his work at Facebook while he was in school.

When Singh started the program he was already working directly with product designers at Facebook. "But I didn't know all the intricacies and different methodologies," he says. "I think there is something about formal training and having experts who are already in the field point you in the right direction. And even though I had a very strong professional network

at Facebook, there was something about working with other students who will go out and be the future of UX. I wanted to be part of that."

Now that he has graduated, Singh says, "The program more than exceeded my expectations." While in the program he



**“Even though I had a very strong professional network at Facebook, there was something about working with other students who will go out and be the future of UX. I wanted to be part of that.” —DEVON SINGH**

found another mentor, Blake DiCosola, an MHCID professor who is also the director of experience strategy and design at Razorfish in London. "Blake's class validated my decision to go back to school. He was so knowledgeable; I learned so much from him. I use him as a sounding board."

For the future, Singh hopes to continue to refine his skills and become an expert qualitative researcher. He'd also love to someday teach part-time at UCI. "It would be great to work for the MHCID program," he says. "I'd love to give back to the school that taught me."

To learn more about the MHCID program, visit [mhcid.ics.uci.edu](http://mhcid.ics.uci.edu).



Devon Singh (left) with Professor Gillian Hayes, faculty director for MHCID, at the program's commencement ceremony in September.



Team filter at ACM's 2017 ICPC World Finals.



Informatics Ph.D. candidate Kathryn Ringland was recognized as an ARCS Scholar.



Khanh Nguyen was awarded a 2017 Ph.D. Google Fellowship.



Memorlane won top prize at the 2017 Butterworth Product Development Competition.

## ICS TEAM COMPETES AT ACM ICPC WORLD FINALS AFTER TAKING FIRST PLACE IN SOCAL REGIONALS

After taking first place among the 76 teams competing in the Southern California Regionals of the 2017 ACM International Collegiate Programming Contest (ICPC) in fall 2016, UCI's team "filter" advanced to the World Finals in 2017. At the World Finals, UCI finished ninth among the U.S. teams. The competition involved 2,736 schools from more than 102 countries. Team filter comprises Dan Chen, Waitaya Krongpiradee and Pasha Khosravi. They were coached by graduate student Timothy Johnson and sponsored by ICS Professor Richard Pattis. The team is grateful to ICS and its corporate sponsor, MeridianLink, for supplying them with funds to compete.

## FIVE ICS STUDENTS RECEIVE NSF GRADUATE RESEARCH FELLOWSHIPS

Five of the 27 UCI recipients of the 2017 National Science Foundation (NSF) Graduate Research Fellowships were ICS students:

- ▶▶ Kyle Canavera, Software Engineering Ph.D. program
- ▶▶ Kyle Conniff, Statistics Ph.D. program
- ▶▶ Michelle Nuño, Statistics Ph.D. program
- ▶▶ Manuel Rodriguez Torres, Computer Science/Math (undergraduate)
- ▶▶ Nikolai Vogler, Computer Science (undergraduate)

Each fellow receives a \$34,000 annual stipend and \$12,000 cost-of-education allowance to their graduate institution. The goal is to encourage and support

research-based graduate degrees in engineering and science. In addition, there are many international research opportunities for fellows to collaborate and grow their professional careers. The NSF hosts the annual national competition to recognize "outstanding students with high potential in science, technology, engineering and mathematics."

## INFORMATICS PH.D. CANDIDATES ACCEPT ARCS SCHOLARS AWARDS

In March 2017, Informatics Ph.D. candidates Kathryn Ringland and Christine Wolf received the ARCS (Achievement Rewards for College Scientists) Scholars Awards for 2016-17 from the National ARCS Foundation. Ringland, a first-year ARCS Scholar, was recognized for her research on assistive technology for youth with disabilities. Wolf, a second-year William Hulings ARCS Scholar, was recognized for her exploration into the social and organizational impacts of big data. They each receive a \$7,500 stipend per year for two years.

## NGUYEN WINS 2017 PH.D. GOOGLE FELLOWSHIP IN SYSTEMS AND NETWORKING

Khanh Nguyen, a Ph.D. candidate in UCI's Department of Computer Science, was selected as a 2017 Google Ph.D. Fellow for North America in the systems and networking category. The program supports graduate students doing exceptional research in computer science and related disciplines, matching them with a Google Research Mentor and providing a monetary award for student expenses and a

stipend. Nguyen is researching practical techniques for solving scalability issues in big data systems. Nguyen was also a 2017 Facebook Fellowship Finalist along with fellow Ph.D. candidate Laleh Aghababaie Beni.

## PHOTO-SHARING APP TAKES TOP PRIZE AT BUTTERWORTH PRODUCT DEVELOPMENT COMPETITION

For the fourth straight year, the Butterworth Product Development Competition in ICS — sponsored by UCI alumnus Paul Butterworth — awarded \$15,000 in prizes to the top three (out of 12) teams who made it through four rounds of competition. Taking first place was Memorlane — led by Evan Schein with Yocelyn Recinos and Michael Tran. Memorlane is a collaborative photo-sharing app that streamlines photo categorization by allowing users to upload photos to communal albums that correspond to specific locations, events and businesses when the user is within a specific preset geofence. Second- and third-place winners were AirNotes (led by Olaoluwa Adesanya with Laura Beken, Justin Mogannam, Peter Philips and Adelanwa Adesanya) and Pippy (led by Karan Kanwar, Douglas Huynh, Kausthub Raj Jadhav, Martin Gomez, Antonio Lopez, and Sam Chen), respectively. Memorlane was also recognized at Ingenuity, the premiere student showcase event sponsored by the schools of ICS and engineering, and will have the opportunity to pitch its new technology to local investors. The judges for this year's competition were Tony Crisp (CRISPx), Brian Dao '03 (Alpha Sprouts), Roger Lloyd (Pericia Solutions, Grupo Cognitiva), David Ochi (UCI ANTrepreneur Center), Neil Sahota '00 (IBM Watson Group) and Jojo Seva (NEFCU).

## 2017 ICS Student Awardees

Competitive scholarships, fellowships and student awards are made possible through the generous support of our community, industry friends and ICS endowments. For more information, contact Kristin Huerth at [khuerth@ics.uci.edu](mailto:khuerth@ics.uci.edu).

### UNDERGRADUATE SCHOLARSHIPS & AWARDS

#### Bob and Barbara Kleist Endowed Student Award

Deming Hao, Senior, Computer Science  
Abdullah Younis, Senior, Computer Science

#### Essie Lev Endowed Memorial Student Award

Alexander Garcia, Senior, Computer Science  
Tung Nguyen, Senior, Computer Science  
Jeffrey Omidvaran, Senior, Computer Science

#### Steve and Jenny Mizusawa Endowed Student Award

Sharon Babu, Senior, Computer Science

#### Sumalee Johnson Transfer Student Award

Katherine Hunsinger, Senior, Computer Science

### GRADUATE FELLOWSHIPS & AWARDS

#### Bob and Barbara Kleist Endowed Student Award

LouAnne Boyd, Ph.D. candidate, Informatics  
Dan Gardner, Ph.D. student, Informatics  
Leah Horgan, Ph.D. student, Informatics

#### Dean's Recruitment Fellowship

Kyle Conniff, Ph.D. student, Statistics  
Efthymia Karra-Taniskidou, Ph.D. candidate, Computer Science  
Jun-Wei Lin, Ph.D. student, Informatics/Software Engineering  
Stanislav Listopad, Ph.D. candidate, Computer Science  
Yingtong Liu, Ph.D. student, Computer Science

#### Fred M. Tonge Endowed Student Award

LouAnne Boyd, Ph.D. candidate, Informatics

#### Google Corporate Partner Graduate Student Award

Jianfeng Jai, Ph.D. candidate, Computer Science  
Shu Kong, Ph.D. candidate, Computer Science

#### Innovation Endowed Fellowship

Nitin Agarwal, Ph.D. student, Computer Science  
Hosub Lee, Ph.D. candidate, Informatics

#### Rob Kling Endowed Memorial Fellowship

Nicole Crenshaw, Ph.D. candidate, Informatics

#### Robert L. Newcomb Endowed Memorial Graduate Award

Michelle Nuño, Ph.D. student, Statistics  
Dustin Pluta, Ph.D. student, Statistics

#### Roberta Ellen Lamb Endowed Memorial Fellowship

Simone Lanette Simpson, Ph.D. candidate, Informatics

## 2017 Alumni Hall of Fame



From left to right: Richard Burton, Andreas Gal, Arthur Hitomi, Frank Kavanaugh, Jennifer Woo Pascua, Tim Kashani, Jon Teichrow and ICS Dean Marios Papaefthymiou.

Two years ago, the Donald Bren School of Information and Computer Sciences established a Hall of Fame to honor alumni who have made a significant impact in their profession or otherwise brought distinction to their alma mater. In February, ICS inducted six more alumni during a ceremony at the Marconi Automotive Museum in Tustin, Calif. For more information on the ICS Hall of Fame or to nominate someone, visit [bit.ly/ICSHallOfFame](http://bit.ly/ICSHallOfFame).

### RICHARD BURTON

*Ph.D. '76, Information and Computer Science*

Burton attended graduate school at UCI to explore ways in which computers can improve education. In 2014, he joined the core content team of Acuitus Inc. and developed an 18-week computer-based immersion course in network administration for the U.S. Navy. Since 2015, his course has trained recruits with no computer experience to be as good as experienced IT professionals.

### ANDREAS GAL

*Ph.D. '06, Computer Science*

Gal is known for his work on several open-source projects and Mozilla technologies. In June 2015, he stepped down as Mozilla's CTO, co-founding the IoT startup Silk Labs with two other members of the Firefox OS team. During his graduate studies at the Otto-von-Guericke University Magdeburg in Germany, he was a co-designer of AspectC++, an extension of C and C++ languages.

### ARTHUR HITOMI

*B.S. '96, M.S. '04, Ph.D. '10, Information and Computer Science*

Hitomi is president, CEO and co-founder of Numecent, leading the company's overall goals and technology strategy. He has led the acquisitions of other technologies and the development of company products, including Cloudpaging. Hitomi is a recognized figure within the areas of application virtualization and streaming, has contributed to the development of internet standards and has authored 19 issued patents.

### FRANK KAVANAUGH

*B.S. '84, Information and Computer Science*

Kavanaugh is the managing director of Fort Ashford, which focuses on education, real estate and industrial technology. He has worked at companies such as Hewlett Packard and Microsoft and founded numerous tech companies. While attending Pepperdine University for an executive MBA, Kavanaugh began Force Protection International and developed MRAP (mine resistant, ambush protected) vehicles, saving thousands of soldiers' lives during the Iraq and Afghanistan conflicts.

### JENNIFER WOO PASCUA

*B.S. '03, Information and Computer Science*

Pascua has had an extensive career in developing, managing and launching in-flight entertainment systems for the aerospace industry. In 2011, Pascua led her team at Rockwell Collins in the successful delivery of the company's first B787 aircraft to Japan following the devastating tsunami, aiding Japan in their post-tsunami recovery plan. Pascua, who received her MBA from Pepperdine University, is also a member of the Women's Unlimited LEAD program.

### JASON ROBBINS

*M.S. '95, Ph.D. '99, Information and Computer Science*

Robbins has been a professional software developer since 1988 and founded the ArgoUML open-source project in 1999. He played a central role in the early development of CollabNet's project hosting toolset, and was a founding member of the team behind Google Project Hosting on [code.google.com](http://code.google.com). His current focus is on building collaboration tools for Google's Chrome development team.

## Blending a Passion for Technology and the Arts

Tony Award-winning ICS alumnus Tim Kashani '86 continues to support UCI by helping engage alumni in meaningful ways.

Tim Kashani — a two-time Anteater alumnus with a B.S. in information and computer science and an MBA — spent his undergraduate years at UCI keeping his passion for the arts and his love of computer science separate. A rock musician and surfer, he was always drawn to the arts but majored in computer science. He was busy with classes, rowing crew and participating in his fraternity when a friend challenged him to try a ballet class. "It opened up a new world for me," says Kashani. Soon he was dancing, acting and performing in musicals, while also keeping up with all his previous activities. "I was living a dual life," says Kashani.

**"Donations are important, but I believe that if you can reconnect on campus in any way, you get so much more out of it than what you give."**

—TIM KASHANI '86

These days, Kashani and his wife, Pamela, now run Apples and Oranges Studios ([nycoc.org](http://nycoc.org)), which combines Kashani's longtime passion for technology and the arts in innovative ways, producing Tony Award-winning musicals such as *Hair*, *Memphis* and *An American in Paris*. Dedicated to giving back, the Kashanis also founded the nonprofit Apples and Oranges Arts' THEater ACCELERATOR. "A big part of our mission is to educate and help the next generation," explains Kashani. Applying the model that accelerates technology startups, THEater ACCELERATOR treats storytellers as founders, creating an opportunity for writers to interact with experts in storytelling, production, distribution and the business of show business. "We blend the best of the best of Silicon Valley with Broadway to accelerate the developmental process by linking story thematic elements to global audiences," says Kashani. "This serves our mission of taking the starving out of artist."



Tim Kashani has produced such award-winning musicals as *An American in Paris*.

Despite his busy schedule, Kashani still finds time to remain engaged with UCI as an active alumnus, and works to both amplify alumni involvement and create a more formal infrastructure to engage alumni in meaningful ways. "Donations are important, but I believe that if you can reconnect on campus in any way, you get so much more out of it than what you give," says Kashani.

The Kashanis have even hosted several UCI alumni events in Manhattan, N.Y. Once, Kashani hosted a UCI event on the day it was announced that the Apples and Oranges Studios' production of *An American in Paris* had received 12 Tony Award nominations. UCI Chancellor Howard Gillman was attending the party. "I told the chancellor I had to leave a little early to celebrate with the cast," Kashani says sheepishly.

What's next for Kashani with regard to his support of UCI? In August, Apples and Oranges Arts launched "Accelerate! The Magic of Making Musicals" at the Irvine Barclay Theatre to celebrate the partnership with UCI's Claire Trevor School of the Arts and ICS.

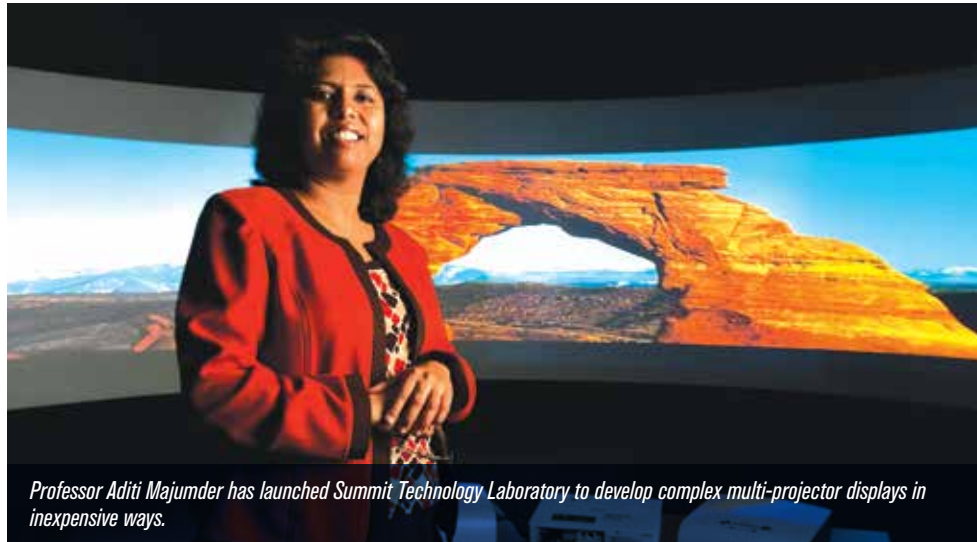
# Entrepreneurial Spirit Leads to Affordable Communicative Spaces

Computer Science Professor Aditi Majumder is changing the way we experience spaces with her innovative, interactive projection company Summit Technology Laboratory.

Computer Science Professor Aditi Majumder still remembers the moment she joined the small yet growing ranks of tech entrepreneurs to receive the National Science Foundation's (NSF) Small Business Innovation Research (SBIR) funding for her company Summit Technology Laboratory in December 2016. Out of the 5 million U.S. small businesses, only 1.5 percent are tech companies and less than half (300-350) are awarded the NSF's SBIR annually. It's also worth noting that less than 8 percent of SBIR award recipients are women in a primary company role. "It was my proudest moment," says Majumder. "I knew this was the culmination of all my years of research and I was overjoyed."

Majumder's own entrepreneurial story began after she received the NSF CAREER Award in 2009 for her project "Ubiquitous Displays Via a Distributed Framework." Although SBIR was far from her original intention, the research sparked her grand vision for a company that would change the way we experience our spaces. Her spark eventually caught fire and launched a company that develops complex multi-projector displays in inexpensive ways. And now that Summit Technology Laboratory has received Phase 1 funding, Majumder is passionately taking her innovation to market.

Currently, she has two employees and an exclusive software IP resulting in multiple U.S. patents to bolster her startup. While there are a number of well-known, big-name companies in the projection mapping business, Summit Technology Laboratory's business model does not attempt to compete with them. Summit Technology Laboratory is about combining the latest hardware technology driven by an exclusive software IP with pure creativity to tell an interactive story and provide unique experiences unlike anything else out there. "We are unique in that we aim to make our competitors our customers," says Majumder.



Professor Aditi Majumder has launched Summit Technology Laboratory to develop complex multi-projector displays in inexpensive ways.

Imagine walking into a building where, rather than individual displays, the entire room does the talking. These are "communicative spaces" made possible by Summit Technology Laboratory's low-cost, high-resolution interactive display experiences. Simply put, Majumder says, "Every space has a story to tell and we're the narrators."

Using a mesh of portable, multi-projector-based displays that spatially augment real spaces with digital content and multi-camera-based feedback sensing and reconstruction, Summit Technology Laboratory has created the world's first interactive multi-user displays that can scale to any shape and size, regardless of projector brands and cost. Majumder's technology is incredibly precise with sub-pixel accuracy, features a lucid interactive user interface that does not encumber the user with any wearable device, and is fully automated to promote easy deployment and maintenance.

One of the first projects for Majumder and her team is installing several projections at UCI Applied Innovation's The Cove, which includes a large-scale ceiling mural that will transform the 46,000-square-foot state-of-the-art technological facility and office into a true communicative space. Her hope is that her fellow entrepreneurs will better connect with each other, build stronger bonds and leave The Cove more inspired thanks to Summit Technology Laboratory.

# Dean's Leadership Council

The Dean's Leadership Council is an advisory board of executive-level leaders that helps advance our research, teaching and public service goals by strengthening the school's ties to industry and the community. For more information, contact Ed Hand at [elhand@uci.edu](mailto:elhand@uci.edu) or (949) 824-6563.

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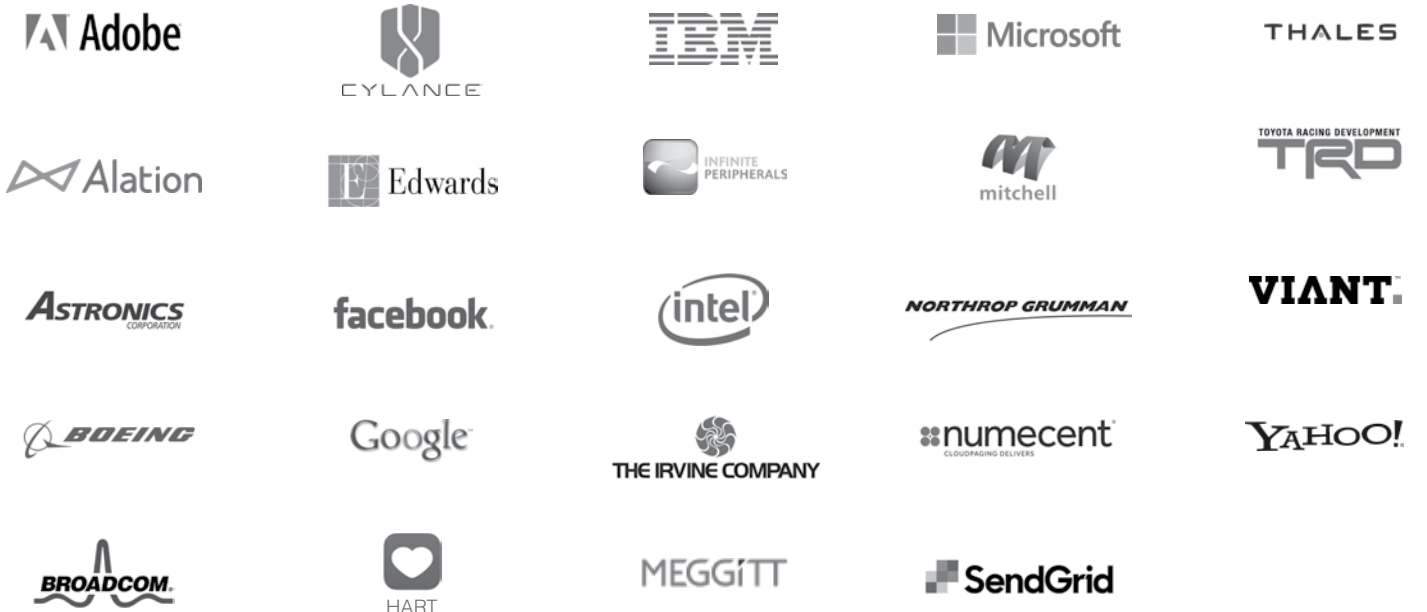
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# Corporate Partners

The Corporate Partners Program allows companies to grow their relationships with the ICS community to reach their strategic goals, while also being highly visible collaborators in moving the ICS mission forward. For more information, contact Shana Chance at [schance@uci.edu](mailto:schance@uci.edu) or (949) 824-3977.



# The Gift That Keeps on Giving

Even in retirement, Informatics Professors Emeriti Judy and Gary Olson continue their research and support of collegiality.

Though they are continuing their research in the field of human-computer interaction, Gary and Judy Olson retired from UCI's Donald Bren School of Information and Computer Sciences in December 2016. The Olsons came to UCI from the University of Michigan in large part because of the ICS faculty.



Informatics Professors Emeriti Judy and Gary Olson

In Michigan, they left behind a legacy of hosting faculty parties that helped their colleagues maintain close relationships. So once they arrived at UCI, Judy and Gary committed themselves to facilitating similar social interactions in the Department of Informatics. To encourage collegiality, the Olsons threw parties at their home, encouraged the Informatics Chair André van der Hoek to hold on-campus lunches and launched a speaker series called "Trends in Society and Information Technology." Each year, the series brought in six high-visibility scholars in the field to speak to students and faculty.

Why did the Olsons put so much deliberate energy into creating a social environment in the department? They both strongly believe that frequent opportunities to "stop and chat" with colleagues can result in faculty that get along and learn from each other. When people bump into each

**"We are on a self-funded, open-ended sabbatical. We are still doing our research, we still have our grants, we still have our offices at the university and we want to continue to be engaged." –GARY OLSON**

other they catch up, find out more about what each person is working on, network, share important personal life events and, ultimately, are more likely to collaborate. These connections can also be helpful when making difficult decisions as a group, such as during a new faculty hire. "When you know each other personally, you are more respectful of each other's opinions," says Gary. "It makes people more accommodating when issues come up," Judy adds.

On their retirement, the Olsons bequeathed funds to ICS to continue this tradition of supporting a collegial atmosphere between both faculty and students. The funds will be used for department lunches, parties or other events that foster a spirit of community. "Faculty luncheons aren't expensive, but they are important," says Judy. "It's a great way to find out how colleagues are doing and what they are up to. Our hope is that after we start the fund, others who believe in this goal might also contribute. People can also honor our philosophy by adding money to the fund."

What's next for the Olsons? "We are on a self-funded, open-ended sabbatical," says Gary. "We are still doing our research, we still have our grants, we still have our offices at the university and we want to continue to be engaged." The Olsons are also using the time freed up by their retirement to travel and spend time with their eight grandchildren. So when you bump into the Olsons, be sure and stop to ask about their travels, work or grandkids, or to let them know about your own family and exciting projects.

# Honor Roll of Donors July 1, 2016-June 30, 2017

Thanks to the generous supporters of the Donald Bren School of Information and Computer Sciences, ICS raised \$2.1 million in gifts and grants from businesses, foundations, alumni, faculty and friends during the 2016-2017 fiscal year. These gifts helped fund faculty research and teaching, undergraduate scholarships, graduate student awards, and other essential expenses. For more information on giving to support ICS, please visit [bit.ly/ICSGiving](http://bit.ly/ICSGiving). ICS acknowledges the generosity of the following donors:

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# Team Science

Transformative gift lays the foundation for interdisciplinary research building.

The Donald Bren School of Information and Computer Sciences has long looked to multidisciplinary research as a key to solving society's global grand challenges.

Now the quest to advance cross-disciplinary collaborations is a step closer to reality, thanks to a generous donation from a philanthropic Orange County family. With its initial \$30 million commitment last spring, the Samuelli Foundation set in motion the construction of a new building where science and engineering research will converge.

The Interdisciplinary Science and Engineering Building, a proposed 180,000 square feet of laboratories, classrooms, offices, conference rooms and flexible open space, is expected to break ground next spring and open its doors in late 2020. It will provide space for collaborative research in engineering, physical sciences and information and computer sciences, enabling UC Irvine researchers to work on key innovations across disciplinary boundaries with colleagues in other fields.

The Samuelli Foundation gift allows UCI to leverage \$50 million from the UC Office of the President and an additional \$40 million in campus funds to construct the building.

Henry Samuelli and his wife, Susan, have been longtime UCI benefactors. Samuelli says that he and his wife "are deeply committed to supporting science, technology, engineering and mathematics (STEM) education at all levels along the learning pipeline, from kindergarten through higher education."

He adds: "Addressing today's grand challenges in society requires collaborative research across a multitude of disciplines, aligning with our STEM ecosystem concept. We hope this gift to UCI can be a catalyst for accelerating cross-disciplinary research and scientific innovations that benefit society."

Samuelli School Dean Gregory Washington envisions collaborations that will directly impact society. According to Washington, water, biological/chemical and data sciences projects will be the first beneficiaries of the multidisciplinary collaborations enabled by the building. "We're going to

bring together key people from engineering, physical sciences and information science in order to have more synergy among these groups," he says.

Potential ideas include developing chemical and material sensors to better diagnose and treat cancers; using big data, environmental engineering and organic chemistry to improve water supply or solar energy; and having cybersecurity coders and mathematicians collaborate on military or medical challenges.

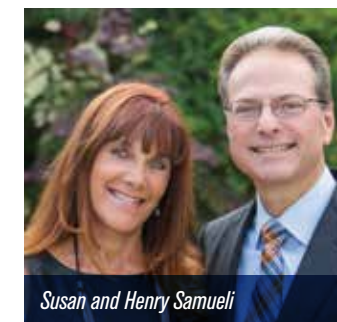
Computer sciences expertise will be key, according to ICS Dean Marios Papaefthymiou. "Everyone wants to work with ICS, because we enable what medicine does, we enable what social sciences does, and physical sciences and engineering — you name it," he says. "We're thrilled to be part of this game-changing piece of UCI."

The structure will be located in the heart of the campus's engineering and sciences quad, adjacent to Bison Avenue and East Peltason Drive. Preliminary plans for the building include seven to eight floors of space, with an emphasis on meeting spaces and contemporary laboratories.

The building will encompass a host of sustainable features, including energy-efficient systems, smart controllers, sensors and design schemes for reducing lighting energy requirements. There will be a number of naming opportunities for donors, including auditoriums, building wings, laboratories, terraces and conference rooms.

"This building will be a focal point of interdisciplinary research for our campus," sums up Dean Washington. "The generous gift from Susan and Henry Samuelli is making this possible."

*Story courtesy of Anna Lynn Spitzer, Samuelli School of Engineering*



Susan and Henry Samuelli

## JOIN THE RING ROAD SOCIETY

**Tackling societal grand challenges facing the world will require innovative approaches from multiple disciplines.**

UC Irvine has a well-known history of nurturing interdisciplinary scholarship and research, with its Ring Road design providing a circle of schools facing each other. Now, the new Interdisciplinary Science and Engineering Building will be constructed along the ring to advance collaborations for finding solutions to complex regional and global problems.

UCI alumni and friends who want to be part of this effort from the ground up can join the Ring Road Society. A gift of \$25,000 or more toward facilities and equipment will provide you with membership in an exclusive group of advocates who believe in the Anteater interdisciplinary tradition and want to see the university maintain its position at the forefront of addressing scientific and technological challenges.

For more information on giving opportunities, please contact Ed Hand at [elhand@uci.edu](mailto:elhand@uci.edu) or (949) 824-6563.



FSC PRINTER TO PLACE



*Bay Area Alumni Event at EA Headquarters*



*Los Angeles Alumni Event at Skyspace LA*



*Congratulations to the 637 undergraduate, 139 master's,  
22 MHCID and 28 Ph.D. students joining more than 10,000  
ICS alumni worldwide!*



*Ingenuity 2017 featuring keynote speaker John  
Seely Brown*

## Upcoming Events

### Winter 2018

Los Angeles Area Alumni Event

### March 2, 2018

Alumni Hall of Fame Celebration  
Lyon Air Museum (Santa Ana, CA)

### Spring 2018

Bay Area Alumni Event

### May 29, 2018

Ingenuity 2018  
UCI's Beckman Center

### Fall 2018

ICS@50 Celebration

Watch your email and check the ICS website for  
more information on these and future events.

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