

UCI Donald Bren School of
Information & Computer Sciences



2020
2021

The Future of Research

The new Susan & Henry Samueli Interdisciplinary Science and Engineering Building was constructed to forge closer partnerships among UCI researchers in the Schools of ICS, Engineering and Physical Sciences who are working to solve grand challenges affecting the world in such areas as health and the environment. Read the full story on page 87.





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ON THE COVER

The smart ring and watch on the caregiver's left hand are representative examples of the wearable technologies explored in UNITE, a multidisciplinary research project aimed at improving maternal care in underserved communities. Led by ICS Professors Nikil Dutt and Marco Levorato in Computer Science, Professors Yuqing Guo and Amir Rahmani in the Sue & Bill Gross School of Nursing, and Professor Stephanie Reich in the School of Education, the UNITE team collaborates with domain experts in hospitals and nonprofits, including the UCI Medical Center and the Children & Families Commission of Orange County. The project is supported by the National Science Foundation. Read about UNITE and other ICS research projects related to health and wellness starting on page 12.

ICS REVIEW

ICS Review is published annually by the Communications Office of the Donald Bren School of Information and Computer Sciences.

Director of Communications

Matt Miller, matt.miller@uci.edu

Senior Writer

Shani Murray

Graphic Designer

Filbert Fontejon

Communications Analyst

Katherine Li Smith

Assistant Writer


Karen Phan

Photography

Jim Kennedy, Sharon Suh, Steve Zylus

Publisher

Mike Delaney, Yebo Group

A man with short, graying hair, wearing a dark blue button-down shirt, is leaning on a dark metal railing. He is smiling and looking towards the camera. His hands are clasped together on the railing. The background is a blurred indoor setting with large windows.

**“ ICS continues to lead the way
toward creating a diverse
and inclusive computing
discipline that is accessible
and welcoming to all. ”**

From the Dean

After a one-year hiatus, I am delighted to share with you the new issue of ICS Review. Working from home for most of 2020 and 2021 has forced our community of faculty, staff and students out of its natural element, the classrooms and collaborative spaces abuzz with ideas and creative interactions. I would like to thank the entire ICS community for literally turning on a dime to move classes, research projects and operations online. I also wish to congratulate everyone for doing so while remaining committed to academic excellence and passionate about the exploration of computing technologies that serve our world.

The accomplishments highlighted in this issue exemplify our continued commitment to the advancement of computing for the common good. Supported through an international partnership with the Hasso Plattner Institute, the new HPI Research Center on Machine Learning and Data Science advances research in human-centered artificial intelligence (AI) technologies, exploring the questions of fairness, safety and accessibility in the design of AI systems. In a similar vein, with support from an endowment established by the late Vincent Steckler (B.S. '80) and his wife, Amanda Steckler, the recently launched Steckler Center for Responsible, Ethical and Accessible Technology is concerned with the design of information infrastructures that are centered on justice and promote human rights and social values. Across ICS, our researchers partner with the federal government, nonprofits, leading technology companies and trailblazing startups to advance computing innovations that promote health and wellness, expand technology access for people with disabilities, and alleviate health disparities.

Student interest in our academic and research programs is at an all-time high, further amplified by new degree programs in game design and data science. A reboot of our undergraduate computer games major has led to a game design and interactive media program that focuses on key principles of interactive design, data science and human behavior. A new professional master's program in data science got off the ground in fall 2021. The number of applications for fall 2022 admission into ICS has exceeded

20,000, a new record. Total enrollment for academic year 2021-22 is approximately 4,000 students, with about 3,100 undergraduates, more than 500 master's students and close to 400 doctoral students. To provide increased attention to its growing graduate programs, ICS has established a new associate dean position with a focus on graduate education.

Mirroring student growth and capitalizing on the opportunities of the expanding computing frontier, the size of our faculty has continued to increase, with 11 new tenure-track faculty joining ICS in the past two years and adding to our strengths in the areas of artificial intelligence, cloud computing, data science, medical informatics, human-computer interaction and security. The total number of tenure-track faculty in the three ICS departments has reached 100, and faculty search continues this year in the areas of artificial intelligence, big data systems and data science. The expansion of our faculty has been facilitated by the new Interdisciplinary Science and Engineering Building, a 120,000-square-foot facility that brings together researchers from the Schools of Engineering, Physical Sciences and ICS in search of data-driven solutions to grand-challenge problems related to energy, health and the environment.

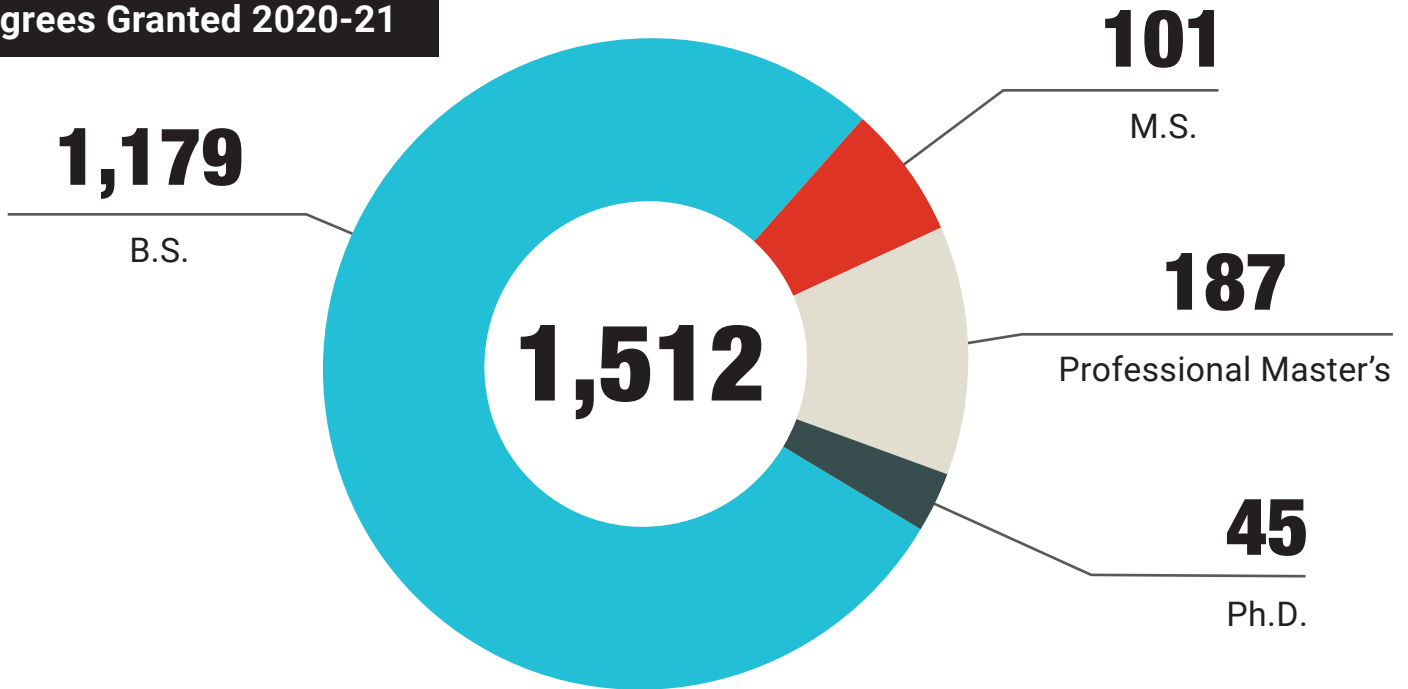
Our School continues to lead the way toward creating a diverse and inclusive computing discipline that is accessible and welcoming to all. We are fortunate to have strong partners in our efforts. A naming gift from UCI Foundation trustee Stacey Nicholas has endowed our Office of Access and Inclusion, a joint program with the School of Engineering, to support the recruitment, retention and graduation of students who are historically underrepresented in computing and engineering.

As always, I welcome your thoughts and insights as we work together to shape the future of our School and its impact on our world.

Marios C. Papaefthymiou
Professor of Computer Science
Ted and Janice Smith Family
Foundation Dean

ICS By the Numbers

Degrees Granted 2020-21



ICS contributes 3% of the 55,000+ computing degrees awarded in North America annually.

Incoming Freshmen Fall 2021

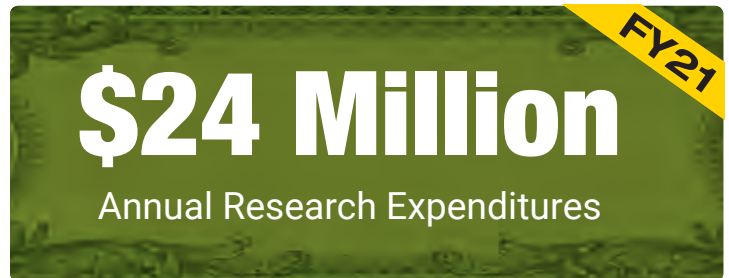
488

40% First-Generation College Students

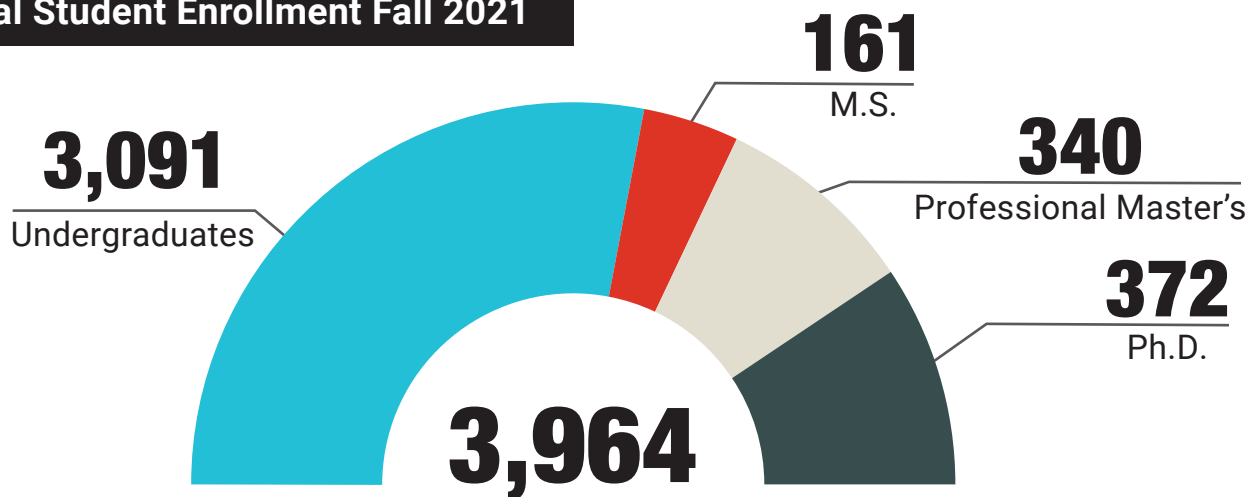
30% Female Students

25% Underrepresented Minorities

7% International Students



Total Student Enrollment Fall 2021



25% Female Undergraduates

33% Female Graduate Students

15% Underrepresented Undergraduates

Tenure-Track Faculty

100 50% Increase Over 5 Years

U.S. News & World Report

#12 Computer Science undergraduate program among public universities

#7 Software Engineering undergraduate program

2022

CSRankings.com

#3 Software Engineering research

#7 HCI research

#13 Systems research

2017-2021

Programs

7 Undergraduate Programs

- ◆ Business Information Management
- ◆ Computer Science
- ◆ Computer Science and Engineering
- ◆ Data Science
- ◆ Game Design and Interactive Media
- ◆ Informatics
- ◆ Software Engineering

5 Professional Graduate Programs

- ◆ Master of Computer Science
- ◆ Master of Data Science
- ◆ Master of Embedded and Cyber-Physical Systems
- ◆ Master of Human-Computer Interaction and Design
- ◆ Master of Software Engineering

5 Research Graduate Programs (M.S. and Ph.D.)

- ◆ Computer Science
- ◆ Informatics
- ◆ Networked Systems
- ◆ Software Engineering
- ◆ Statistics



HPI

**Hasso
Plattner
Institut**

Digital Engineering · Universität Potsdam



Improving the Outcomes of Real-World AI

Partnering with the Hasso Plattner Institute, ICS launches the HPI Research Center in Machine Learning and Data Science at UCI to advance human-centered AI.

As artificial intelligence increasingly seeps into our daily lives, affecting everything from marketing and transportation to law enforcement and healthcare, more attention is turning to the accessibility, safety and fairness of AI systems. Researchers in the Donald Bren School of Information and Computer Sciences, who have been exploring these issues for years, partnered with the Hasso Plattner Institute (HPI) in February 2020 to open its newest research school, the HPI Research Center in Machine Learning and Data Science at UCI. HPI at UCI (ics.uci.edu/hpi) opens up tremendous opportunities for innovative collaboration while advancing and increasing the visibility of the important work of ICS graduate students worldwide.

“We are pleased that the University of California, Irvine joins our graduate school in training promising young computer scientists and data experts,” says HPI Director Christoph Meinel. “The new HPI Center at UCI will enable highly talented computer scientists to jointly investigate and work closely together on projects in the important areas of data science and machine learning.”

“ This international collaboration will create an unparalleled research environment for exploring AI technologies that have a positive impact on our world. I look forward to the outcomes of this tremendous partnership between two of the world’s leaders in computing and information technology research and education. ”

– Marios Papaefthymiou
ICS Dean

The partnership also strengthens UCI’s affiliation with SAP, whose co-founder, Hasso Plattner, founded HPI. With a recently expanded Newport Beach office, SAP looks forward to building on the collaboration it has had with UCI from the beginning, said Anamarie Franc, SAP’s COO for California, in an *Orange County Business Journal* article. According to Franc, UCI is a source of “great talent” for SAP. “We guest lecture there, we host industry showcases where some of the computer science students come and pitch ideas to our teams here at SAP.”

Since its opening, HPI at UCI has funded 15 three-year fellowships for ICS Ph.D. students. In particular, the fellowships are funding research into:

- ♦ online and adaptive AI systems that are less data intensive and thus more accessible for a wide range of applications;
- ♦ robust and safe AI that can identify decisions made with low confidence and accurately assess its own limitations; and
- ♦ human-centered AI that offers transparency in predictions and decisions, reducing bias.

“The faculty and students of the HPI at UCI have been thrilled with our two years of work to advance the state of the art in AI,” says Erik Sudderth, professor of computer science and statistics in ICS and director of HPI at UCI. “Our student fellows are working on such diverse problems as enhancing the fairness of machine learning systems, making AI systems more trustworthy and interpretable, and learning personalized predictors of health outcomes from medical records.”

Participating ICS faculty include Professors Alex Ihler, Padhraic Smyth, Sameer Singh, Stephan Mandt and Roy Fox, all of whom are conducting cutting-edge work in AI and machine learning, as well as Professors Sharad Mehrotra and Michael Carey, who have award-winning research groups in databases and information retrieval.

“This international collaboration will create an unparalleled research environment for exploring artificial intelligence technologies that have a positive impact on our world,” says ICS Dean Marios Papaefthymiou. “I look forward to the outcomes of this tremendous partnership between two of the world’s leaders in computing and information technology research and education.”

2020 HPI Fellows

Although the COVID-19 pandemic closed the UCI campus just as the first five HPI student fellows received funding in April 2020, the students moved forward with their research. In October 2020, this first cohort participated virtually in the 14th Fall Retreat of the HPI Research Schools, highlighting their work:

- ♦ Dheeru Dua discussed ways to improve robustness and consistency in complex question-answering models;
- ♦ Noble Kennamer talked about how to optimize scientific experiments with active learning;
- ♦ Yiming Lin proposed a system for cleaning Wi-Fi data for location-based services;

- ◆ Preston Putzel presented a deep dynamic survival analysis for electronic health record data; and
- ◆ Yibo Yang provided new perspectives on data compression with deep neural networks.

2021 HPI Fellows


HPI at UCI welcomed five new student fellows in 2021 who presented their work at an in-person event at the end of 2021:

- ◆ Harry Bendekgey is incorporating fairness constraints into machine learning and AI systems;
- ◆ Glenn Galvizo works with graph database systems with a focus on query optimization and benchmarking using big data;
- ◆ Dailin Hu focuses on hierarchical reinforcement learning, multi-agent systems, and control learning from mixed supervision;
- ◆ Gavin Kerrigan is developing machine learning models that are more robust and trustworthy; and
- ◆ Dylan Slack focuses on machine learning safety and interpretability.

2022 HPI Fellows

The recently announced student HPI Fellows for 2022 include:

- ◆ John Lanier focusing on multi-agent reinforcement learning (RL), specifically around game-theoretically optimal algorithms for competitive settings;
- ◆ Eliot Wong-Toi researching uncertainty quantification and model-fitting techniques in Bayesian neural networks;
- ◆ Nada Lahjouji working on various aspects of data ingesting, curating and cleaning in the context of smart spaces;
- ◆ Samuel Showalter exploring machine learning robustness in computer vision, natural language and reinforcement learning applications; and
- ◆ Federica Ricci developing novel statistical models for relational data that respect the sparsity of real-world networks, and associated learning algorithms that scale to big datasets.

“We look forward to further (hopefully non-virtual) interactions with our HPI colleagues in the years ahead,” says Sudderth. “We are thrilled by this opportunity to further study the issues that arise when machine learning is applied to important scientific, commercial and societal problems.” 



Hasso Plattner: A Passionate Tech Leader

The person behind HPI is Hasso Plattner, a passionate leader in business, research and science. Plattner majored in communications engineering at the University of Karlsruhe and graduated with an advanced degree in engineering before starting his professional career at IBM in 1968. Four years later, he and four colleagues left IBM and founded the enterprise software group SAP, which is now the world's third-largest software company. Today, the company has 80,000 employees worldwide, including 330 at its recently expanded Newport Beach office, where ICS and SAP researchers are collaborating on a variety of software-related projects in areas such as healthcare.

In addition to his business success, Plattner is dedicated to education and research related to innovative technology, which led to the founding of HPI in 1998 in Potsdam, Germany. “The institute here in Potsdam is my contribution to training internationally competitive junior managers who help to shape and advance the digital world,” says Plattner on the HPI website. The institute has since expanded to locations in China, Israel, South Africa and the United States, including New York, with its latest location being the new center at UCI.



As part of the 2020 Two Happy Hearts study, the pictured mom participant, with her baby girl, shared her successful pregnancy and delivery experience as well as provided valuable feedback on how to improve the Two Happy Hearts app.

Two Happy Hearts

Through UNITE, ICS researchers develop technology to deliver smart, connected maternal care in underserved communities.

How might technology help underserved expectant mothers better monitor their health and engage with community-oriented agencies? This is the motivating question behind a \$2.1 million National Science Foundation (NSF) grant, “UNITE: Smart, Connected, and Coordinated Maternal Care for Underserved Communities.”

UNITE (UNderserved communitiEs) is a multidisciplinary project led by Computer Science Professors Nikil Dutt and Marco Levorato of the Donald Bren School of Information and Computer Sciences and Professors Yuqing Guo and Amir Rahmani of the Sue & Bill Gross School of Nursing. They are working in close collaboration with Stephanie Reich from the School of Education and with a number of local hospitals and nonprofits, including UCI Medical Center and the Children & Families Commission of Orange County.

The four-year UNITE (unite.ics.uci.edu) project started in 2018. The team has conducted a variety of pilot studies and is planning a randomized control study with approximately 100 expectant mothers in summer 2022.

The project is part of the NSF’s Smart and Connected Communities effort. “It’s a big bet by NSF to harness researchers from different groups to try and solve problems that have societal impact, that build smart and connected communities,” says Dutt. “We typically don’t do a lot of human subject studies in computer



science, but now we're making sure the technologies we develop benefit humans. We're not just making technology for technology's sake."

Building a Community Engagement Model

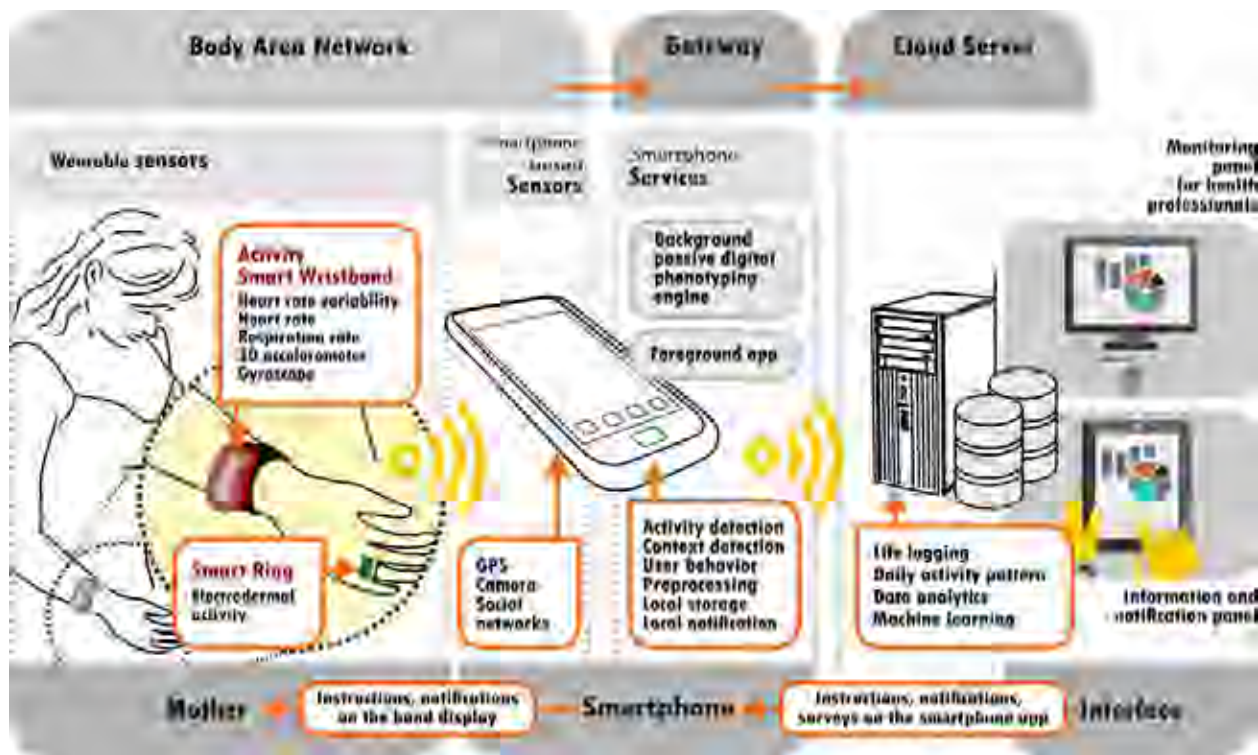
The team has been working to develop and evaluate a technology-based maternal care monitoring-intervention model. In particular, they have been integrating smart, wearable technologies – including an Oura ring for sleep monitoring, a Samsung smartwatch for capturing physiological parameters such as heart rate, and an app they created called Two Happy Hearts for promoting mindful breathing and exercise to reduce the mother's stress level.

"Data collection is so important because that is what allows us to deliver our recommendations," says Dutt. "We need to know that we can collect actionable data from wearables so that we can then determine what we can do to increase health and reduce stress." Based on the data, the goal is to offer recommendations for improving sleep, increasing exercise and reducing stress, as outlined by the American College of Obstetricians

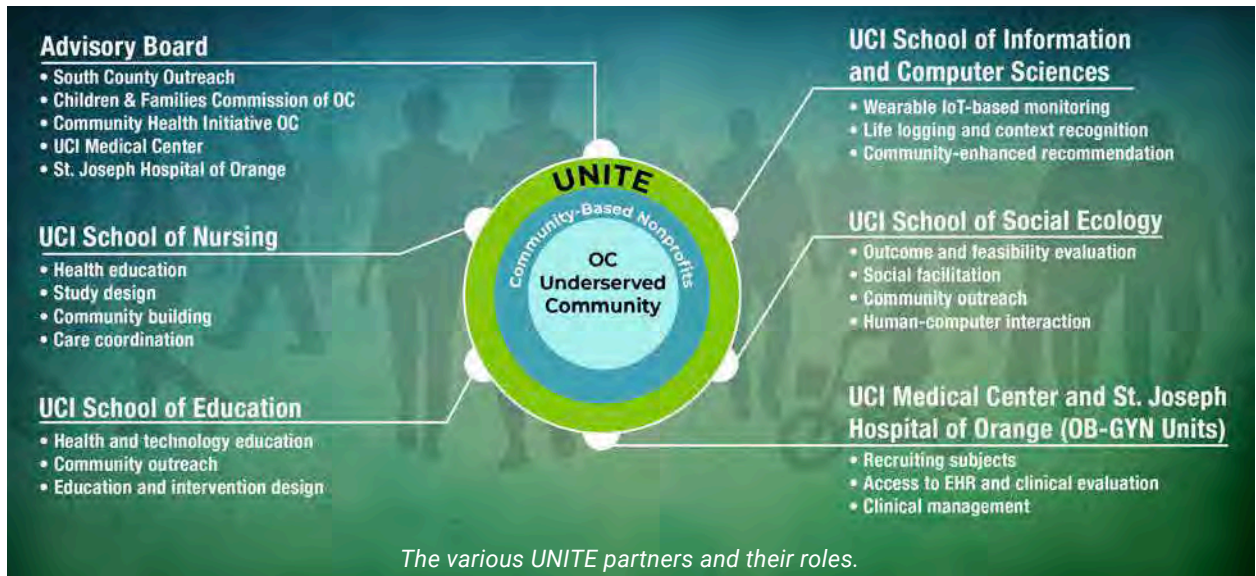
and Gynecologists. "This is the professional organization that gives guidelines in terms of the recommended level of exercise during pregnancy, recommended weight and what to do to stay healthy," says Dutt. "And when we say we want to help mothers stay healthy, it's not only their physical health but also their mental health."

The team is relying on feedback from the UNITE community advisory board, composed of members from the UCI Medical Center, St. Joseph Hospital of Orange, Children & Families Commission of Orange County, and the Community Health Initiative of Orange County. "They help us evaluate and assess our proposals so we know if we're headed in the right direction," says Dutt. This is particularly important for addressing the mothers' mental health.

"There is hardcore science that demonstrates how a mother's mental health can affect the cognitive and physical development of the infant and the mental health of her family," says advisory board member Pam Pimental, former CEO of MOMS Orange County. "Of all the thousands of referrals we made each year for a higher level of care than what [MOMS Orange County] could provide, the single most difficult was for mental



A three-tier sensor-smartphone-cloud mobile health platform enabling smart and connected maternity care solutions for underserved communities.



health services,” she says. This is why she jumped at the chance to get involved with UNITE, which she views as a potential solution. “I am confident that over time, UNITE can change the landscape of maternal mental health!”

Two Happy Hearts

In addition to leveraging the photoplethysmography (PPG) sensors found in the Oura ring and Samsung smartwatch, the researchers designed their own app, Two Happy Hearts. This app, which study participants can download onto their smartphone, captures the emotional state of the mother through ecological momentary assessment (EMA). “If a mom isn’t feeling well,” asks Dutt, “is it because of her health, or stress from a social situation?”

The app enables personalized model building to offer informed intervention via personalized recommendations. “This is not meant to be a burden,” Dutt stresses. The app presents a mindful breathing and exercise regimen, coached by community health workers, that takes into account the mother’s starting point.

“The experience and data we acquired in this project emphasized the need for personalized machine learning algorithms,” notes Levorato. Given that the daily activity and biosignal patterns of different users are very heterogeneous, an effective analysis and intervention framework must be able to quickly build user-specific datasets. “We are currently working on new AI-based adaptive algorithms that learn how to optimally interact


with the users to maximize our ability to infer their context and physiological status.”

Children & Families Commission of Orange County has committed to adopting the Two Happy Hearts mobile app and exercise/breathing regimen after pilot testing.

Promoting Health

The team is having a group of nonpregnant nurses test pieces of the technology and interventions, and they will make adjustments based on the nurses’ suggestions prior to conducting the summer study. “We’re trying to tease that out so we can make these moms achieve their recommended levels of activity and do that in a manner such that they feel good about themselves,” says Dutt. “That’s the goal, because that translates to the babies having a healthy delivery. Healthy mom, healthy baby.”

At the end of the project, the team hopes to have a model that can be replicated across other communities and applied in different contexts. “If this project is successful, is it something we could deploy at scale in other areas of the U.S.?” asks Dutt. “We’re in an urban area primarily. Would it be applicable in rural communities?”

They also hope to someday extend their model beyond pregnancy. “We’re primarily focused on maternity care, but the outcome in the first couple of years is also important,” says Dutt, recognizing the need to monitor the health of a new mom and her child. “But that’s a different project. Baby steps!” 



A Digital Prosthetic Eye for the 21st Century

Professor Ian Harris demonstrates the digital prosthetic as it tracks his natural eye movements.

Viewed straight on, today's prosthetic eyes look very realistic. But when the healthy eye moves naturally, the prosthetic eye has no or limited movement, creating a misalignment that many wearers find disfiguring.

Dr. Jeremiah P. Tao, chief of oculofacial plastic and orbital surgery at the UCI Health Gavin Herbert Eye Institute, has helped many patients who have lost an eye to trauma, cancer or other disabling conditions. Through a surgery called enucleation, he creates the appearance of an eye by attaching the remaining eye muscles to an orbital implant and later fitting the patient with a custom shell that serves as the artificial eye. The prosthesis, made from a plastic acrylic, is matched in size and color to the patient's remaining natural eye. "These devices look great," Tao says. "But the failure of the eyes to move together has caused many of my patients to feel self-conscious."

Determined to find a solution, Tao sought out UC Irvine computer scientist Ian G. Harris to help design a new type of prosthetic. They hypothesized that digital microscreen technology – widely used in smartphones and smartwatches – could be coupled with algorithms that track pupil movements.

In this way, they could achieve a more dynamic ocular prosthetic, one that moves in synchrony with the healthy eye. Moreover, organic light-emitting diode (OLED) technology allows for single-layer screens that are thin, flexible and lightweight enough to be trimmed and shaped on an ocular shell.

Tao, a professor of ophthalmology at the UCI School of Medicine, and Harris, a professor of computer science at the UCI Donald Bren School of Information and Computer Sciences, began by capturing ocular rotations of a healthy eye using a small video camera. Facial landmark

detection and camera-based tracking software were used to create a coded algorithm to detect eye movement and pupil size. The data was hardwired to a laptop computer screen where an image of the moving contralateral eye was displayed with minimal delays undetectable by the human eye.

The next prototype incorporated spectacles created with a 3D printer with a micro camera embedded in the frame to capture the movements of a healthy eye. Pupil location was wirelessly transmitted to a flat OLED microscreen about the size of a standard eye prosthesis. A crude image of the opposite eye was displayed on the screen and showed the appearance of the eyes working in tandem. The system was limited to replicating slow eye movements in a controlled environment.

Their latest prototype applies what is called a convolutional neural network (CNN) – a type of deep learning artificial neural network used in image recognition and processing – to track pupil location and capture natural fine darting eye movements under various conditions. These algorithms are merged with the microscreen digital eye prototype. "We found that the neural network captured pupil location with high accuracy and allowed the prosthetic eye to move with the same amplitude and velocity as the natural, tracked eye," says Tao.

Work still needs to be done to make the digital eye look more realistic, but Tao and Harris believe their real-time image processing in tandem with the neural network may lead to a viable next-generation eye prosthesis for patients. Their findings were published online in April 2021 in the *American Journal of Ophthalmology*.

A version of this article, written by Valerie Elwell, was originally published on the UCI Health Live Well blog. 



Mobilizing Technology to Build a Personalized Health Model

The interdisciplinary UCI Institute for Future Health combines research and clinical care to empower people.

The recently established UCI Institute for Future Health will combine research and clinical work to address the movement toward a more personalized healthcare model.

The institute aims to integrate lifestyle, community, environment and socioeconomic factors in conjunction with biomedical and clinical knowledge to radically transform health systems away from hospitals and clinics and into the hands of each individual.

“The mission of the Institute for Future Health is to empower people to better manage their health and quality of life with technology-enabled, personalized and timely advice,” says Pramod Khargonekar, UCI’s vice chancellor for research.

“Our approach is to understand lifestyle and environmental factors as they affect an individual and use them to build a personal model that will steer one’s health state to meet an individual’s goals,” says Ramesh Jain, professor emeritus of computer science and the institute’s director. “This requires collecting real-time lifestyle and environment data in real-life situations. This approach requires that we build an infrastructure to simultaneously do research and translation rather than first doing research and then translation.”

To do this, institute members are developing technology to use a person’s lifestyle and health data from sources that include mobile phones, wearable and personal sensors, environmental data, data related to various personal activities, data from diagnostic medical tests, other medical records, and even genomics and proteomics. This data will be combined with both well-established and the latest knowledge from relevant research areas to develop personalized lifestyle guidance approaches. These, in turn, will guide a person perpetually as needed using lifestyle adjustments and medical care to achieve their health goals.

Institute members aim to harness the power of mobile phones to create a novel approach to health, using an application called a personal health navigator. Similar to a commonly used navigation system, the personal health navigator is for guiding lifestyle and medication, when required, to achieve health goals for a person’s desired quality of life. This application provides personalized quality healthcare access using their most commonly used device, their mobile phone. The main goal of the institute is to develop technology by combining the latest health-science knowledge from computing and society to build a simple navigational approach

for people to attain the quality of life they want.


Already there are more than 40 projects underway in the new institute, including:

- ♦ Building a personal model using personal data from mobile phones, wearable devices and other sources for guiding lifestyle decisions to take care of diseases like diabetes.
- ♦ Recommending satisfying food choices that address all three levels of a person's health: individual (taking genetics into consideration), societal (supporting local communities and infrastructure) and environmental (reducing global warming).
- ♦ Creating an open-source World Food Atlas (worldfoodatlas.org) in collaboration with the University of Tokyo to help people find healthy food all over the globe.
- ♦ Redesigning patient portals provided by

healthcare providers to make the medical record more useful to the patient.

- ♦ Conducting a public health, longitudinal study of environmental threats to track real-time physical and mental health using wearable technology.
- ♦ Supporting adolescents struggling with emotional health issues through the use of wearable technology.

"This is the first advance to use each person's unique model and closed-loop cybernetic approach to perpetually help in achieving personal health goals," says Jain.

The Institute for Future Health is a provisional Organized Research Unit. More information about the researchers, projects and activities of the Institute for Future Health can be found at futurehealth.ics.uci.edu. 



“ This is the first advance to use each person’s unique model and closed-loop cybernetic approach to perpetually help in achieving personal health goals. ”

- Ramesh Jain
UCI Institute for Future Health Director



Transforming the World With **CREATE**

ICS alumnus Vincent Steckler '80 and his wife donate \$5 million to establish the Steckler Center for Responsible, Ethical and Accessible Technology.

From healthcare to criminal justice, there are countless examples of the impact of artificial intelligence – and of the human bias that can be carried within it. “Over the last decade, we have seen the havoc AI can wreak on the world as well as the gifts it can bestow,” says Gillian Hayes, vice provost for graduate education and dean of the Graduate Division at UCI. So how might we reconfigure technological processes and infrastructures to center justice and promote human rights and social values? This is just one of the many questions that the new Steckler Center for Responsible, Ethical and Accessible Technology (CREATE), housed in UCI’s Donald Bren School of Information and Computer Sciences, aims to address.

The center was made possible through a generous gift from Vincent Steckler, who graduated from UCI in 1980 with a B.S. in information and computer science and a B.S. in mathematics. Steckler and his wife, Amanda, gifted \$10.4 million to UCI in January 2021, half of which is supporting art history students while the other half helped establish CREATE.

“I believe that the Center for Responsible, Ethical and Accessible Technology could dramatically change some of the toxic tendencies within Silicon Valley,” said Steckler, before his tragic passing in June 2021 (see the In Memoriam on page 21). “And if we change the way Silicon Valley operates, we can change the world.”

Hayes, who is also the Robert A. and Barbara L. Kleist Professor of Informatics, worked closely with the Stecklers on the CREATE proposal. “When we first began discussing this opportunity in 2020, it was clear from the start that they saw the way that UCI was poised to step out in front and change the culture of the entire industry while preparing our students for the new world they are entering,” she says. “Machines do as they are trained, and CREATE has the opportunity to train them to do good.”

The center is fostering multidisciplinary projects between faculty and graduate students from ICS and researchers from law, anthropology, media studies, sociology, philosophy, political science and economics. “The problems are larger than just ICS,” explains Paul Dourish, Steckler Endowed Chair, who is serving as the center’s director. “If we want to tackle questions of how data technologies shape people’s experience in domains like criminal justice and public services, we need strong interdisciplinary partnerships, and CREATE will establish an environment to do just that.”


Dourish views the center as an opportunity to amplify and build on previous efforts, pointing to the long history of work ICS has done in this area. “Going back to the founding of the department in the late ’60s, there has always been a focus on the social consequences of digitalization,” he says. He explains that Ph.D. fellowships offered through CREATE will provide the stability needed to expand the reach of projects started with grant funding. “This lets us build sustainable relationships, and I think that’s going to be incredibly important,” he says.

“If we want to tackle questions of how data technologies shape people’s experience in domains like criminal justice and public services, we need strong interdisciplinary partnerships, and CREATE will establish an environment to do just that.”

- Paul Dourish
Steckler Endowed Chair

Furthermore, the center is working on collaborations that extend beyond campus and academia. “The way that we have to do this work is by partnering with community organizations, with civil society organizations and with others outside the university in order to achieve lasting change,” says Dourish. At the same time, by emphasizing diversity, inclusion and accessibility, the center will ensure that technology is built both by and for people from diverse backgrounds.

As outlined on the CREATE website (create.ics.uci.edu), the vision is to “produce positive change in the world, focused on principles of equity, accountability and care.”

“I am grateful to Vincent and Amanda for their vision and generosity,” says ICS Dean Marios Papaefthymiou. “Their transformative gift propels our School to the vanguard of research and educational institutions around the globe that promote fairness and inclusiveness in the information-driven societies of the future.” 



Paul Dourish Named Steckler Endowed Chair

As the UCI community mourned the loss of beloved alumnus Vincent Steckler '80, who led the tremendous growth of Avast Antivirus Software during his time as CEO, solace came from seeing the impact of his legacy. Steckler was a dedicated advocate for socially responsible technology. As announced in January 2021, a generous gift from Steckler and his wife, Amanda, led to the creation of the Steckler Center for Responsible, Ethical and Accessible Technology (CREATE) in UCI's Donald Bren School of Information and Computer Sciences. Funding from that gift also helped establish the Steckler Endowed Chair, with Chancellor's Professor of Informatics Paul Dourish being appointed as the inaugural chair holder in July 2021.


"Building on a long tradition of scholarship at UCI on technology and society, the establishment of the Steckler Chair reflects the pressing urgency of those topics today," says Dourish, who has been studying socially responsible technology for years and now serves as the director of CREATE. "We're in a particularly significant moment for research on socially responsible technology," he explains. "On one hand, there is a growing dissatisfaction with tech industry practices and business models, while, on the other, the pandemic has made us even more reliant upon digital infrastructures in working life and beyond."

One area in particular Dourish is currently researching is the practical contexts in which AI and data systems are deployed. "As researchers, we produce new ideas, systems and technologies, but when real-world organizations pick them up, the practical realities of institutional politics, organizational dynamics, uneven technical capacities, and the competing interests of different stakeholders are often at odds with our idealized assumptions,"

he explains. "If we want to build systems and strategies that have an impact in the world, we need to begin with those realities and organize our technologies around them."

In addition to his research, Dourish also notes the importance of educating future designers and developers to better understand the consequences of their creations. "We need to make sure that the next generation of technical professionals is able to engage with the social and cultural dimensions of their work," he says. Recognizing that engagement with social and cultural dimensions requires pulling in new perspectives, Dourish prioritizes diversity in STEM. "The Steckler gift was inspired in large part by the challenges of ensuring a diverse and inclusive technology workforce to serve an equally diverse and inclusive society," says Dourish.

The chair position may be held for five-year renewable terms. "Only one person can hold the chair, but I'm very conscious of the support of my many mentors, colleagues, collaborators and students," says Dourish. "I regard myself as holding the chair on all of their behalf." In fact, many ICS colleagues and students are CREATE collaborators working with Dourish on projects focused on principles of equity, accountability and care.

"Dr. Dourish is a world leader in understanding the intersections between technological innovations and social environments. He has spent a fruitful career analyzing the ethical implications of a dramatically changing world," says Melissa Mazmanian, chair of the Department of Informatics. "His technical savvy, rich humanity and unwavering commitment to inclusive and safe futures make him an ideal candidate to realize Vince Steckler's legacy." 

In Memoriam: Vincent Steckler '80




The UCI community mourns the loss of beloved alumnus, friend and supporter Vincent Steckler '80. The former CEO of Avast Antivirus Software died unexpectedly in a car accident on June 15, 2021, at the age of 62.

Vince graduated from UCI in 1980 with a B.S. in information and computer science and a B.S. in mathematics. He joined Avast as CEO in 2009 and transformed the company from a small regional business into a global provider of internet security. Vincent remained active in the Orange County community and was a strong advocate for equity and inclusion in the computing industry. As a global business leader who had a tremendous impact on technology and innovation, while also remaining dedicated to his alma mater, Vincent was inducted into the Donald Bren School of Information and Computer Sciences Alumni Hall of Fame in 2018.

"Our School was a cause close to Vince's heart," says ICS Dean Marios Papaefthymiou. "We are deeply saddened by the loss of a cherished friend and ardent supporter of the ICS community. At the same time, we remain as committed as ever to pursuing his vision of an accessible, equitable and inclusive digital future for our society."

At the beginning of 2021, Vincent and his wife, Amanda, gifted \$10.4 million to UCI, half of which is supporting art history students, while the other half helped establish the Steckler Center for Responsible, Ethical, and Accessible Technology (CREATE) led by Chancellor's Professor Paul Dourish, who was named the first Steckler Endowed Chair in Information and Computer Science. The Stecklers previously donated \$1 million to ICS to support women in computing, creating an endowed fellowship for graduate students as well as an endowed scholarship for undergraduates.

"Vince's sudden passing has come as a tremendous shock," says Dourish. "We are especially sorry that he will not be able to see the legacy and impact of his transformational gift. His passion for inclusivity and responsibility in the technology sector has built a foundation for research and education in this space for years to come, and we are devastated not to be able to share that with him."

The ICS and UCI communities extend their sincerest condolences to the Steckler family and friends. Vincent will hold a special place in the hearts of many at the UCI campus. He is survived by his wife, Amanda, and five children. 

INTRODUCING OUR NEW FACULTY FOR 2020-2021



Elena Agapie

Assistant Professor, Informatics

Ph.D., Human Centered Design and Engineering, University of Washington

Agapie researches, designs and builds technologies that empower people to engage in positive behaviors through a human-centered approach. Her work draws on people's lived experiences and practices from psychology, exercise science or mental health, as she designs tools to help people pursue healthy behaviors. For example, she developed an online system that uses crowdsourcing to help people access expert-quality exercise advice from peers. Agapie has worked on research teams at Microsoft Research, FXPAL, Intel Labs and JPL. She joined the ICS faculty in July 2020.



Mohsen Imani

Assistant Professor, Computer Science
Ph.D., Computer Science and Engineering, UC San Diego

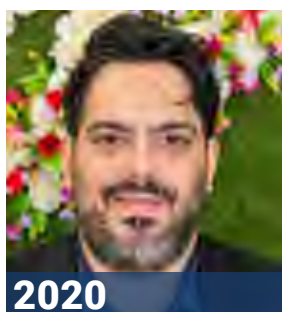
Imani's research interests are in the areas of computer architecture, brain-inspired computing and embedded systems. His research aims to design secure, real-time, robust computing systems that can natively support a wide range of learning and cognitive tasks on edge devices. Specifically, he is working to accelerate big data and machine learning applications by redesigning algorithms using strategies that more closely model the human brain. His Ph.D. has opened up new interdisciplinary research on brain-inspired hyperdimensional computing that connects areas in machine learning, computer systems and neuroscience. Imani joined the ICS faculty in July 2020.



Faisal Nawab

Assistant Professor, Computer Science
Ph.D., Computer Science, UC Santa Barbara

Nawab's research is in the areas of distributed cloud computing and big data management. He runs the EdgeLab, which focuses on solving distributed data management problems to enable edge technologies, such as Internet of Things (IoT), smart surveillance, augmented and virtual reality, smart cities, and autonomous vehicles. More recently, Nawab has been utilizing advances in blockchain and serverless technology to build more efficient data management systems that span both edge and cloud computing infrastructures. He was an assistant professor of computer science and engineering at UC Santa Cruz before joining the ICS faculty in January 2021.



Ioannis Panageas

Assistant Professor, Computer Science
Ph.D., Algorithms, Combinatorics and Optimization, Georgia Tech

Panageas is interested in the theory of computation, machine learning and its interface with non-convex optimization, dynamical systems, probability and statistics. More specifically, his research focuses on addressing questions about equilibration, robustness and performance of algorithms and complex systems. Some applications include regression from dependent/censored data, min-max optimization, online learning and learning in games. Panageas was the recipient of the 2019 NRF Fellowship for AI. He was an assistant professor at the Information Systems Department of Singapore University of Technology and Design before joining the ICS faculty in October 2020.



Anne Marie Piper

Associate Professor, Informatics
Ph.D., Cognitive Science, UC San Diego

Piper's research in human-computer interaction and accessible computing aims to create more equitable and inclusive digital experiences for people of all ages and abilities. Her prior and ongoing work focuses on designing new technologies for collaborative work among ability-diverse teams of professionals and academics; developing accessible content production tools for artists, writers and musicians who are blind; and leveraging the arts as a form of expression and as a resource for designing alongside people with dementia or speech-language impairments. Before joining the ICS faculty in July 2020, Piper was on the faculty at Northwestern University.



Tianchen Qian

Assistant Professor, Statistics
Ph.D., Biostatistics, Johns Hopkins University

Qian's research focuses on answering causal questions from novel experimental design and complex data. He develops efficient and robust statistical procedures for settings where the data is high-dimensional and longitudinal, the treatment is time-varying, and missing data is present. His work on designing and analyzing micro-randomized trials helps the development of digital and behavior change interventions. He is interested in causal inference, clinical trials, machine learning, mobile health, precision medicine and semiparametric models. Before joining UCI, he was a postdoc at Harvard University's Department of Statistics. Qian joined the ICS faculty in July 2020.



Jing Zhang

Assistant Professor, Computer Science
Ph.D., Electrical Engineering and Molecular and Computational Biology, University of Southern California

Zhang's research interests are in the areas of bioinformatics and computational biology. She was previously a postdoc at Yale University. During her postdoc, she was one of the coordinating trainees in international consortia, such as ENCODE and psychENCODE, where she leveraged various machine learning technologies and novel high-throughput sequencing assays to decipher the gene regulation "grammar." She led the current release of the ENCODEC deep annotation resource for cancer in ENCODE3. Her current research focus is on developing computational methods to understand how genetic variations can result in phenotypic changes. Zhang joined the ICS faculty in July 2020.



Alex Berg

Associate Professor, Computer Science
Ph.D. Computer Science, UC Berkeley

Berg's research concerns computational visual recognition. He has worked on general object recognition in images, action recognition in video, human pose identification in images, image parsing, face recognition, image search, and machine learning for computer vision. He co-organizes the ImageNet Large Scale Visual Recognition Challenge, and has co-organized a series of workshops on large-scale recognition in computer vision. Berg's Ph.D. at UC Berkeley developed a novel approach to deformable template matching. He is currently a research scientist at Facebook AI Research and holds a faculty position at University of North Carolina, Chapel Hill. He will be joining UCI in spring 2022.



Anton Burtsev

Assistant Professor, Computer Science
Ph.D., Computer Science, University of Utah

Burtsev is a systems researcher with many years of first-hand experience in designing and building operating systems. Currently, he is interested in clean slate design of operating systems for novel hardware and software environments, and in the practical evolution of existing systems toward hardware, software and security requirements in the age of warehouse computing. Burtsev's research covers novel operating system designs that utilize the safety features of the Rust programming language for security and reliability, secure cloud architectures, and operating system support for modern low-latency, heterogeneous data centers.



Madhu Reddy

Professor, Informatics
Ph.D., Information and Computer Science, UC Irvine

Reddy's primary interests are in understanding how we can better design and implement health information technologies to improve communication and collaboration in clinical settings. His interdisciplinary research connects medical informatics, computer-supported cooperative work, and information sciences. Reddy's research has been supported by NSF, Lockheed Martin Corp., The Commonwealth Fund, the National Network of Libraries of Medicine Mid-Atlantic Region, and the Center for Integrated Healthcare Delivery Systems. He is an American College of Medical Informatics Fellow and was awarded the American Medical Informatics Association's Diana Forsythe Award in 2002 and 2010. Before joining UCI, Reddy was on the faculty at Northwestern University.

New Department Chairs

ICS welcomed two new leaders in July 2021 with the appointments of Professors Tony Givargis and Melissa Mazmanian as chairs of the Computer Science and Informatics Departments, respectively. Both start their three-year term with more than a decade of experience in ICS and excitement about leading faculty and students to success in cutting-edge research and education with real-world impact.

Computer Science Chair Tony Givargis

Tony Givargis (ics.uci.edu/~givargis), who joined the UCI faculty in 2001 after earning his Ph.D. in computer science from the University of California, Riverside, says he's excited and honored to be the next chair of the Computer Science Department. An expert in the area of embedded systems, his research emphasis is on system software, advanced compilation for targeted applications, computational storage devices, accelerators and high-dimensional computing. He has authored more than 100 peer-reviewed papers, co-authored two popular textbooks, and received several awards for his research and teaching, including the ACM SIGDA Technical Leadership Award and ICS Dean's Award for Excellence in Undergraduate Teaching. He has also served in several leadership positions, including ICS associate dean for student affairs (2011-2016) and CS vice chair (2018-2021).

At the same time, Givargis excels in bridging the gap between academia and application. He is a named inventor on 13 U.S. patents and is co-founder of Levyx (levyx.com), an Irvine-based startup company focused on enterprise big data software.

Givargis takes the reins from Alex Nicolau, who served as department chair for eight years. "I consider myself lucky, and grateful, to be next in line after Alex," says Givargis, "as he has set a high bar for excellence in hiring, among other things, and has paved the way for continued growth and development." Givargis plans to continue the excellence in hiring and growth of enrollment, particularly at the



graduate level. "I also want us to become better at promoting ourselves and gaining the national and international visibility that we deserve, given the great work that we're doing," he says. "We have an incredible department that is home to outstanding researchers, educators and students. I look forward to working with each and every member of the department as well as the school in helping to build and promote us to the highest levels."

Informatics Chair

Melissa Mazmanian


Melissa Mazmanian (melissamazmanian.com) stepped into her new role as chair of the Informatics Department with more than a decade of experience in the Donald Bren School of Information and Computer Sciences. She first joined the faculty in 2009, after earning a Ph.D. in organization studies from Massachusetts Institute of Technology. She has served ICS in a variety of roles, including as vice chair for graduate affairs in informatics and as a representative on the UCI Academic Senate.

Her research focuses on communication practices in personal and organizational contexts, specifically in relation to social norms, and the nature of personal and professional time in the digital age. This gives her a unique perspective during these unprecedented times. “My immediate goals as the new department chair are to think about how to consciously and proactively regroup as a department after this time apart [caused by the pandemic],” she says. “We need to have care and empathy in coming back together so we can reaffirm ourselves as a community and create energy and excitement around what we do and why we do it.”

She aims to build on the community nurtured by her predecessor, André van der Hoek. “One of the many things he did for the department was take a proactive role in nominating faculty for different awards, which is no small task,” says Mazmanian. “That’s something that I definitely want to continue in his stead.” Last year, thanks to van der Hoek’s nomination, Mazmanian received a Chancellor’s Fellowship, further supporting her research. Some of her recent



collaborations include designing technology that supports workers’ needs holistically and exploring how predictive analytics affect “risk work” such as firefighting.

“Technology will continue to revolutionize our physical, social and individual worlds,” she says, “and the Informatics Department is the space for not just designing and building but also examining the deep moral implications of these changes.” 

ICS Leadership



Marios Papaefthymiou
Ted and Janice Smith Family
Foundation Dean
Professor of Computer Science



David Redmiles
Associate Dean for Academic
Affairs
Professor of Informatics



Madhu Reddy
Associate Dean for Graduate
Education
Professor of Informatics



Gopi Meenakshisundaram
Associate Dean for Undergraduate
Education
Professor of Computer Science



Rina Dechter
Associate Dean for Research
*Distinguished Professor of
Computer Science*



Dan Gillen
Statistics Department Chair
Professor of Statistics



Tony Givargis
Computer Science Department Chair
Professor of Computer Science



Melissa Mazmanian
Informatics Department Chair
Professor of Informatics



Madhu Reddy Joins ICS as Associate Dean for Graduate Education

Informatics Professor Madhu Reddy began his three-year term as the ICS associate dean for graduate education in July 2021. In this new role, he will oversee all aspects of the graduate research (Ph.D., M.S.) and professional programs in ICS, including recruitment initiatives and fellowship administration. Reddy, who received his Ph.D. in information and computer science from UC Irvine in 2003, spent the last six years as a professor of communication studies and associate dean for graduate programs in the School of Communication at Northwestern University. Among his many distinctions, Reddy has received the American Medical Informatics Association's Diana Forsythe Award and is a fellow of the American College of Medical Informatics. His current research focuses on the design and implementation of digital mental health tools and services to better meet the needs of users and to improve health and wellness.


Communication and Collaboration

Reddy studies the challenges of using health information technology in clinical settings. "Technologies such as the electronic health record (EHR) are not designed and implemented to support effective communication in these information-rich, complex and highly collaborative environments," he says, "so users are forced to develop workarounds." To understand and address these challenges, Reddy's research examines how clinical staff work with each other and how the EHR supports their collaboration. For instance, he was involved in the development of R-CAST-MED, an agent-based collaborative decision support system for clinical teams.

Tools for Mental Health

Reddy is also interested in improving the delivery of mental health services. "There simply are not enough mental health service providers in the country," he says. "Digital mental health tools can play a role in helping close this gap, but there have been few, if any, successful large-scale implementations of these tools in healthcare organizations." Reddy is working to better understand and address the organizational and design challenges related to digital mental health applications as he finds ways to integrate these tools into the healthcare system to improve patient access.

Individual Engagement

Currently conducting a series of studies of individuals who live with depression, Reddy has started to identify the different approaches that these individuals use to monitor depression and how self-management tools can best support these approaches. "We need to design mental health tools that better reflect users' actual needs and goals," he explains. While most users engage with mobile applications in brief segments, many mental health tools require a much longer engagement period in order to be effective. Consequently, striking the balance between how users want to engage with mobile applications and what is necessary to deliver effective support is an important challenge. "I'm working on designing and implementing digital mental health interventions that will better integrate both clinical goals and user preferences," says Reddy. 



Pushing the Frontiers of AI Research

Associate Dean for Research Rina Dechter advances the research mission of ICS by working to strengthen faculty and student recruiting, support and collaboration.

Distinguished Professor of Computer Science Rina Dechter has been teaching and conducting research at the Donald Bren School of Information and Computer Sciences since 1990. Focused on advancing our understanding of automated reasoning in artificial intelligence, she has helped develop algorithms and models that enable computers to perform foundational tasks such as diagnosis, prediction, situation assessment, decision making, and planning. Now, as the ICS associate dean for research — a role Dechter was appointed to in late 2019 — she continues to influence the computing field, advancing not only her own research but also that of fellow faculty and students.

What is the focus of your research?

My area is artificial intelligence and my research is in the field of automated reasoning. Two of the primary areas in AI are machine learning, where we aim to replicate human learning, and automated reasoning, where we replicate human thinking. Reasoning and thinking are central to human intelligence and, as such, constitute a

fundamental challenge in making computers “intelligent.” My focus is on graphical models, including both constraint networks and Bayesian networks. These models are used to accomplish various scientific and engineering tasks, as well as human-based reasoning applications like scheduling, planning, diagnosis, prediction, hardware and software verification, and bioinformatics.

A common use case for this work is medical diagnosis. Physicians have a huge amount of knowledge, but when making a diagnosis, they need to quickly and accurately — based on only a few pieces of information — confront difficult questions. Which information is relevant and which is not? What are the plausible diagnoses? What treatment should they give? What are the risks involved? What tests should be ordered? My research is focused on how to deploy such huge quantities of knowledge to make good predictions and to support decisions about actions, diagnosis and planning — and finding ways to do so efficiently and accurately.

In developing AI algorithms, we get inspiration from human problem-solving and the ability of the human brain to simplify and abstract problems

into “rules of thumb,” also called heuristics. Related to heuristics, we want to replicate the human ability to focus only on locally relevant information out of the enormous amount of knowledge people have accumulated throughout a lifetime of learning. The use of graphs, which can efficiently depict notions of direct relevance, dependence and causal relationships, help us to develop efficient algorithms. In 2019, together with my colleague Alex Ihler, I received a National Science Foundation (NSF) grant titled “Anytime Algorithms and Bounds for Probabilistic Graphical Models.” With this work, we are pushing the frontier in trying to develop algorithms for planning and decision making under uncertainty.

As associate dean of research, what are some of your goals for ICS?

My role is to advance the research mission of the school in any way I can. We have one of the best computer science schools in the nation, with excellent faculty leading cutting-edge research. I believe that we are uniquely positioned to address current challenges in areas such as big data, AI, machine learning, human-computer interaction and cybersecurity, with our three departments: Computer Science, Informatics and Statistics.

What are some challenges you hope to tackle in this role?

Our main priority is attracting first-class faculty and excellent graduate students. The question for department leadership is how to compete for top faculty and students who are also sought after by other top programs in the nation. I see several paths.

The first is recruiting distinguished faculty who are in the middle of their careers at other institutions. One vehicle for accomplishing this is through our endowed Bren Chairs for internationally recognized leaders in emerging areas of information and computer sciences. Another path is engaging far more in large multidisciplinary, multi-institution proposals that have visibility (for example, current NSF AI centers). And we should also create an environment for our existing faculty and research activities that will enhance their productivity and quality of work. One initiative I support is providing more administrative assistance to faculty to relieve them of


“ ICS is uniquely positioned to address current challenges in areas such as big data, AI, machine learning, human-computer interaction and cybersecurity with our three departments. ”

– Rina Dechter

bureaucratic tasks. Another is fostering increased collaboration among faculty by creating a pleasant social atmosphere and encouraging meetings inside and between different groups throughout the school.

Are there certain areas where you’d like to focus more attention?

One priority has been to develop effective support mechanisms for increasing the number of large collaborative grant proposals involving ICS faculty. A step in this direction has been the recent hiring of an ICS research development director to help prepare such proposals, which require a lot of effort in coordinating with multiple institutions and many researchers, and to deal with requirements that are not related directly to research. Bringing on this new director has increased our research development capacity so faculty members can focus on what they do best: the research components of the proposals.

Another area I’m focused on is finding a better balance between teaching and research by reducing the teaching load for faculty who shoulder more of the research mission of the school. Specifically, I am working to more sustainably balance the teaching load of faculty engaged in preparing big grants or who lead large research centers. We must recognize faculty who are engaged in larger projects and how they contribute to the whole school by showcasing our strengths and real-world impact. 

FACULTY HIGHLIGHTS



Photo courtesy of Technical University of Braunschweig.

Franz Wins ACM Chuck Thacker Breakthrough in Computing Award

The Association for Computing Machinery has selected Chancellor's Professor of Computer Science Michael Franz to receive the ACM Charles P. "Chuck" Thacker Breakthrough in Computing Award. Franz was recognized for his development of just-in-time compilation techniques that enable fast and feature-rich services on the internet, including such widely used applications as Gmail and Facebook.

"This is a wonderful recognition," says Franz. "Without fast compilation of dynamic languages, most of the services that we now take for granted on the web could not exist today."

Franz first started working in this area as a Ph.D. student in the 1990s. "It is a little bit of an irony in fact that when I first arrived at UCI in the late 1990s, there were many senior faculty trying to nudge me away from working on topics related to compilers and just-in-time compilation, because, as one senior colleague put it, 'Everything that can possibly be discovered in this field has already been discovered.' Of course, as we know now,

nothing could have been further from the truth."

As noted in the award announcement, by inventing a new compilation technique and using it to develop a JIT compiler for JavaScript — which was incorporated into the Firefox browser through a collaboration with Mozilla — Franz enabled massive growth in the use of JavaScript, now one of the world's most heavily used programming languages.

"We all use web-based applications every day and they are now so prevalent that we often forget how revolutionary they were when they were first introduced," says ACM President Gabriele Kotsis. "Michael Franz's work certainly fits the Thacker Award's criteria for 'leapfrog contributions to computing ideas and technologies.' Franz displayed foresight in working with Mozilla to implement his ideas on their browser and in making his technology open source, so that it could be continually refined and adapted by developers worldwide."

Franz says, "I want to recognize all the fantastic students who have worked with me at UCI over the years — overall, I have graduated 34 Ph.D.s as their primary adviser. While it is usually the professor who gets all the glory, my collaborators on most of this groundbreaking research were UCI graduate students and postdocs. I am very grateful for their contributions, and it has been both a joy and a privilege to serve as their adviser."

Franz also recognizes the University of California: "I need to acknowledge the wisdom of the University of California, which agreed to donate the intellectual property rights to some of our inventions to the open-source community." Franz and his Ph.D. student Andreas Gal received a U.S. patent on the compiler technology that underlies the original JIT compiler in Firefox, a patent owned by UC. "By allowing this technology to be used for free without royalties, UC played a crucial part in making the internet a more open and inclusive place and bridging the digital divide between rich and poor," says Franz. "We can all be proud of that."

As a recipient of the award, Franz is invited to give the ACM Breakthrough Lecture at a major upcoming ACM conference. He will also receive a \$100,000 cash prize, with financial support provided by Microsoft.

"Michael Franz's work on just-in-time

compilation is a great choice for the Breakthrough in Computing honor,” says Eric Horvitz, Microsoft’s chief scientific officer. “His work has been transformative, enabling today’s rich web experiences by allowing websites to execute sophisticated, interactive programs nearly instantaneously. Michael Franz’s insights, and his successful application of those insights, have had tremendous real-world impact.”

\$5 Million in NSF Funding Boosts Development of XR Platform for Workforce Training

Informatics Professor Kylie Peppler is part of a multi-organizational team, led by Professor Karthik Ramani of Purdue University, that aims to greatly improve manufacturing workforce education with Skill-XR, a new training platform that leverages AR, VR and mixed reality (XR) applications. Work on the platform started in 2019 with \$1 million in funding from the National Science Foundation (NSF) through its Convergence Accelerator program. “This program is about bringing together multiple fields to solve pressing problems that are facing the U.S. today,” says Peppler. “This is meant to transform industry to get new tools into their hands.” In 2019, the team’s Skill-LeARn platform was one of 43 projects to receive Phase I funding. Now, the team’s work is one of nine projects transitioning to Phase II. Over the next two years, they will receive an additional \$5 million in funding to advance the current iteration of the project, “Skill-XR: An Affordable and Scalable X-Reality (XR) Platform for Skills Training and Analytics in Manufacturing Workforce Education.”



UCI-Led Project Seeks to Combat Wildfires

A UC Irvine-led team has received \$3.6 million over three years for a project that

uses science and engineering to help California fight wildfires. The funding comes from the UC Laboratory Fees Research Program competition, a contest designed to promote the development of multicampus projects and collaborations that advance the missions of the national laboratories and University of California. The research will integrate physics, chemistry, engineering, computer science and ecology to conduct and disseminate information supporting an increase in the pace and scale of prescribed fires in the region. Computer Science Professors Nalini Venkatasubramanian and Sharad Mehrotra are co-PIs on the grant with Tirtha Banerjee, an assistant professor of civil and environmental engineering. “Our team will design information-centric platforms that can integrate live sensing data, simulation/modeling technologies and intelligent analytics,” explains Venkatasubramanian. “Fire agencies can use these tools to intelligently plan and tune fire management strategies for our communities.”



Stern Selected as ISBA Fellow

Chancellor’s Professor of Statistics Hal Stern was one of nine new fellows selected by the International Society of Bayesian Analysis (ISBA) in 2020. Fellows are exceptional ISBA members who have made outstanding contributions to the field of statistics through research, teaching or service to the scientific community and our society. Stern, former ICS dean and current UCI provost and executive vice chancellor, was recognized for extraordinary contributions to Bayesian theory and methodology, for advancing Bayesian thinking and the principled use of Bayesian methods in a wide range of disciplines, and for his outstanding service to the profession through editorial and administrative positions.



Baldi's Book Explores 'Deep Learning in Science'

Outlining the foundations of artificial intelligence using first principles, Distinguished Professor of Computer Science Pierre Baldi's latest book, *Deep Learning in Science* (Cambridge University Press, 2021), reveals the connections between deep learning and neuroscience, explores applications in the natural sciences, and sets the record straight on fact versus fads in AI. After introducing "carbon-based" versus "silicon-based" computing, he then delves into the building blocks of AI before outlining applications in physics, chemistry and biomedicine.



Malek Receives Test of Time Award for Work on Self-Adaptive Software Systems

At the 2020 ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2020), Informatics Professor Sam Malek received the Test of Time Award in recognition of a paper he co-authored a decade ago with his then Ph.D. students Ahmed M. Elkhodary and Naeem Esfahani. That work, "FUSION: A Framework for Engineering Self-Tuning Self-Adaptive Software Systems," introduced a novel framework for constructing systems that can autonomously

change their behavior at runtime to achieve certain objectives, such as mitigating security attacks or optimizing resource usage.

Berrocal Elected Chair of ISBA Section in Environmental Sciences



Statistics Associate Professor Veronica Berrocal was elected to a three-year term as chair of the Section in Environmental Sciences (EnviBayes) of the International Society of Bayesian

Analysis (ISBA). EnviBayes promotes research and education in Bayesian methods in environmental sciences by organizing conferences and workshops and developing short courses for students and practitioners. It also encourages academics to work with environmental and public health organizations. During her term leading EnviBayes, Berrocal hopes to grow the section and increase its visibility. "Ultimately, I'd like for environmental statisticians, Bayesians and non-, to have a stronger presence and play a greater role not only in pushing environmental sciences research forward but also in informing environmental policies in protection of the environment, the Earth and human health," says Berrocal.

ICS Researchers Receive \$1.6M DARPA Grant to Advance Machine Learning

The Defense Advanced Research Projects Agency (DARPA) has started a new program focused on the Science of Artificial Intelligence and Learning for Open-world Novelty (SAIL-ON). The SAIL-ON program, with help from ICS researchers, aims to develop AI systems that can act appropriately in situations that were not previously encountered. ICS Professors Stephan Mandt and Padhraic Smyth, along with Professor of Cognitive Sciences Jeffrey Krichmar, are part of a research team headed by SRI International and also involving the University of Washington. UCI will be awarded \$1.6 million for 3 1/2 years,

funding one postdoctoral fellow and three Ph.D. students who will conduct fundamental research on open-world novelty detection for AI and machine learning systems.

ICS Team Explores Distance-Based Mental Health Services for Minority Students



Informatics Professor Rebecca Black partnered with Gloria Washington, assistant professor of computer science at Howard University, on a new project, "Distance Based Support for HBCU and HSI Students." The two researchers, along

with informatics doctoral student Lucretia Williams, are leading a team that aims to develop and study AI-supported online communities in place of in-person engagements for students at Howard University, a Historically Black College/University, and UCI, a Hispanic-Serving Institution. These online communities will provide tangible and useful resources for students in need of mental health services.

Singh Receives NSF Grant to Explore Vulnerabilities in Machine Learning Explanations



ICS researchers have been awarded an NSF grant on machine learning explanations in collaboration with colleagues from Harvard University. The three-year, \$450,000 grant, "Post hoc Explanations in the Wild: Exposing Vulnerabilities and

Ensuring Robustness," will support new research into machine learning interpretability that focuses on understanding how adversaries can manipulate explanation techniques. The goal is to then better defend against such attacks. "Given the lack of

interpretability in modern machine learning techniques, many approaches have been introduced (some by us, like LIME) in explaining why the machine learning models work," says Computer Science Professor Sameer Singh, who is leading the project. "However, before these techniques can be deployed in the real world, especially in applications that affect lives directly, we need to understand the ways in which the explanation techniques might themselves be misleading, and what the potential impact of that could be on users."

Dogucu Recognized as Teach Access Curriculum Development Awardee



Assistant Professor of Teaching Mine Dogucu was named one of 15 Teach Access Curriculum Development Awardees for 2021-2022. Teach Access is a collaboration among educators, industry leaders and disability advocacy organizations that aims to support faculty across the country

teaching accessible technology design and development to undergraduates. The Curriculum Development Award comes with \$5,000 in funding for creating modules, presentations, exercises or curriculum enhancements that introduce the fundamentals of accessible design in classroom-based courses. "I will use the award to develop teaching materials on accessibility in data science," says Dogucu, noting that the materials will be taught as part of the Seminar in Data Science, a course required for all data science majors at UCI.

Imani Awarded Two Grants to Study Brain-Inspired Hyperdimensional Computing

Assistant Professor of Computer Science Mohsen Imani, as director of the Bio-Inspired Architecture and Systems Laboratory (BIASLab),

is working on a wide range of problems in the areas of brain-inspired computing, machine learning and embedded systems. “Our research goal is to design real-time, robust and transparent cognitive learning platforms that closely mimic brain properties,” says Imani. “We are also designing a secure and scalable learning framework for distributed learning/computing over a swarm of devices in IoT systems.”

Based on this work, Imani received two grants totaling more than \$400,000 in 2021. He received \$310,000 from Semiconductor Research Corp. for a multiyear project, “A Hyperdimensional Learning System for Efficient, Robust and Secure Online Learning.” He also received \$92,000 from Cisco for the development of EdgeHD, a brain-inspired hyperdimensional computing system.

Franz and Tsudik Elected to Inaugural Cohort of IFIP Fellows

The International Federation for Information Processing (IFIP) announced its first cohort of 18 fellows in 2020, which included Chancellor’s Professor of Computer Science Michael Franz and Distinguished Professor of Computer Science Gene Tsudik for their substantial and enduring contributions to the information and communications technology industry. The fellow award recognizes individuals of the highest professional standing and expertise in one of IFIP’s constituent societies who have also contributed directly to IFIP – a nongovernmental, nonprofit umbrella organization for national societies working in the field of information processing.

Tsudik was named a fellow for his significant contributions to cybersecurity and privacy, particularly through the development of the highly efficient provably secure PDP (provable data possession) technique based entirely on symmetric key cryptography, as well as his group signature and companion identity escrow scheme. Franz was recognized for his breakthrough contributions through his invention of trace-tree dynamic compilation, particularly suited for dynamic languages like JavaScript, and his technological leadership in bringing this technology to the open-source Firefox browser.

Mazmanian’s Book Offers a New Perspective on Technology and the Realities of Work-Life Balance



When Melissa Mazmanian first set out to study the effect of technology on the “life” side of the work-life balance, she didn’t realize how much her focus would branch out beyond technology use. The associate professor of informatics designed and conducted an ethnographic study with her colleague at

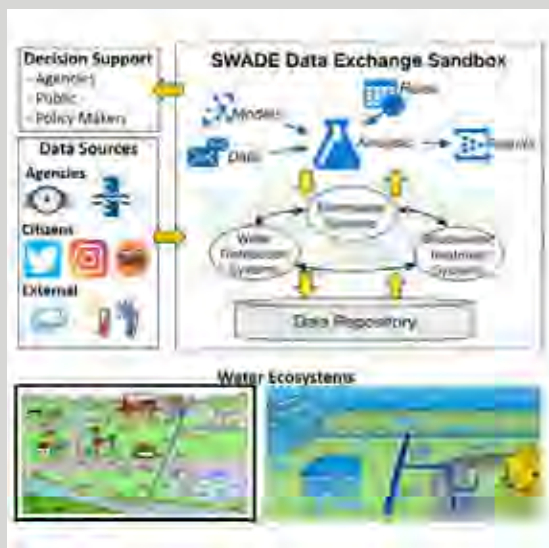
the University of Southern California, Christine M. Beckman, professor and Price Family Chair in Social Innovation in the Sol Price School of Public Policy. Their book, *Dreams of the Overworked: Living, Working and Parenting in the Digital Age* (Stanford University Press, 2020), details what they learned while embedding themselves into the daily lives of nine Southern California families.



Mandt Collaborates With Disney Research to Develop AI-Enhanced Video Compression Model

A new artificial intelligence-enhanced video compression model developed by computer scientists at UCI and Disney Research has demonstrated that deep learning can compete against established video compression technology. Unveiling their work in December 2019 at the Conference on Neural Information Processing Systems in Vancouver, British Columbia, the UCI/Disney Research team members showed that their compressor –

while still in an early phase – yielded less distortion and significantly smaller bits-per-pixel rates than classical coding-decoding algorithms such as H.265 when trained on specialized video content and achieved comparable results on downscaled, publicly available YouTube videos. “Ultimately, every video compression approach works on a trade-off,” says research team leader Stephan Mandt, UCI assistant professor of computer science, who began the project while employed at Disney Research. “If I’m allowing for larger file sizes, then I can have better image quality. If I want to have a short, really small file size, then I have to tolerate some errors. The hope is that our neural network-based approach does a better trade-off overall between file size and quality.”



ICS Researchers Receive \$1.5 Million NSF Grant for Smart Water Infrastructures

Can emerging technologies help alleviate water reliability concerns in various communities by minimizing water waste, supporting conservation and providing a resilient supply of safe drinking water? This is the question ICS researchers are working to address with a \$1.5 million grant from the National Science Foundation through its Smart and Connected Communities (S&CC) program. The project, “Creating an Extensible Data Exchange and Analytics Sandbox for Smart Water Infrastructures,” is being

led by Computer Science Professor Nalini Venkatasubramanian. “We hope to develop next-generation water infrastructures using a data-centric approach, where data integration and analysis from multiple sources can help improve resilience,” she says. The goal is to foster greater interoperability between drinking water, stormwater and wastewater infrastructures.

Qu Works to Enhance the Detection of Invasive Cancers Using Medical Imaging Data



Chancellor's Professor of Statistics Annie Qu and her team are developing methods and tools to enhance the detection of early stage invasive cancers using medical imaging data. Common breast cancer imaging techniques, such as mammography, are not

able to differentiate high-risk breast cancer from low-risk breast cancer cases, which can lead to an inaccurate diagnosis and prognosis, and prevents potential invasive cancer patients from receiving early cancer intervention and treatment. Motivated by multimodal multiphoton optical breast cancer imaging data produced by the Boppart Lab at the University of Illinois at Urbana-Champaign and the Carle Foundation Hospital in Illinois, Professor Qu is exploring how to leverage optical imaging data produced by the newly developed multiphoton microscopes.

Tanenbaum Selected as Ambassador of Innovation and as Dynamic Womxn of UCI

In December 2020, UCI Beall Applied Innovation named its second cohort of Faculty Innovation Fellows, and Informatics Associate Professor Theresa Tanenbaum was among the 18 faculty members selected to serve as “ambassadors of innovation.” The program, now totaling 35 members between the two cohorts, recognizes UCI faculty conducting research with real-world impact. The fellowship is a two-year appointment that involves participating in

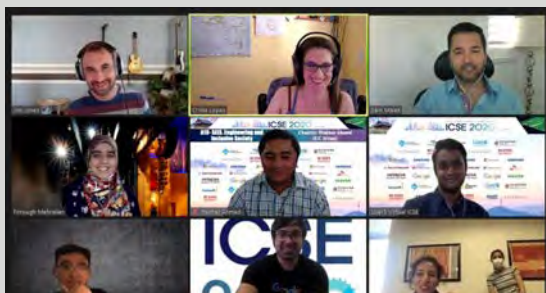
lectures, workshops and retreats to encourage increased interdisciplinary collaboration across campus, fostering innovative work that can positively impact the broader community. In 2021, Tanenbaum also received an Outstanding Social Justice Activist award from the Dynamic Womxn of UCI, which honors individuals who have demonstrated a commitment to working on anti-sexist endeavors and who work to end multiple forms of oppression.

Amiri Sani Develops Mobile System for Secure Legal Contracts



Assistant Professor of Computer Science Ardan Amiri Sani and his students (Ph.D. candidate Saeed Mirzamohammadi and Ph.D. student Myles Liu) collaborated with Sharad Agarwal,

principal researcher at Microsoft Research, as well as Assistant Professor of Law Sung Eun (Summer) Kim and J.D. candidate Ann Huang from UCI's School of Law to develop Tabellion. This new system lets users securely sign legal contracts electronically on mobile devices such as smartphones and tablets. "Tabellion will significantly reduce the time to achieve a signed contract and reduce disputes on the authenticity of signed contracts," says Agarwal. "We expect our work to enable a variety of commerce to happen more quickly and easily."



Lopes and Colleagues Develop Virtual Conference Portal

Serving as virtualization chair for the 42nd ACM/IEEE International Conference on Software Engineering (ICSE), Informatics

Professor Crista Lopes pulled together a globally dispersed team of almost 50 volunteers and moved ICSE from the originally planned location of Seoul, South Korea, to the homes of researchers everywhere. Leveraging an innovative virtual conference portal she is developing with support from the National Science Foundation, she helped organize a live event for five days that attracted over 1,300 people from around the world.

Participants attended the conference through Clowdr, the Web-based virtual conference platform Lopes has designed with Jonathan Bell of Northeastern University and Benjamin Pierce of the University of Pennsylvania. With funding from their NSF grant, "RAPID: Virtual Conference Platform," they quickly found a way to support several forms of synchronous interaction among participants by integrating the necessary technological pieces into a single, easy-to-use web interface. In order to be geographically inclusive, the conference was organized around the concept of time bands – three-hour periods where two-thirds of the world is awake. Faculty and students from UCI's Institute for Software Research (ISR) led the livestreaming of the sessions that fell in the Pacific time band.

Dechter Receives 2020 Classic Paper Award

Distinguished Professor of Computer Science Rina Dechter received the 2020 Classic Paper Award from the *Artificial Intelligence Journal*. Given to papers "published at least 15 calendar years ago in the *AI Journal* that are exceptional in their significance and impact," the award recognized "Temporal Constraint Networks," which Dechter co-authored with Itay Meiri and Judea Pearl in 1991. The work introduced a new framework called the temporal constraint satisfaction problem (TCSP). "The TCSP, and the polytime solvable special case of simple (non-disjunctive) temporal problems, have gained widespread use in planning and scheduling and other applications," notes the award announcement. "The simple and elegant problem formulation of this paper also inspired subsequent work on temporal reasoning with temporal uncertainty, preferences and other extensions."

Mehrotra Named IEEE Fellow

On Dec. 9, 2020, IEEE announced the select group of members it would recognize in 2021 as IEEE Fellows. Less than 0.1% of voting members are selected annually for this member grade elevation, and part of this select group for 2021 was Computer Science Professor Sharad Mehrotra, who was recognized for “contributions to the fields of data management and multimedia information retrieval.”



Levorato, Mandt Receive NSF/Intel Grant for Autonomous UAVs

Computer Science Professors Marco Levorato and Stephan Mandt have received a \$450,000 award through a National Science Foundation and Intel partnership for Machine Learning for Wireless Networking Systems (MLWiNS). Their project, “Ultra-Reliable Collaborative Computing for Autonomous Unmanned Aerial Vehicles,” which will run through June 2023, aims to develop techniques to make distributed computing much more reliable in the context of UAV systems. Their research should help UAVs play an increasing role in areas such as urban and infrastructure monitoring, precision agriculture, and delivery services.

VMware Supports Burtsev’s Next-Generation Safe Operating System

Assistant Professor of Computer Science Anton Burtsev received a \$40,000 gift from VMware Research in 2020 to support RedLeaf, a new operating system developed from scratch in Rust. This is the second gift from VMware that supports the development of RedLeaf, a project that is funded by NSF, VMware and Intel. RedLeaf was developed by Burtsev and his Mars Research Group (mars-research.github.io/projects/redleaf) with the goal of exploring the impact of language safety on operating system organization.



Chen’s Research on Security Vulnerability in Self-Driving Cars Unveils Achilles’ Heel of Sensor Fusion

At the 2020 Usenix Security Symposium, Computer Science Assistant Professor Qi Alfred Chen and his research team presented a first-of-its-kind study revealing a “take-over vulnerability” in self-driving car systems that could result in serious accidents. Today’s high-level (level-4) self-driving car systems predominantly rely on sensor fusion algorithms that combine sensor inputs from GPS, LiDAR and IMU to achieve robust localization. “We discovered that the most widely adopted sensor fusion algorithms exhibit a takeover vulnerability to GPS spoofing attacks,” says computer science Ph.D. student Junjie Shen. “By exploiting this vulnerability, the attacker can use existing GPS spoofing techniques to quickly introduce a lateral deviation as large as 10 meters in the localization estimation, eventually causing the victim self-driving car to drive off or on the wrong side of the road.”

Zheng Helps UCI Leverage Health Data



UCI’s Institute for Clinical and Translational Science (ICTS) is part of a nationwide Clinical and Translational Science Awards program aimed at advancing scientific discovery and medical breakthroughs, and the

ICTS Center for Biomedical Informatics (CBMI) is a key enabler of this work. “There has always been a high demand for medical data, particularly patient

records and imaging data,” says Informatics Professor Kai Zheng, who serves as the director of CBMI. “This year, we have made a lot of progress in providing access to our health system data [and] establishing UCI as a place where health and data science really get together and produce something magnificent.” CBMI has not only helped make UCI’s health data more accessible but has also held a series of virtual workshops to ensure UCI researchers understand how to access that real-world data and apply it to their work.

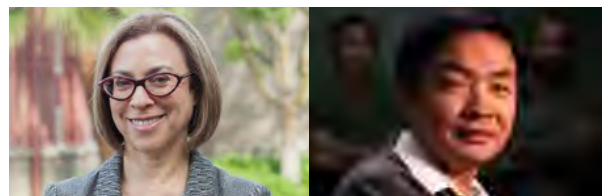
Singh Awarded Fairness in AI Grant From NSF and Amazon

In an effort to contribute to the trustworthiness of AI systems, the National Science Foundation (NSF) and Amazon partnered in 2019 to start funding projects through the Fairness in Artificial Intelligence program. Since the program first launched, 21 projects have been funded, including “Towards Adaptive and Interactive Post Hoc Explanations,” a collaboration between UCI, Harvard University and the University of Chicago. The project aims to develop a novel framework for generating adaptive explanations of ML models, allowing for interactive communication, which will help people better understand the decisions being made for and about them. “UCI will be focused on creating explanations that adapt to the user’s need – that is, automatically creating custom explanations depending on what subgroups they are interested in, or what their level of expertise is in the ML application,” says Associate Professor of Computer Science Sameer Singh.

Hayes and Mehrotra Named Distinguished ACM Members

In December 2020, the Association for Computing Machinery (ACM) introduced 64 new Distinguished Members, selected by their peers for outstanding scientific contributions that “propel the digital age.” Among the 2020 inductees were two ICS faculty members: Gillian Hayes, Robert A. and Barbara L. Kleist Professor of Informatics, and Sharad Mehrotra, professor of computer science. Both were recognized for outstanding scientific contributions to

computing. Hayes, who currently serves as vice provost for graduate education and dean of the Graduate Division at UCI, was specifically acknowledged for her focus on inclusive and ethical design, particularly for assistive and educational technologies, and how it empowers diverse groups of people. Mehrotra was praised for his expertise in data management and distributed systems, and for pioneering the database-as-a-service concept.



Leveraging Twitter Data for Real-Time Public Health Responses to Coronavirus

To gain a better understanding of the impacts of COVID-19, Informatics Professor Gloria Mark and Computer Science Professor Chen Li have teamed up with Suellen Hopfer from UCI’s School of Public Health on a new NSF-funded grant, “Leveraging Twitter Data for Real-time Public Health Responses to Coronavirus: Identifying Affective Desensitization, Loneliness and Depression, and Trust.” Working with ICS students Qiushi Bai, Ted Grover and Yicong Huang, along with public health students Emilia Fields and Magdalen Ramirez, the researchers leveraged the immediacy of Twitter data to provide signals in real time of citizen responses to the pandemic.

Franz Named 2020 AAAS Fellow

Chancellor’s Professor of Computer Science Michael Franz was one of the nine UCI researchers named 2020 fellows of the American Association for the Advancement of Science (AAAS), the world’s largest general scientific society. A total of 443 AAAS members were honored in 2020 for their efforts to further science or its applications. Franz was recognized for his contributions to the areas of just-in-time compilation and optimization and techniques for computer security, as well as for directing UCI’s Secure Systems and Software Laboratory and being a leading authority on cybersecurity.

Epstein Receives ICTS Pilot Studies Award



On May 5, 2021, the UCI Institute for Clinical and Translational Science (ICTS) announced the eight recipients of its Pilot Studies Award, which was “designed to support exceptionally innovative

and/or unconventional research projects that have the potential to create or overturn fundamental paradigms.” Among the 2021 ICTS Pilot Awardees was Assistant Professor of Informatics Daniel Epstein for his research into a set of apps to support patients in tapering off of psychiatric drugs. Specifically, Epstein’s project is a feasibility study of an innovative informatics application that facilitates tapering of psychiatric medications through patient-reported outcomes and shared decision making.

Maestro: A New Platform for Building Reliable and Robust AI Systems



Computer Science Professors Sameer Singh and Sergio Gago-Masagué, in collaboration with Assistant Professor Zhou (Joe) Li in UCI’s Henry Samueli School of

Engineering, have been working on a National Science Foundation (NSF) Early Concept Grants for Exploratory Research (EAGER) project, “Multi-Level Attack and Defense Simulation Environment for Artificial Intelligence Education and Research.”

According to Gago-Masagué, “This project will provide a platform – Maestro – that will help advance both AI cybersecurity research and education, while also allowing implementation of active learning strategies through gamification in AI project-based courses.” The team has spent the past year developing Maestro, and they plan to test it during winter and spring 2022 in the course CS 175: Project in Artificial Intelligence.

Nardi Receives 2020 ACM SIGCHI Social Impact Award



Informatics Professor Emerita Bonnie Nardi was one of two recipients of the 2020 Social Impact Award given annually by the Association for Computing Machinery’s Special Interest Group on Computer Human

Interaction (ACM SIGCHI). The award recognizes individuals who apply HCI research to pressing social needs, and Nardi’s research into the political economy and sustainability has challenged the status quo, providing a new perspective on the role of computing in understanding and dealing with real-world limits. The *Communications of the ACM* paper she co-authored with a multidisciplinary group of researchers, including Informatics Professor Bill Tomlinson, delves into the relationship between fundamental planetary limits and computing research.

Connected Learning Lab to Explore Pivotal Transitions in STEM Learning, Career Development



Connected Learning Lab (CCL) Director Mimi Ito, CLL Associate Director Vera Michalchik and Informatics Professor Kylie Pepler have received a STEM Next Opportunity Fund grant for

\$250,000 through the Gordon and Betty Moore Foundation for their project, “Connecting Middle School Girls’ STEM Learning Across Settings.” The project is connected to another STEM Next project, the Million Girl Moonshot, which aims to engage 1 million girls in STEM learning over the next five years through afterschool and summer programs. A second CLL project is the result of a \$100,000 gift awarded to Ito and Michalchik from Roadtrip Nation and the Strada Education Network. Ito and Michalchik, along with CLL Senior Research Manager Amanda Wortman, will be evaluating the new Roadtrip Nation Experience online career-exploration program. This work builds on current CLL work, funded by the Gates Foundation under the Equitable Futures initiative, which is looking at community-based nonprofits that support kids’ career development.



In 2021, four faculty members from the Donald Bren School of Information and Computer Sciences received the prestigious National Science Foundation's Faculty Early Career Development (CAREER) award: Stacy Branham and Roderic Crooks from the Department of Informatics, and Stephan Mandt and Sameer Singh from the Department of Computer Science. The CAREER program supports junior faculty serving as academic role models in research and education and leading advances in their field of interest as they "build a firm foundation for a lifetime of leadership in integrating education and research."

Accessible Computing for Independent Living

Assistant Professor of Informatics Stacy Branham received the award for her project, "Advancing Computing for Parents with Vision Impairments." The work will provide an empirical foundation for developing technologies for people with disabilities that supports them in their everyday lives. It will identify challenges that people with vision impairments face in caring for others and will develop novel interaction models for voice assistants to facilitate parent-child bonding and

learning as parents who are blind read with their young children. "What I love about this research project," explains Branham, "is that it addresses both a research and practice gap related to technology needs of people with disabilities more holistically."

In addition, the project aims to help produce future software developers skilled in building innovative accessible technologies. Branham and her team, which includes two students with vision impairments, will be partnering with students enrolled in the AP Computer Science course at Woodbridge High School (in Irvine) in collaboration with community partners from the Dayle McIntosh Center, the biggest independent living center for people with disabilities in California.

"On the one hand, students in my research lab — many of whom have disabilities — will be developing accessible voice technologies with blind parents. On the other, students in mainstream classrooms — most of whom do not have disabilities — will be learning about accessible software development with blind technologists," explains Branham. "Together, these initiatives support my lab's vision for a future where everyday technologies are designed upfront to integrate rather than ostracize people with disabilities."

Data-Intensive Tech & Community Organizing

Assistant Professor of Informatics Roderic Crooks was recognized for his research into “Community Organizing for Datafied Worlds.” The award funding will help Crooks as he engages with working-class communities of color by collaborating with community organizers to better understand data activism and the social consequence of data-intensive technologies.

“This project begins with a simple premise,” says Crooks. “What if academics acknowledged what working-class people of color know about the data-intensive technologies already deployed in our communities?” Building off that acknowledgement, Crooks has organized the projects into four main parts: (1) research data practices of community organizers engaged with technology; (2) co-design with community organizers as partners; (3) construct a platform to support academic research on community organizers; and (4) promote data literacy and K-12 data science education through outreach in working-class communities of color.

Crooks stresses that every aspect of this project has been designed to be inclusive of working-class communities of color and both their ongoing, historical struggles for full citizenship in American society and their more recent struggles for equitable forms of technology. “Contemporary community organizers in working-class communities of color, like other kinds of data professionals, create, aggregate and visualize data in order to inform organizational activities and to communicate with various audiences,” he says. “Paradoxically, they also criticize – via their work – the design, development and use of data-intensive technologies in a variety of domains, including law enforcement, public education, public health and pandemic response.” Crooks hopes to give academic researchers “tools to work with community organizers and other kinds of community-based institutions more ethically, more empathetically, more carefully.”

Resource-Efficient Machine Learning

Assistant Professor of Computer Science Stephan Mandt, through his project, “Variational Inference for Resource-Efficient Learning,” aims to address the resource inefficiencies of deep neural networks. Such inefficiencies have become a major roadblock for progress in AI. “For example, recent models for natural language

generation contain more than a hundred billion parameters,” Mandt says. “Training such models can cost enormous amounts of electric power – nearly five times the lifetime carbon dioxide emissions of a typical car.”


The innovative aspect of Mandt’s approach toward resource-efficient deep learning is using a unified set of mathematical and statistical methods: He views models and algorithms through the lens of information theory, making it possible to formally quantify and minimize the required resources. Outcomes of his project include new methods for compressing both neural networks and their data as well as new algorithms for faster training. “Making deep learning more resource efficient is of enormous societal relevance,” he says. “Algorithms will make better decisions with less data, making them more reliable in safety-critical areas such as autonomous driving. Also, more data can be processed with less energy and storage.”

In addition, Mandt plans to create a new machine learning track for the UCI Office of Access and Inclusion’s Summer Transition Program that seeks to support the careers of historically underrepresented groups.

Addressing NLP Vulnerabilities

Recent advances in machine learning have led to an increase in natural language processing applications, but NLP models are far from perfect. Assistant Professor of Computer Science Sameer Singh is focused on “Detecting, Understanding, and Fixing Vulnerabilities in Natural Language Processing Models.”

Singh hopes to make it easier to address NLP vulnerabilities by developing several techniques in support of more robust training and evaluation pipelines. He also plans to engage with the developers of NLP models in academia and industry to develop a data science curriculum for K-12 education, particularly for students from underrepresented communities.

“NLP has been used in lots of important applications such as detecting hate speech, abuse and misinformation,” says Singh. “These are applications in which mistakes by the models can result not only in a poor user experience but also bullying, abuse, and even misguiding and changing people’s views.” Singh hopes to improve these important NLP applications by providing tools that help practitioners build models that are free of errors. 



A person with a visual disability* using Aira to access visual displays in an airport. (Aira Tech Corp.)

* Visit bit.ly/sigaccess to learn more about language and disability.

Expanding Technology Access for People with Visual Disabilities

UCI researchers collaborate with Toyota to provide Aira, a visual interpreter service, to local community members.

The pandemic has brought about a host of challenges, with social distancing presenting difficulties for everyone – especially for those with a visual disability. How do you know your proximity to people if you can't see them? How do you get assistance from others while remaining 6 feet apart? These are questions Assistant Professor of Informatics Stacy Branham decided to address together with Toyota Motor North America (TMNA).

"People with visual disabilities often need sighted assistance in the grocery store, but that doesn't work with social distancing," Branham says, noting that food insecurity was just one of many concerns highlighted in a survey of adults who are blind or have low vision. "Some people who are blind normally order groceries online, but these services quickly became completely backed up with increased demand by the general population."

A focus of Branham's research in UCI's Donald Bren School of Information and Computer Sciences is accessible computing, and with funding from Toyota, she has been leading an effort to better support people with visual disabilities during the pandemic.

A Pivot in Research

Prior to the pandemic, Toyota was engaged with UCI and the University of Maryland, Baltimore County (UMBC) on a project to develop technologies to support individuals with

disabilities. “We’ve been working together to find ways to help improve accessibility,” explains Mike Goss, general manager of Toyota Social Innovation. “With the pandemic, and like most projects, we wanted to find a way to pivot to address immediate needs and improve access.”

Branham started reaching out to the project’s advisory board members for potential ideas. When she spoke with UMBC graduate research assistant Ali Abdolrahmani, who has a visual disability and is actively involved in the Toyota Mobility Project, he told her about Aira, a visual interpreter service that lets users call a sighted remote assistant.


Access to Aira

Aira (aira.io) is a smartphone app that connects people who are blind and low-vision to highly

trained, remotely located agents who can provide immediate visual assistance. Abdolrahmani has used the service for a variety of reasons, from locating a building number and doorbell to finding a dropped AirPods to changing the temperature on his home’s digital thermostat. “The very good thing about Aira is, because the agents are trained, they know how to communicate with blind and visually impaired people,” he says.

However, because Aira requires a smartphone and good connectivity, it’s not universally accessible. While the service is free in five-minute increments, a paid subscription is often needed for longer, continued use. These obstacles are increasingly problematic as demand for the service is growing at a time when more and more people are experiencing economic hardship.

“People with visual disabilities are unemployed and underemployed at much higher rates than



“One of my personal goals is to develop strong ties with the community ... so that we can work together to bring about the sort of technological innovations that people with disabilities are calling for.”

- Stacy Branham
Informatics Professor

Professor Stacy Branham (third from left) worked with UCI students Hipolito Ruiz, Andrew Tumang, Mayra Cortez, Emory Edwards and Maya Gupta on the Toyota Mobility Project.

the sighted population, and I'm sure during a pandemic this is only exacerbated," says Branham.

So, after talking with Abdolrahmani, she started work to increase access to Aira. With Toyota funds, UCI purchased 600 unlimited Aira accounts for one year and secured iPhones to include with the subscription if needed. In addition, Aira donated 100 Samsung J8 phones to support Black people with visual disabilities.

"Since the pandemic started, Aira usage has increased for a range of activities, including social distancing, assistance in setting up home electronics, and various activities that can benefit from a visual interpreter," says Troy Otilio, CEO of Aira. "This project aligns closely with Aira's mission to make the world more accessible for the blind and low-vision community."

Abdolrahmani is excited to gain unlimited access to the service through the project, but he's even more excited to provide Aira to those who wouldn't otherwise have access. "We have this opportunity to provide equal access to services for underprivileged, minority groups of people in society ... which aligns with the main mission of our research team," he says.

A New Partnership

A collaboration was formed with a local independent living center, the Dayle McIntosh Center (DMC, daylemc.org), to integrate Aira in the community. DMC is now offering a free Aira subscription to its members as well as a free smartphone for those in need. Branham's team is offering tech support for setting up the phones and service, and will also conduct surveys to assess Aira's impact during the pandemic.

"People with visual disabilities should be able to decide for themselves whether or not Aira helps," says Branham. "They should be able to have access that's not prohibited by their lack of money or access to technology." This project removes financial and technological barriers and, by surveying users, aims to quantify the impact.

"I'm so thankful to Toyota and UCI for partnering with us on this project," says Larry Wanger, director of DMC, who has been using Aira since 2017. His first experience with the service was at an airport, where he used it to find his gate. "It was pretty amazing," he says,

recalling the independence he felt in not needing to ask anyone at the airport for assistance. "It truly impacts people's lives."

Wanger hopes that the data collected will give DMC the evidence it needs to push for additional funding to close the technology gap and improve the daily lives of an underserved subcommunity within the visual disabilities community. "I hope this project helps demonstrate to local county officials that offering Aira is extremely helpful [by] showcasing the various needs and uses," says Wanger.

Campus Support


Branham also reached out to UCI's Office of Equal Opportunity and Diversity (OEOD) to ask about offering Aira to students and faculty with visual disabilities. Andrew Berk, the ADA coordinator at OEOD, was thrilled to help facilitate this effort.

"I am excited about Aira because it keeps UCI on the cutting edge of assistive technology," says Berk. "Providing this service goes beyond complying with laws like the Americans with Disabilities Act. Aira gives these individuals tools that they need to succeed in academics, student life and independent living."

Berk put Branham in contact with Karen Andrews, the director of UCI's Disability Services Center, and the two worked to make the service available on a trial basis. Branham's team is also assessing campus use of the service as part of the data collection for the project.

"Those who have visual disabilities — students, faculty and staff — now have a tool to fully integrate into campus and college life," says Andrews. "Aira will increase a sense of independence and mobility for users while promoting a culture of inclusivity at UCI and in the community."

Since the Aira sign-up was launched on Sept. 30, 2020, the team has honored over 400 requests for the service. Branham's team also disseminated smartphones and provided support to those who required new devices to activate Aira.

"One of my personal goals here is to develop strong ties with the community, whether that be here at UCI or out in Orange County," says Branham, "so that we can work together to bring about the sort of technological innovations that people with disabilities are calling for." 

STUDENT HIGHLIGHTS



6 Ph.D. Students Awarded NSF Graduate Research Fellowships for 2020-21

Over the last two years, six students from the Donald Bren School of Information and Computer Sciences have received National Science Foundation (NSF) Graduate Research Fellowships, which recognize and support outstanding graduate students in STEM disciplines nationwide. Recipients receive a three-year annual stipend of \$34,000, as well as \$12,000 paid directly to the university to cover tuition and fees. The Graduate Research Fellowship Program has a history of selecting recipients who go on to achieve high levels of success, and the promising work of these ICS recipients shows great potential in positively impacting society.

In 2020, the three ICS fellowship recipients were: Alex James Boyd, Derenik Haghverdian and Lucy Pei. Boyd is a Ph.D. student in the Department of Statistics whose research focuses on the intersection of machine learning and statistics in deep probabilistic models. Haghverdian, also a statistics Ph.D. student, conducts research on developing efficient and scalable methodologies to tackle computational challenges encountered in Bayesian statistics – more specifically, in Hamiltonian Monte Carlo (HMC) and its variants. Pei is a Ph.D. student in the Department of Informatics whose research involves technology interventions aimed at helping minoritized communities.

In 2021, ICS had three more NSF Graduate Research Fellowship recipients: Elizabeth Ankrah, Adam Birnbaum and Emani Dotch. Ankrah, an informatics Ph.D. student and a member of the Social & Technological Action Research (STAR) group, is addressing health inequities faced by those living with chronic illness. Birnbaum is a statistics Ph.D. student whose research focuses on developing flexible methods for modeling spatiotemporal data that make fewer assumptions but are still easy to use by practitioners. Dotch, an informatics Ph.D. student, is researching human-computer interaction and accessibility with an emphasis on design technologies for children with autism spectrum disorder.



Startup Marketplace Takes Top Prize at Butterworth Product Development Competition

After taking a year off due to the pandemic, the 2021 Butterworth Product Development Competition, sponsored by UCI alumnus Paul Butterworth (M.S. '81, B.S. '74), came back stronger than ever, offering dozens of teams composed of more than 100 students a chance at \$20,000 in prizes. Taking first place was Team Grasshopper Fund (Caitlyn Yang, Ovy Barani and Nathan Tisuela), which is a startup marketplace and funding platform for youth-led startups (those under 30). Second place went to Team Nutripair (Bing Mo and Catlin Tran) for its

tech-enabled health and wellness company that pairs people with personalized nutrition solutions so they can make more informed decisions for tackling chronic illnesses while staying on budget. Team Armory (Kumar Vaibhav, Maaz Syed Adeeb, Vineet Bharot and Shuvam Ghosh) took third place for its interactive platform where developers can experiment and learn about cybersecurity threats so that they can proactively write secure code. The 2021 Butterworth judges were Tony Crisp (CRISPx); Brian Dao, B.S. '03 (V1 Ventures); Patrick Jacolenne (Data Strategist); Dan Jenkins (Smart Health Clubs); Zack Ji, B.S. '07 (Oracle); Roger Lloyd (Pericia Solutions/ Grupo Cognitiva); David Ochi (Alpha Sprouts); Jason Odden (Splunk); Neil Sahota, B.S. '00 (IBM-Watson Group); and Jojo Seva (Mission Federal Credit Union).

Johnson Receives Microsoft Research Ada Lovelace Fellowship



Informatics Ph.D. student Jazette Johnson was one of five students selected by Microsoft Research to receive the 2020 Ada Lovelace Fellowship, which aims to “increase the diversity of talented people receiving

advanced degrees in computing-related fields.” The fellowship comes with three years of tuition funding and a \$42,000 annual stipend. This will allow Johnson to focus on her research of technologies that support healthy independent living for older adults with dementia, which she’s conducting in partnership with the nonprofit organization Alzheimer’s Orange County and UCI’s Stark Lab in Neurology & Behavior.

Johnson’s work examines how virtual support technologies might help combat social isolation and improve mental, emotional and physical health in people with dementia and their caregivers. “My research seeks to understand this design space more deeply, prototype potential innovative solutions, and empirically validate these approaches with an eye toward not only contributing to the science behind technologies for aging but also potentially creating life-changing products for this huge

and growing user population,” says Johnson. “In a modern, digitally enabled society, access to advanced technologies and the ability to use them for the greater good are becoming increasingly essential for ethical and human challenges.”

Muthukumar Named 2021 Goldwater Scholar



Pratyush Muthukumar, a senior computer science major, was one of two UCI students named a 2021 Goldwater Scholar by the Barry Goldwater Scholarship and

Excellence in Education Foundation. The highly competitive award, which provides up to \$7,500 in annual financial support, is given to academically promising sophomores and juniors who intend to pursue research careers in natural science, mathematics or engineering.

Muthukumar’s current research includes working on a project funded by the city of Los Angeles and NASA to predict spatiotemporal air pollution in LA and its health effects on residents. He’s working with the Lawrence Berkeley National Laboratory to develop software-defined networks at the exascale in the era of big data, machine learning and cloud computing. Also, through UCI’s Undergraduate Research Opportunities Program and Summer Undergraduate Research Fellowship Program, Muthukumar is investigating deep learning for an empathy-based AI chatbot under the mentorship of Pramod Khargonekar, UCI vice chancellor for research and Distinguished Professor of electrical engineering and computer science.

After earning his bachelor’s degree in 2022, Muthukumar plans to pursue graduate education in machine learning. He says his career goals are to “develop ethical and effective machine learning models to increase interconnectivity and altruism among people.”



Hu Takes the Gold at Alibaba Global AI Innovation Challenge

Xinyi Hu, a former graduate student in UCI's Master of Software Engineering (MSWE) program, was part of a team that won the top prize at the 2020 Alibaba Cloud Global AI Innovation Challenge, which was an open competition for global AI developers, researchers, startups and solution providers to make and/or enhance their products or projects using Alibaba Cloud's Machine Learning Platform for AI. Along with the gold medal, the team won 100,000 yuan (more than \$15,000), which they plan to use to further invest in the development of their product.

Hu served as a machine learning engineer on the seven-person Simei team that spent five months building its innovative beauty application, which uses computer vision technology to offer personalized makeup tutorials. The application, which leverages face recognition and machine learning, allows users to re-create the look of anyone, including celebrities, by following step-by-step instructions.

Hu's long-term goal is to open a startup technology company, but in the short term, she's focusing on becoming a software or machine learning engineer. Of course, she'll also continue working to advance this award-winning application, which she hopes will help women and girls feel more confident. "I provided technical support and invented algorithms and apps for our products," she says, adding that through this work, "I came to see the power of technology."

Pan Receives IMS, IBM Awards



Statistics Ph.D. student Tianyu Pan was the recipient of two competitive awards in 2021. Pan was one of 16 students worldwide to receive the 2021 Institute of Mathematical

Statistics (IMS) Hannan Graduate Student Travel Award and one of five U.S. recipients of the 2021 IBM Student Research Award from the New England Statistical Society. The first award provides funds for travel to any IMS-sponsored or co-sponsored meeting, while the second award offers recipients the opportunity to present their work at the New England Statistics Symposium.

Pan's work, which uses statistics to study heterogeneity in different spatial locations, looks at mixture models and clustering analysis in nonparametric Bayesian research. For example, in economic studies, there is an interest in quantifying the association between the household income and other economic indicators such as GDP and unemployment rate over different time periods and locations. In environmental studies, people study the effect of greenhouse gas emissions on climate change over different regions. Pan's contribution is to propose a class of new Bayesian methods for analyzing those types of data, to provide efficient computational solutions, and to study their theoretical properties. His work is based on a collaboration with Dr. Guanyu Hu, an expert on Bayesian computation and spatial statistics from the University of Missouri-Columbia. After earning his Ph.D., Pan hopes to land a position as a data scientist or academic.

UCI Finishes in Top 5 at National Cyber Defense Competition

At the start of the 2021 Collegiate Cyber Defense Competition (CCDC), there were more than 160 university/college teams participating in the event designed to test the ability of undergraduate students to detect and respond to real-world security threats by managing and protecting a network infrastructure. Only 10 teams – one finalist from each region – advanced to the National CCDC in April 2021. Among them was the UCI team, thanks to its first-place finish in the Western Regionals.

Funded by UCI's Cybersecurity Policy and Research Institute, the team was composed of seven undergraduate student members of the Cyber@UCI cybersecurity club: Jordan Whiting (captain), Reggie Dequit, Sam Hansen, Brandon Nguyen, Jacob Bokor, Alan Nguyen and Ryan Blanchard. "This was our first time at nationals ... but UCI fought like a veteran and did even better than some experienced teams," says Assistant Professor of Computer Science Qi Alfred Chen, who served as the team's adviser and helped them to finish fifth overall. "To place national top 5, in our first trial, is a big achievement for UCI."

Anderson Named Kleiner Perkins Fellow



Informatics major Emma Anderson '20, who started working as software engineer at Intuit following graduation, was named a 2020 Kleiner Perkins Fellow. The KP Fellows Program gives students the opportunity to work with Silicon Valley companies, and Anderson had

the opportunity to work with Zumper, an apartment rental startup. In addition to gaining real-world experience working with a KP partner company, KP Fellows have access to entrepreneurial workshops, a founder speaker series with CEOs and executives, a variety of community events,

and a large alumni network of tech leaders.

"When I did my final interview with Zumper, I knew this was the company I wanted to work with," says Anderson, noting that she signed the offer letter the same day she received it. "I knew that if I took this job, I'd be able to make a positive impact with my code." Anderson worked on Zumper's iOS team, further developing their mobile application. She also networked with other KP Fellows, as her long-term goal is to one day have her own startup focused on feminine health technology. "My dream is to build my own business developing femtech," she says. "I want to work in an all-female team designing products by women, for women."

Figueiredo Receives 2020 Microsoft Research Dissertation Grant



Former informatics Ph.D. candidate Mayara Costa Figueiredo '21 was the recipient of a 2020 Microsoft Research Dissertation Grant, earning her \$24,000 for the 2020-2021 academic year along with an invitation to present

her research at a virtual two-day Ph.D. Summit in 2020. Microsoft awards the grant to Ph.D. students at North American universities who are underrepresented in the field of computing. Of the 225 proposals received, only 10 were selected. "Efforts such as this grant are important because we need to not only get minorities interested in computer science but also provide the necessary conditions for these minorities to thrive," says Figueiredo.

The funding helped her focus on finalizing her dissertation, "Self-Tracking for Fertility Care: A Holistic Approach." Figueiredo's research looks at the wide range of activities involved in collecting and reflecting on personal health data related to fertility – activities such as trying to conceive, avoiding conception or tracking your menstrual cycle – and how apps can better support different activities and goals, especially during times of transition.



Abel, Cullen Receive Google's Women Techmakers for Gaming Scholarships

Google has awarded Women Techmakers Scholarships for gaming to two scholars in the Department of Informatics: Ph.D. student Christie Abel and Ph.D. candidate Amanda Cullen each received \$10,000 for the 2020-21 academic year, along with opportunities to connect with fellow scholars and Google mentors. Google's Women Techmakers Scholars Program supports gender equality in the tech industry by providing scholarships to women studying computer science and gaming.

Abel is researching identity formation in middle schoolers, particularly how the interweaving of design, marketing and social media around games excludes girls from those spaces. She also studies the ways in which families play together and the ways this could mitigate some of the negative effects of stereotypes. Using ethnographic methods, she aims to inform design to mitigate toxicity and hate in gaming communities. Her goal is to contribute to the design of games and gaming communities that promote messages of collaboration, understanding, hope and nonviolence.

Cullen's dissertation explores how working and playing in the context of video game livestreaming may be different for women. Her hope is that by understanding these differences, we can find more ways to mitigate or even prevent the spread of harmful behaviors online, develop tools and frameworks that support the contributions of women and others who are marginalized and minoritized online, and strengthen our understanding of

the complexities of life online. Cullen plans to pursue a career in which she can conduct research that applies a critical perspective and qualitative methods to understanding the issues that complicate life online.

Cullen was also one of five students selected as a Twitch Research Fellow for 2020. Fellowship recipients each received a \$10,000 award from the livestreaming company, as well as a full-time paid internship at its headquarters in San Francisco. The summer internship allowed her to be involved with projects that took a closer look at how streamers develop their own unique communities and exchange information.



Nuño Selected to Participate in 70th Lindau Nobel Laureate Meeting

Former statistics Ph.D. candidate Michelle Nuño '20 was selected to participate in the 70th Lindau Nobel Laureate Meeting, which brings together 30 to 40 Nobel Laureates annually in Lindau, Germany, to meet the next generation of leading scientists: 600 undergraduates, Ph.D. students and postdoc researchers from all over the world. Although the 2020 meeting was postponed because of the coronavirus, Nuño was able to participate in several online activities that summer and attended the rescheduled event during the summer of 2021. Her research focuses on clinical trials and the development of robust methodology for efficient sampling designs, particularly in Alzheimer's disease. Upon graduating from UCI in 2020, Nuño became an assistant professor at the University of Southern California and the Children's Oncology Group.



ZotBot Competes in the Alexa Prize Socialbot Grand Challenge 3

In July 2019, a team of UCI students led by William Schallock '20, who double-majored in computer science and physics, and advised by Assistant Professor of Computer Science Sameer Singh, was selected to participate in the Alexa Prize Socialbot Grand Challenge 3, a multimillion-dollar competition among colleges worldwide to build the best socialbot. Marking the first time a UCI team had applied for the competition, they were one of 10 teams selected for the competition's third year, receiving \$250,000 in research funding as well as Alexa-enabled devices; free Amazon Web Services (AWS) to support development efforts; and access to other tools, data and Alexa team support.

The 14-member team, which included nine ICS students, designed a socialbot named ZotBot that made personal connections with its users. The goal was to converse coherently and engagingly with a human for 20 minutes on a range of topics — from current events and politics to sports, technology and fashion — and receive a customer rating of at least 4 (on a scale of 1-5). The competition aims to advance conversational AI through research into natural language understanding and generation, context modeling, dialogue management, commonsense reasoning, and knowledge acquisition.

While they didn't make it to the final rounds in spring and summer 2020, Schallock points out that working on a

project like this gives students real-world experience they can't get in a classroom. "The Alexa Prize team from Amazon has been quite helpful," he says. "It was an overall great experience to work side by side with some of the best engineers and computer researchers in the world."

Zhang Awarded Facebook Ph.D. Fellowship



Last April, computer science Ph.D. student Cheng Zhang was named a 2021 Facebook Fellow. The Facebook Fellowship program supports promising doctoral students in the areas of computer science and engineering, providing two years of paid tuition and fees and a \$42,000 annual stipend for living and conference expenses. Facebook also covers

the costs of attending the annual Fellowship Summit at Facebook headquarters.

Zhang was one of 26 fellows selected from a group of 71 finalists who remained from the more than 2,100 applications received. Among the finalists were ICS computer science Ph.D. students Vikram Narayanan (in the area of distributed systems) and Avinash Kumar (in the area of database systems). Zhang was recognized for his work in the area of AR/VR computer graphics.

Zhang has been working on physics-based differentiable rendering — an emerging area with the potential to greatly benefit applications in many areas, including computer graphics, vision, virtual/augmented reality, and computational imaging. His recent works have established the mathematical and computational foundations for many problems in this area. Zhang plans to go into industry after graduation and says his long-term goal is to "provide an efficient and robust solution to the inverse rendering problem centered around the inference of geometric and material properties from physical measurements (such as from photographs or a depth sensor)."



When Daniel Cheng first came to UCI in 2013, he wanted to pursue a bachelor's degree in computer science because of its "applicability to many other fields." Now, as a Ph.D. student in ICS, he's practicing that applicability with real-world impact. Specifically, he has led the development of the Calving Front Machine (CALFIN), a program that uses artificial intelligence, machine learning and neural networks to help Earth science researchers monitor glacier loss. Cheng collaborated on CALFIN with researchers from UCI, the University of Washington and NASA's Jet Propulsion Laboratory (where he's an intern), and the team outlined their work in a paper published by *The Cryosphere*. Their efforts were further spotlighted in "An Artificial Neural Network Joins the Fight Against Receding Glaciers," an article pointing out that this "neural network is capable of recognizing and measuring the edges of glaciers in satellite images of Earth's surface nearly as well as a trained scientist, except it's autonomous, quick and can reliably process countless more glaciers than any human being ever could." Here, Cheng talks more about his impactful research:


What motivated you to develop CALFIN?

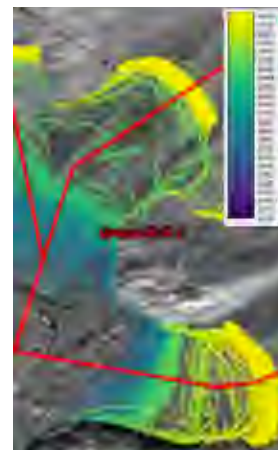
After getting introduced to other researchers, we were able to identify a need for automating a certain task that was both useful and time-consuming. This task was the labeling of calving fronts, or where glaciers break off ("calve") into the ocean. It's important to track these changes in glaciers over the past decades, so that we can understand and even model how the Earth's changing climate affects sheets of ice in places like Greenland and Antarctica. Automating this labeling task is perfectly suited to AI/ML, and neural networks in particular, which is what motivated me to develop CALFIN.

How are you continuing to improve and expand CALFIN?

I'm looking to improve CALFIN's capabilities to detect additional glacier features, such as where water gathers in melt ponds on top of glaciers, or where cracks and rifts appear on the glacier surface. I'm also looking to expand CALFIN, as we've been focused on glaciers in Greenland but are already seeing promising results in extracting useful information from ice sheets in Antarctica.

How can computer science and these kinds of multidisciplinary projects help address climate change?

The intersection between computer science and other fields such as Earth science is large, and growing larger. We have a lot of data but a limited amount of people to process and analyze it. Computer science, through new techniques like AI/ML, will allow us to make use of our data to help understand and model climate change, which, in turn, will allow us to make decisions that affect our lives in the immediate and near future. 



An example of the Upernavik Isstrom Glacier (north and central branches) showing the retreat of the glacier from 1972-2019. As this CALFIN image shows, over the years, calving has extended beyond the central area (shown in blue) and expanded to other parts of the glacier (green and yellow).

ICS Fellowships and Scholarships 2020-21

Congratulations to our 2020 and 2021 donor-funded student award recipients. We thank our generous supporters for their commitment to higher education and student success, as well as playing an active role in the future of information technology.

GRADUATE FELLOWSHIPS & AWARDS

ICS Innovation Fellowship Endowed Fund

Elizabeth Ankrah
Isabela Figueira
Jazette Johnson

Roberta Ellen Lamb Memorial Endowed Fellowship

Mayara Costa Figueiredo
Kevin Storer

Rob Kling Memorial Endowed Fellowship

Benedict Olgado
Eugenia Ha Rim Rho
Lucas Silva

Bob & Barbara Kleist Endowed Graduate Student Award

Shu Kong
Navid Salehnamadi
Brian Tran

Robert L. Newcomb Memorial Endowed Graduate Student Award

Thanasi Bakis
Navneet Hakhu
Federica Zoe Ricci

Fred M. Tonge Endowed Graduate Student Award

Jason Reitman
Tera Reynolds

Richard N. Taylor Endowed Graduate Award in Software Engineering

Sumaya Almanee
Negar Ghorbani

Rosalva Gallardo Valencia Endowed Graduate Award

Maria J. Anderson-Coto
Adriana Meza Soria

Beall Family Foundation Graduate Student Entrepreneur Award in Computer Science

Tim Hin Wai Lui
Ali Rostami
Takami Sato
Junjie Shen
Ningfei Wang

Beall Family Foundation Graduate Student Societal Impact Award in Statistics

Navneet Hakhu

Joseph & Dorothy Fischer Memorial Endowed Fellowship

Nika Nour

UNDERGRADUATE SCHOLARSHIPS & AWARDS

Accenture Endowed Outstanding Junior Award

Britney Berrada
James Kim
Avi Shah

Essie Lev Endowed Memorial Transfer Student Award

Johnson Men
Jorge Ortiz-Flores
Edward Wu

Steve & Jenny Mizusawa Endowed Student Award

Subham Ksherti
Isaiah Raya

Bob & Barbara Kleist Endowed Transfer Student Award

Navid Bazmoon
Joselyne Guillen
Mohammad Khalid
Tedi Zadouri

Kenneth Simms Endowed Memorial Scholarship

Faiza Azizan
Palak Gajera
Sepehr Jamshidian
Jose Lopez
Shril Panchigar
Tedi Zadouri

Julian Feldman Endowed Scholarship

Michael Allotey
Tyron Anderson
Venkatakrishna Kandhipati
Jorge Ortiz-Flores
Isaiah Raya
Nikan Taheri
Roy Vivat
Kim Young

Billy Steckler Endowed Scholarship

Irene Chang
Jose Lopez
Kai Tan

Richard & Patricia Utts Endowed Data Science for Social Good Award

Nhat Minh Dao
Elizabeth Lee

Boeing Scholarship Award

Christa Hatch

NCWIT Undergraduate Award for Aspirations in Computing

Katrina Mizuo

Educating Tomorrow's Data Scientists

ICS expands its portfolio of professional programs by welcoming its first cohort for the new master of data science.



MDS Program Ambassadors (from left to right): Adelynn Paik, Tanya Shourya, Hongzi He, TY Shao and Rijul Malik.

Data scientist was No. 2 on Glassdoor's list of the "50 Best Jobs in America for 2021," thanks to the rise of big data and the growing demand for empirical-based decision making across many industries. To help meet this demand, the Donald Bren School of Information and Computer Sciences launched its new master of data science (MDS, mds.ics.uci.edu) professional graduate program in the fall of 2021.

"Industry is learning very quickly that a lot of people can scrape and analyze data," says Daniel Gillen, chair of the Department of Statistics, "but to do something truly meaningful with data — to make decisions that will drive the industry forward — you need the foundations of data science and an understanding of statistics and computing methods."

The Best of Both Worlds

"We see lots of demand coming from individuals who were trained in computer science, for example, without rigorous statistical training," says Gillen. "We also see demand coming from individuals who were trained in mathematical sciences and statistics but don't have the computing background," he continues. "And then there are a lot of individuals coming from other disciplines as well ... from business analytics backgrounds [and] from political and social science backgrounds."

The MDS program is designed to advance students' data science skills, regardless of whether they're in the tech industry, at a financial institution, in a domain such as education or

healthcare, or recent graduates. The goal is to fill certain gaps in training while providing practical, hands-on experience.

“What makes this program unique is that it is taught and delivered by world-renowned experts in the foundations of data science, meaning both statistics and computing,” says Gillen. The courses cover applied probability and mathematical statistics, statistical modeling and computing, machine learning, data management and visualization, and artificial intelligence. More importantly, they are evenly split between faculty from the Department of Statistics and the Department of Computer Science, both of which are housed in ICS.

Welcoming the Inaugural Cohort

On Sept. 17, 2021, the MDS program welcomed 25 students. Notably, 32% of this first cohort is domestic, female students. “These numbers are high for STEM degrees and more notably for data science degrees,” says MDS Program Director Bryan Muñoz. “Our goal is to diversify the field of data science and break the mold – we want to increase female representation in tech and also help improve social mobility for underrepresented groups in the U.S.”

The 15-month program spans five quarters, with the first three quarters comprising coursework in both statistics and computer science. The summer quarter is available for internships or additional courses. To accommodate working professionals, all courses are offered in the late afternoon or evening, and for those in need of financial assistance, scholarships and financial aid are available. The final quarter is the capstone course, where students work on industry-derived projects, gaining real-world, hands-on experience.

“Nestled in the Tech Coast of Orange County, MDS is in the unique position to empower innovation through data science,” says Muñoz. “We are looking to leverage UCI’s powerhouse ecosystem to generate incredible talent that will feed into the greater economy.”

Growing Portfolio of ICS Programs

The MDS program adds to the list of high-demand professional graduate programs already offered through ICS:


- ♦ The master of computer science (MCS, [mcs.ics.uci.edu](https://ics.uci.edu/mcs)) program had 91% of its 2020

“Our goal is to diversify the field of data science and break the mold – we want to increase female representation in tech and also help improve social mobility for underrepresented groups in the U.S.”

- Bryan Muñoz
MDS Program Director

cohort secure full-time employment within three months of graduation, breaking the industry standard rate of within six months of graduation.

- ♦ The master of human-computer interaction and design (MHCID, mhcid.ics.uci.edu) is one of the top 10 HCI master’s programs in the country, boasting a 100% graduation rate among its five graduating classes.
- ♦ The more recent master of software engineering (MSWE, mswe.ics.uci.edu) program, now in its third year, is a hands-on program that gives students in a variety of STEM fields the skills to become software engineers.
- ♦ The master of embedded and cyber-physical systems (MECPS, mecps.uci.edu) is a joint program with the Samueli School of Engineering and was one of the first in the U.S. to focus on both embedded and cyber-physical computer systems, which integrate hardware and software.

MDS students will be able to leverage resources and events available through these already established graduate programs, such as dedicated career counselors and showcase events. This will further help ensure students are ready to thrive as data scientists as soon as they graduate, applying their new skills whether their goal is to work in the tech industry, government or anywhere in between. 

Program Reboot

Introducing

GAME DESIGN AND INTERACTIVE MEDIA



The Donald Bren School of Information and Computer Sciences first launched its Computer Game Science (CGS) degree in 2011, the same year Minecraft was released, and it has served students well over the years. By 2017, *College Magazine* had named UCI the No. 1 school for gamers. However, as the degree now enters its second decade on campus, the Department of Informatics knew it was time for a transformation.

“Game development evolves rapidly,” says Informatics Professor Kurt Squire, who was on the committee to revise the major. “A future in game development requires understanding art, code, psychology, and increasingly business and data science, and we’ve revamped the major to reflect that.”

The revised and renamed B.S. degree offering, Game Design and Interactive Media (GDIM, informatics.uci.edu/GDIM), welcomed its first cohort of 86 students in fall 2021.

Cutting-Edge Game Development

Informatics Professor Katie Salen Tekinbaş led the effort to update the program, partnering with ICS colleagues and working closely with the CGS Steering Committee and others across campus to address feedback from students, ICS alumni and industry representatives.

“The original curriculum was very solid but lacked flexibility,” explains Salen Tekinbaş. “[The revised] curriculum was designed to be more flexible and responsive to changes in the field.”

There are many more electives and special topics courses, and, notably, the program includes “an increased emphasis on design and development.” The 223 CGS students set to graduate by 2024 can also leverage the new curriculum, strengthening their design skills to address ongoing shifts in industry.

Ten years ago, most graduating CGS majors went on to become programmers or engineers at game development studios; today’s graduates are now seeking jobs not only in game development but also in interactive media. The emergence of cross-platform game engines such as Unity and Unreal and a growing interest in AR/VR has created a greater demand for design literacy in addition to technical skills. Staying on the cutting edge of game development thus required adding an element of design as well as better balancing the social and technical aspects of the program.

“The major is evolving from a program that was really about computer science and computer science skills to a major that is more in line with the traditional focus of informatics, which is how people and computers come together,” explains Assistant Professor of Informatics Aaron Trammell. “To thrive as a game designer today you need to understand people, and this is the game major that will help you do that as well as give you the technical skills needed.”

Developing Next-Generation Designers

While the technical rigor remains, students will no longer wait until their junior year to start



“We want to be able to train and prepare students to understand key principles of interactive design and issues around data science and user behavior.”

- Katie Salen Tekinbaş
Informatics Professor

Student-developed games from the Computer Game Science capstone course



Sky Farm

Sky Farm is a turn-based puzzle game where the player is a time-traveling farmer who must navigate through obstacles and collect energy crystals to progress through the levels. The game took first place at the 2018 IEEE GameSIG Intercollegiate Competition.

Dogs Vs. Cats Space Edition

You're a cybernetic dog in a pod being hurled through space toward Mars on a mission to see if the planet is habitable for mankind. Along the way you fight through waves of evil space cats led by the ancient Egyptian cat god who is waiting for you at the end of the fleet.



Waifu on Wheels

In Waifu on Wheels, cars have become sentient in a world humans have left behind. As players journey to collect parts in order to leave, they meet a ragtag crew that hopes to save it. While players go around interacting with these cars, they hope to change your mind, and maybe your heart.




designing games. “Right from day one, you’re going to be learning game programming in the context of making games and learning to work in teams,” says Salen Tekinbaş. By the time students graduate, they will have a robust portfolio of both single- and multiplayer games.

This is crucial in an era where game designers are now in demand at media companies looking to produce more interactive and immersive experiences. “Our new program is carefully designed to prepare students to understand key principles of interactive media design, visual design and code in that context,” says Informatics Professor and GDIM Program Chair Constance Steinkuehler. “There are myriad professional pathways not only in the games industry itself but also in adjacent professional domains in which the ability to design interactive experiences is a highly sought-after skill.” Possible careers include everything from a game or systems designer at a game development studio, to an interactive media designer or quality assurance engineer for a media company, to an AR/VR developer for a theater company.

Furthermore, broadening the program scope should simultaneously boost efforts to recruit and retain a broader range of students. “By adding this design element and moving away from a kind of strictly CS-oriented degree, we’re hoping to attract and support a more diverse population of students that is more representative of the UCI population,” says Salen Tekinbaş. “We know from research that in order to retain a nontraditional tech student, you need to bring them into a cohort model where they’re in smaller classes, with a more consistent group of students, building that community early on.”

The curriculum will include introductory courses in four core areas, so, in addition to a foundational sequence on computer programming and data science, courses will be offered in:

- ♦ design and development, involving robust iteration and playtesting;
- ♦ world building, focused on visual design, character development and interactive storytelling; and
- ♦ games and society, which will examine how games operate culturally.

The program will still conclude with the two-quarter capstone course, ensuring students have the real-world skills necessary to thrive in industry. 



Professor Constance Steinkuehler with UCI Provost and Executive Vice Chancellor Hal Stern and Bryan Starr, president and CEO of the Greater Irvine Chamber.

Award-Winning Program From the Start

On Oct. 13, 2021, the Greater Irvine Chamber hosted its inaugural Distinguished Educators program, and the Distinguished Educator Award for Technology was presented to UCI’s Game Design and Interactive Media program. Informatics Professor Constance Steinkuehler, the GDIM program chair, accepted the award on behalf of ICS. “The GDIM faculty are honored to be recognized in this way,” says Steinkuehler. “We’re excited about the new program, our incoming students, the return to campus, and building strong partnerships with the incredible game and interactive media companies right here in our local community.”

EVENT HIGHLIGHTS

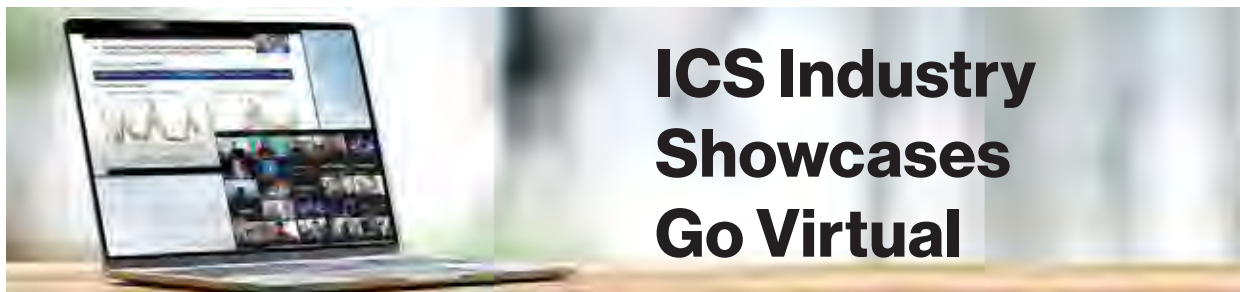


Class of 2020 Rises to the Challenge

UCI's 55th annual commencement marked the first time in the school's history that the ceremony had to be pushed online due to the global coronavirus pandemic. ICS Dean Marios Papaefthymiou said he hoped the commencement would be remembered for more than just its virtual ceremony, however. He talked about how, with more than 1,150 ICS undergraduates receiving a bachelor's degree and more than 110 students receiving a master of science degree, the 2020 ICS graduating class was the largest ever. "We hope that this commencement will also remain in your memories as the conclusion and celebration of a journey that gave you much more than an education in computing and information technologies," he said. "Our aspiration is that you're graduating from our programs equipped to make a positive impact on our world, use technology to do good, and successfully rise up to future challenges, no matter how great they may be." The student commencement speaker was computer game science major Avineesh "Avi" Kompella, while the main speaker was ICS alumna Rosalva Gallardo Valencia (Ph.D. '12, M.S. '06), a data analytics program manager at Google. They delivered prerecorded speeches, followed by a slide for each graduating student presented as the names were announced virtually.

The Resilience of the Class of 2021

UCI's 56th annual commencement, though not unique in marking the university's now second-ever virtual ceremony, nevertheless represented something extraordinary. "The class of 2021 will have a unique place in our institutional memory as the most resilient and responsive class we have ever had the privilege of teaching," said UCI Chancellor Howard Gillman during his opening remarks. "Under the most extraordinary circumstances, you rose to the occasion, supported each other, adapted and persisted." ICS graduates heard a similar sentiment from Dean Marios Papaefthymiou in his welcome for the ICS ceremony. ICS conferred more than 1,200 undergraduate and 100 graduate degrees in 2021. The 2021 commencement ceremony was also unique because it featured four student speakers who recalled their Anteater journeys: computer science major Tiffany Kong, software engineer major Jennifer Kwon, computer science and engineering graduate Ming-Hua Lawrence, and computer science graduate Francisco Loya. Following the prerecorded messages, each graduating student had their name read with "Pomp and Circumstance" playing in the background.



ICS Industry Showcases Go Virtual

Despite being held online because of the pandemic, the second and third annual ICS Industry Showcases (*industryshowcase.ics.uci.edu*) were still able to bring together the ICS community with industry leaders to strengthen research collaborations and recruitment in areas such as machine learning, cybersecurity, software engineering, human-computer interaction, health informatics and cloud computing.

The second annual ICS Industry Showcase, held Oct. 13-14, 2020, opened with ICS Dean Marios Papaefthymiou presenting details on the booming digital economy and the unprecedented growth of ICS before turning to a panel of computer science professors discussing their cutting-edge AI projects (view the panel discussion video online at bit.ly/ICS-showcase-2):

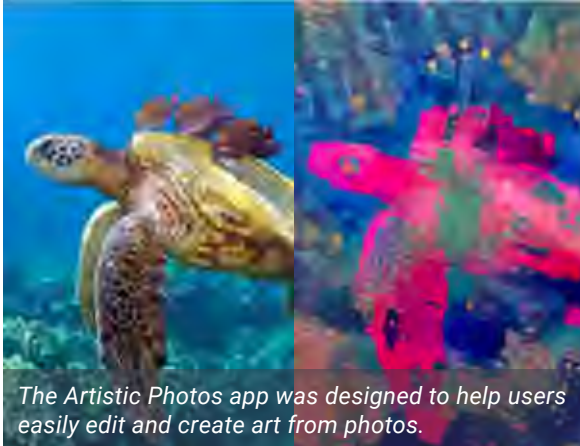
- ♦ Erik Sudderth presented work associated with UCI's Center for Machine Learning and Intelligent Systems in the areas of health, finance, law, the environment and national security.
- ♦ Sameer Singh talked about UCI's collaboration with the Allen Institute for Artificial Intelligence and efforts to address vulnerabilities in natural language processing.
- ♦ Xiaohui Xie discussed deep learning in medical research – in particular, projects aimed at the early detection of lung cancer and enhancing our understanding of the human genome.
- ♦ Charless Fowlkes, who leads the ICS Computational Vision Lab, closed out the discussion by talking about ways to engineer visual intelligence, achieving better computer efficiency without reducing performance.

The third annual ICS Industry Showcase, which took place Oct. 12-13, 2021, opened with a faculty panel discussion on "Changing the World Through Analytics" that was moderated by Bren Professor of ICS Michael Carey, an expert in database management:

- ♦ Stephan Mandt discussed probabilistic deep learning for data analysis, examining when it should be used, and explored promising application areas.
- ♦ Jing Zhang talked about bioinformatics – a big data science for biology and medicine – and how we have entered the era of predictive and personalized medicine, which has shifted the focus from data sequencing to data analysis for disease prevention, diagnosis and treatment.
- ♦ Vladimir Minin covered dynamic systems in the biological sciences, specifically highlighting infectious disease analytics and his work with the Orange County Health Care Agency.
- ♦ Roderic Crooks presented information on data analytics in education and criminal justice, talking about his research into datafication and community activism.

The Q&A that followed touched on a variety of topics, including anomaly detection, automation and adversarial attacks, the future of AI in medicine, risk assessment in public health, cultural expectations about data, and the role of data science in addressing climate change. The full panel discussion can be viewed online at bit.ly/ICS-showcase-3.

Following each year's panel discussions, participants were invited to attend corporate recruitment information sessions hosted by more than 20 high-tech companies spread over a day and a half. Both the 2020 and 2021 ICS Industry Showcases attracted more than 700 students to connect with the ICS corporate partners. One company that has been involved in all three ICS Industry Showcase events is Taco Bell. "We look forward to the ICS Industry Showcase every year," says India Forster, associate manager of talent acquisition for Taco Bell. "This event allows us the opportunity to engage with the next generation of top talent in technology."



The Artistic Photos app was designed to help users easily edit and create art from photos.

Inaugural ICS Project Showcase Highlights Student Work

Even with the global pandemic moving people out of classrooms and offices and into online spaces, more than 130 ICS capstone projects were successfully completed in academic year 2020-21. This growth was on full display at the inaugural ICS Capstone & Student Design Showcase in June 2021, where nine of the 12 projects presented were a mere sampling of the more than 60 projects completed for the undergraduate informatics, computer science and data science capstone programs last year. You can view many of the student project videos online at bit.ly/ICS_project-Spring21.

“It was hard to select projects [for the showcase] because they all were very competitive,” says Assistant Professor of Teaching Sergio Gago-Masagué, who led the new computer science capstone and its 16 projects after a successful pilot version in 2020. The course has already grown from 50 to 70 students, and Gago-Masagué plans to scale it up again this year.

The capstone required for the data science major — the first such undergraduate degree program offered in the UC system — resulted in 14 projects created by 42 students last year. The course is co-taught by two faculty members each year, one from the Computer Science Department and one from the Statistics Department. “The balanced and rigorous curriculum of the data science major allows students to take on a wide range of ambitious capstone projects, ranging from predicting medical treatment effects using electronic health records to using time-series techniques to forecast product demand,” stresses Statistics Professor Vladimir Minin, who directed the data science program the last three years.

The other three projects presented at the Capstone & Student Design Showcase were

award-winning designs from the Butterworth Design Competition, a software development competition open to ICS students (see story on page 48).

ICS has also witnessed growth at the graduate level, with the Master of Computer Science (MCS) Spring 2021 Capstone Showcase featuring 18 different projects. One of the projects, Armory, which lets developers experiment with various cybersecurity threats so they can proactively write secure code, took third place in the Butterworth Design Competition. This year, another seven projects were also completed for the master of human-computer interaction and design (MHCID) program, and a joint MCS and Master of Software Engineering (MSWE) Winter Showcase in December presented 46 projects — 10 of which were created by the inaugural MSWE cohort of 34 students.

Even those who already have a background in industry have a lot to gain from the capstone experience. “Working on this project has expanded my knowledge of Agile development and working on a team, which will be significant in my career progression,” says former MCS student Uddeshya Kumar ’21, who worked on an Artistic Photos application to help people create art from photos.

Gaining this practical, hands-one experience is what the capstone courses are all about. “There are things we just can’t teach in a traditional classroom — the capstone course gives students a leg up as they transition out of their undergraduate degrees and into their careers,” says Informatics Lecturer Matthew Bietz, who taught one of the capstone courses. “For all of the skill-building and new knowledge the students get, the real impacts of the capstone program lie in building relationships, careers and passions.”



2nd Annual SoCal Software Engineering Symposium Builds Promising Partnerships

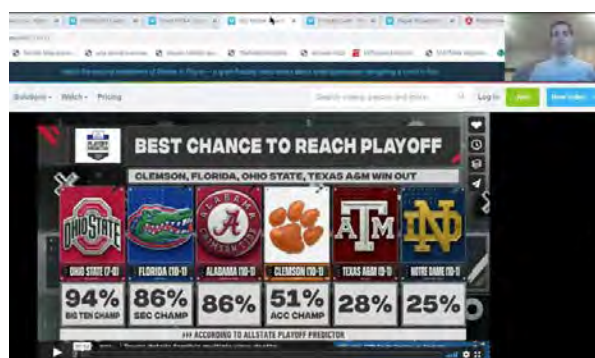
On Jan. 24, 2020, UCI's Institute for Software Research (ISR) hosted its second annual Southern California Software Engineering Symposium (SuCSES). The event helped build bridges between software engineering researchers, industry leaders and technical practitioners by bringing together over 150 attendees to identify trends, discuss current and future research, and explore new technological directions. The daylong program featured industry keynote talks, including one by Dan Russell, B.S. '77, Google's senior research scientist for search quality and user happiness; short faculty talks; a lunch with a poster and demo session; and a career-oriented reception. ISR also partnered with the master of software engineering professional program to host a career-oriented mixer at the end of the day where employers and students interacted one-on-one and in small groups – connecting local companies looking to hire with software engineering-focused graduate students looking for internships and jobs.

Alumni Lunch & Learn Panels Showcase Black and Women ICS Superstars

In honor of Black History Month, the ICS Alumni Chapter hosted an online panel, "Black Superstar Leaders in ICS," as part of its Lunch & Learn series in February 2021. Chapter president Pooja Lohia Pai moderated the panel, which featured Anthony Mays, formerly of Google; Mamadou H. Diallo of NIWC Pacific; Brian McCurtis of Apple; Informatics Ph.D. student Jazette Johnson; and Assistant Professor of Informatics Roderic Crooks.

The following month, in recognition of Inter-

national Women's Day, the ICS Alumni Chapter assembled a diverse panel of ambitious, trailblazing women from a variety of industries for its March 2021 Lunch & Learn series to discuss inclusivity, respect and gender equality in computer science-related fields. Lohia Pai moderated the online panel, "Her-story: Women Superstars in ICS," which featured the following six superstars: Renee Reid of LinkedIn, Rosalva Gallardo Valencia of Google, Jola Bolaji of Tic Toc Games, Cayci Yount of VSolvit, Arlene Soriano Atwell of Ossur Americas, and Yasi Alemzadeh of EROAD.



Webinar Series Strengthens Sports Statistics at UCI

The Sports Statistics Group @UCI (sites.uci.edu/sportstatistics) began offering a webinar series focused on exploring careers in sports statistics in 2020. "There's a lot of interest around sports research right now," says Statistics Professor Michele Guindani, who is helping Ph.D. student Corey Brett Katz lead the new group, along with Statistics Professors Hal Stern and Weining Shen. "Sports excites many people, so we've started hosting seminars to introduce students to the types of problems one might work on in sports stats." The long-term goal of these webinars is to help recruit a dedicated group of UCI students interested in working on a variety of projects related to sports stats. In the February 2021 webinar, "Presenting Sports Research to an Average Sports Fan," ESPN Senior Sports Analytics Specialist Paul Sabin talked about the work that goes into providing the game predictions shared by ESPN newscasters and appearing on the channel's news ticker. Other webinars have featured data scientists from the Boston Red Sox, Cincinnati Reds, DraftKings and Zelus Analytics.



Global Game Jam 2020: A Model of Diversity and Inclusivity

For six years, UCI has participated in the Global Game Jam (GGJ), and during the last weekend in January 2020, GGJ included 160 participants at the UC Irvine site, led by Informatics Associate Professor Theresa Tanenbaum. One of the main goals of GGJ is to “bring new emerging voices and talent into the game making space,” and Tanenbaum has consistently realized that goal by building a jam site focused on inclusivity. The UCI site welcomes artists, designers, musicians, engineers, programmers and writers from UCI and the local community, from all backgrounds and all walks of life. Tanenbaum stresses that the UCI site encourages kindness and support, which was apparent in many of the 29 games developed during the free 48-hour game jam.



VenusHacks Fosters Gender Inclusivity in STEM


UCI's first women-centric hackathon, VenusHacks, attracted more than 680 attendees from 250 schools, successfully supporting and encouraging women in STEM — including 180 first-time hackers. The two student-run organizations hosting the event, Women in Information and

Computer Sciences (WICS) and Hack at UCI, leveraged the virtual format, expanding outreach and attracting more attendees than would have been possible with an in-person hackathon. During the weekend of April 24-25, 2021, participants heard industry keynote speakers, virtually attended a number of panels and workshops, and created more than 50 projects. Fourteen teams took home \$13,000 in prizes.



Students Build Award-Winning Projects at HackUCI 2020-2021

Five hundred undergraduate and graduate students camped out in UCI's Student Center for 36 hours from Jan. 31-Feb. 2, 2020, resulting in record-breaking attendance for HackUCI 2020. The students spent the weekend building all kinds of apps, games and platforms, and with \$10,400 in prizes, productivity was at an all-time high for this sixth annual hackathon. The end result was 91 projects, including 19 award-winning hacks in categories such as health, infrastructure, AI and education. The 1st Place Best Overall award went to tradr, an all-girls team (pictured above) that developed an app for storing and trading stickers depicting UCI's Peter the Anteater mascot.

HackUCI 2021 hosted more than 600 hackers who competed for 40 hours during the Jan. 29-31 weekend from the comfort of their own homes, all vying for \$45,000 in prizes. The event resulted in 89 projects, including 22 award-winning hacks. The awards ranged from Best Overall Hack — which went to Givvy, a platform leveraging AI to optimize charitable giving — to the Female Empowerment Hack, awarded by UCI's Women in Information and Computer Sciences to fEMPOWERED, a virtual community in which women can connect and support each other. The AI@UCI club sponsored the AI Hack award, which went to Lecture T-Ai, a system that helps teachers engage with students online through automatically generated questions. 

Distinguished Speakers 2020-21

View videos of the distinguished speakers below by visiting [youtube.com/UCIBrenICS](https://www.youtube.com/UCIBrenICS). Stay informed about upcoming ICS events by visiting ics.uci.edu.

ICS Distinguished Lecture Series in Information Technology and Society



Alfred Spector

Chief Technology Officer, Two Sigma

"Opportunities and Perils of Data Science: A Roadmap"

Department of Computer Science Distinguished Lecture Series



Ion Stoica

Professor, Department of Electrical Engineering and Computer Sciences, UC Berkeley
Director of Berkeley's RISELab

"Systems and ML at RISELab"



Gul Agha

Professor Emeritus and Research Professor, University of Illinois at Urbana-Champaign
Co-founder and CEO, Embedor Technologies

"Scalable Programming: Progress, Prospects and Challenges"



Nancy Lynch

NEC Professor of Software Science and Engineering, Department of Electrical Engineering and Computer Science
Massachusetts Institute of Technology

"A Theoretical View of Distributed Systems"

Institute for Software Research Distinguished Speaker Series



Andrew T. Campbell

Albert Bradley 1915 Third Century Professor in
Computer Science, Department of Computer Science
Dartmouth College

"Future of Mental Health Sensing – Call to Arms"



Tim Menzies

Professor, Department of Computer Science
North Carolina State University

"The Five Laws of SE for AI"



Myra Cohen

Professor, Department of Computer Science
Iowa State University

*"Assuring Organic Programs:
Software Engineering of the Future"*



Neha Rungta

Senior Principal Applied Scientist, Automated
Reasoning Group with Amazon Web Services

"Enabling Provable Security at Scale"

Hall of Fame Celebration 2020

On Feb. 28, 2020, just before the pandemic shut down most of the world, more than 220 attendees gathered to attend the 2020 Hall of Fame Celebration for the Donald Bren School of Information and Computer Sciences and Samueli School of Engineering. With widespread quarantines just around the corner, the event could not have happened at a better time — or place. The Discovery Cube Orange County was the perfect place to honor the achievements of computer scientists and engineers. UCI alumni and their family and friends, along with faculty and staff, playfully explored a room full of interactive science-based exhibits before heading to the theater. There, they received a warm welcome from ICS alumnus and past Hall of Fame inductee Tim Kashani, B.S. '86. “Welcome to the fifth annual Hall of Fame Celebration,” said Kashani, co-founder of Apples and Oranges Studios. “Tonight is about celebrating an amazing group of people.”



ICS Hall of Fame Inductees Ersin Uzun, Rosalva Gallardo Valencia and Greg Bolcer with Dean Marios Papaefthymiou (third from left). (David Wood not pictured.)

Greg Bolcer

Ph.D. '98, B.S. '98, Information and Computer Science

Bolcer is a talented high-tech executive who has held multiple chief technology and founder positions at several of Orange County's most successful startup companies. He began his career working for Professor Richard Taylor as a DARPA-funded programmer in ICS, and went on to co-found Encryptanet with fellow ICS alumnus Clay Cover. Encryptanet launched its first product, Paycloud, as the first and only PayPal micropayments partner. Currently, Bolcer serves as the chief data officer for Bitvore Corp. (bitvore.com), where he uses vast AI and computing resources to process, clean and analyze the world's English business news and alternative data on a daily basis. Bitvore has been recognized twice as one of Orange County's best tech startups by the *Tech Tribune*.

Ersin Uzun

Ph.D. '10, M.S. '06, Computer Science

The focus of Uzun's Ph.D. was on network security and applied cryptography, and as an active member of the security research community, he has contributed to more than 100 influential patents and publications with over 5,000 citations to his field. Early in his career, he co-founded Identillect Technologies and architected its security products as an entrepreneur. He went on to work as a researcher at HP Labs in Palo Alto, at Nokia Research Center in Finland, and at INRIA in France. Today, he is the vice president of R&D at Palo Alto Research Center (parc.com) and the global head of IoT ventures, which is responsible for creating and incubating new IoT businesses for the Xerox Holding Co.

Rosalva Gallardo Valencia


Ph.D. '10, M.S. '06, Information and Computer Science

Gallardo Valencia received her B.S. in informatics from the Pontifical Catholic University of Peru. Today, she is a data analytics program manager for Partner Developer Relations at Google. Gallardo Valencia is committed to empowering women and Latinas to be leaders in computing,

and she has led the Google.org collaboration with Laboratoria, which continues to transform tech education for women in Latin America. She is also the co-founder of PeruSV.org, a nonprofit with the mission of closing the technology gap between Peru and the Silicon Valley. In collaboration with the UCI Foundation, in 2019, she created the Rosalva Gallardo Valencia Graduate Award to support Ph.D. students at UCI.

David Wood

B.S. '85, Information and Computer Science

The final 2020 ICS inductee, Wood, wasn't present at the Hall of Fame celebration, but his father and son were in attendance, and Kashani accepted the award on his behalf. Wood received his B.S. in ICS and earned his MBA from the University of Washington's Foster School of Business. He spent much of his career developing a wide range of Microsoft products, including early versions of Microsoft Word and Excel. After leaving Microsoft, he served as a management consultant for tech companies and larger clients, including the Bill and Melinda Gates Foundation, Kaiser Permanente and Sony Corp. Today, he is CEO of Eventene (eventene.com), a software company he founded that creates applications to streamline the organization and management of group events. 



Hall of Fame 2021

Although there was no in-person celebration because of the global pandemic in 2021, that didn't keep the Donald Bren School of Information and Computer Sciences from inducting five distinguished alumni into the ICS Hall of Fame. Since its inaugural cohort in 2015, the ICS Alumni Hall of Fame has recognized more than 40 highly accomplished ICS alumni for making a significant impact in their profession or for bringing distinction to our School. Once again, the selection committee was faced with the impossible task of identifying just a few among an overwhelming number of outstanding nominees. Please join us in congratulating the 2021 ICS Alumni Hall of Fame cohort – and stay tuned for an announcement about an in-person ceremony in 2022. Learn more about the ICS Hall of Fame at tech.uci.edu/halloffame.

Smita Bakshi

Ph.D. '96, Information and Computer Science



Bakshi, senior vice president of Wiley Technology & Engineering Careers (TEC) and co-founder of zyBooks, is a high-tech professional with more than 25 years of experience spanning entrepreneurship, education and software technology.

She co-founded zyBooks (zybooks.com) in 2012 to empower students to acquire knowledge and skills in STEM disciplines with highly interactive “less text, more action” learning material. Shown through studies to improve learning outcomes, zyBooks (acquired by Wiley in 2019) have been used by over 800,000 students across more than 800 colleges/universities. Prior to zyBooks, Bakshi was an assistant professor at UC Davis in the Department of Electrical and Computer Engineering. She also spent 10 years of her career in Silicon Valley high-tech companies across engineering, product management, business development and strategy in the software industry.

Frank Vahid

Ph.D. '94, Computer Science



Vahid is a professor of computer science and engineering at UC Riverside and is also co-founder and chief learning officer of zyBooks. His research focus is on improving college-level CS/CE/STEM education, and

on embedded systems. He is author of textbooks from Wiley, Pearson and zyBooks on topics such as C++, C, Java, data structures, digital design, computer organization, embedded systems, computing technology, introductory math, and algebra. He has received several teaching awards, including UCR Engineering's Outstanding Teacher Award and UCR's Innovative Teaching Award. In recent years, he has spoken on CS/CE education

at more than 100 universities across the country. His work has been supported by the National Science Foundation, the Semiconductor Research Corp., the U.S. Department of Education, and companies such as Google and Intel.

Don Box

M.S. '91, Information and Computer Science



Box is a vice president in Meta Reality Labs where he works on augmented and virtual reality software, services and devices. Box left UCI in 1992 a dissertation short of his degree to start DevelopMentor, a training and consulting company. His focus turned to protocol-

based software integration technologies – the Component Object Model/Distributed Component Object Model in particular – and his book, *Essential COM*, became the primary text on the technology. Box also co-invented SOAP, an XML/HTTP-based messaging system used in the early days of web services and cloud computing. In 2002, he joined Microsoft, starting on the web services team building HTTP- and XML-based messaging systems. In 2011, he joined the Xbox division and led the creation of the Xbox One operating system and developer platform. He then served as VP of engineering in mixed reality at Microsoft, leading the software development for HoloLens 2, Azure Spatial Anchors and Azure Remote Rendering before joining Reality Labs in 2021.

Dan DeLeeuw

B.S. '91, Information and Computer Science



DeLeeuw's passion for movies inspired him to seek out a career in the visual effects industry. After his ICS graduation, he started working at Dream Quest Images in Simi Valley, California, as a combination


programmer and generalist. His first duties were to design and code an image compositing program using X11 on a Sun Workstation housing a Vitec Imaging board. Learning the VFX craft from the bottom up, he became the digital supervisor on the Disney films: "Crimson Tide," "The Rock" and "Reign of Fire." He then branched into character animation at Rhythm and Hues, where he was the VFX supervisor for "Night at the Museum," which was recognized at the Academy VFX Bake-Off. DeLeeuw was also honored with three Academy Award nominations for his work on "Captain America: The Winter Soldier," "Avengers: Infinity War" and "Avengers: Endgame."

James P. Hobbs

B.S. '73, Information and Computer Science



Hobbs was the first undergraduate to declare ICS as his major at UC Irvine. He organized the department's first computer lab (a Varian Data 620/i and teletypewriters), and after earning his bachelor's degree in 1973, stayed on as a

university employee, becoming manager of system programming at the campus computing facility. In 1978, he joined Intel Corp., where he had a series of technical management positions in information technology and telecommunications, followed by work in enterprise architecture. The favorite part of his work was the application of IT experience to long-range product planning. After almost three decades at Intel, he retired in 2008 and now spends his time doing volunteer work and visiting with family. In 1998, in honor of his beloved mentor, ICS Founding Faculty and Chair Julian Feldman, Hobbs and his wife, Monica, established the Julian Feldman Endowed Scholarship. 





A Computing Visionary

Paul Mockapetris, Ph.D. '81, Receives ACM Software System Award for Developing the DNS.

In May 2020, Paul Mockapetris was among the technology leaders recognized by the Association for Computing Machinery (ACM) for advances in computing research, education and industry. Mockapetris was honored with the 2019 Software System Award for his development of the domain name system (DNS), a key enabler of the internet. Given annually since 1983, this prestigious award comes with a \$35,000 prize for an institution or individual credited with developing a software system with a lasting influence.

“Mockapetris exploited his experience working with the MIT Architecture Machine Group (now the Media Lab) and UC Irvine’s Distributed Computer System to specify the domain name system and associated query protocol, a bold, disarmingly simple design,” notes the ACM announcement. “[DNS] functionality has increased significantly and the ability of the design to accommodate new features is a credit to Mockapetris’ architecture.”

Today, Mockapetris is a chief scientist at ThreatSTOP. He earned his B.S. degrees in physics and electrical engineering from MIT and

his Ph.D. in information and computer science from UCI in 1981. He was also inducted into the Donald Bren School of ICS Hall of Fame in 2015. Here, Mockapetris talks about how he was handed the “nice little problem” of designing the DNS and where he looks to find opportunities for innovation.

What was your reaction to receiving the ACM Software System Award?

I was happy to see the DNS recognized as I believe it was a catalyst for the expansion of the internet and diversity of internet applications and services. My work was on the foundation of the DNS. It’s been gratifying to see how many people have used this foundation and built upon it over nearly 40 years, validating the original design but also adding to it.

So you recognized early on the significance of the DNS?

Short answer: Yes. At the start, I was doing some performance studies on TCP (transmission

control protocol). But there were a lot of people doing that, all more senior than I, so I jumped at the opportunity to do what became the DNS.

One of the questions I get asked a lot is, “How did you get the very important job of designing the DNS?” The answer is that at the time, the research community and government sponsors thought that replacing the HOSTS.TXT system of the time was, at best, “a nice little problem” for a newly minted Ph.D. and certainly not one of the important issues of the day. There were at least four or five proposals, including a new centralized service that I was supposed to consider.

My time at the MIT Architecture Machine Group (now the Media Lab) working on distributed systems; IBM and virtual machine technology; Draper Labs and space flight; and, most importantly, UC Irvine’s Distributed Computer System (DCS) had built up a stock of principles and ideas in my head about how to build reliable, performant, distributed systems. It was an opportunity to just let my creative juices flow.

So what I designed was much more general and open ended than “replace HOSTS.TXT.” It was a unique distributed database. I knew it could change the way we thought about networking, and it did. However, when you design something to be general and open ended, you will always get uses that you didn’t expect. That’s not a bug, that’s a feature.

What is the secret to creating such a simple, durable and adaptable software design?

Design something that relies on simple concepts that are easy to explain but is extensible. Expect that when it’s first released, people will complain it’s too general and complicated, but in three to five years, they’ll complain it’s missing features. Essential features come first.

For example, the DNS purposely had no security when it first came out, though I had ideas, and there were ways for an organization to protect its own infrastructure. The Wright brothers had no bathrooms on their first plane. Security is essential today for DNS, but it wasn’t then.

How has your ICS education helped you throughout your career?

I had some great mentors and heroes at UCI – Dave Farber, Tom Standish, Julian Feldman, Martin Kay, Ed Thorpe, and many more. I had

only lived in Boston, so driving to California and starting at UCI was quite an adventure. The ICS department, a startup itself, welcomed me and jump-started my networking with the research community and local industry.


Dave’s DCS project employed me and did an early version of cloud computing and a LAN hardware system that contributed to the design of IBM’s token ring. UCI also led me to my first ARPAnet access via USC’s Information Sciences Institute (ISI), where I eventually did the DNS. Marshall Rose and I did a dialup internet connection from ISI to UCI in the very early days of the internet. Early adopters included UCI’s Thesaurus Linguae Graecae [research center] – internet pioneers who worked in ancient Greek!

Dave also introduced me to Carver Mead at Caltech, who introduced me to integrated circuit design and let me audit classes at Caltech. My programming skills, coupled with my physics background, made me valuable to companies using the very primitive simulation tools of the day. Orange County had several startups in the area at the time, and UCI’s computer center supported their work.

I wrote my first (unsuccessful) NSF proposal with Tom Standish while at UCI. We proposed network research focused on real-time application support, probably ahead of its time.

Can you talk a bit about your current work?

I’m on the board of two companies that use DNS to improve network security: ThreatSTOP (threatstop.com) in Carlsbad, and Farsight Security (farsightsecurity.com) in the Bay Area. I’m also chief scientist at ThreatSTOP. Both of these companies work on threat intelligence – knowing which domain names and IP addresses the bad guys are using, both for forensics after an attack and blocking to prevent attacks. Farsight creates threat intelligence and ThreatSTOP deploys it in your organization.

Your first line of network defense should be to simply block known bad actors from accessing your computer and network. But the problem is keeping up with the ever-changing set of threats. ThreatSTOP makes it easy – and “easy” is not usually associated with network security products. The problem here is changing a lot as more and more Internet of Things (IoT) devices connect: printers, robotic surgery devices, cameras, access control systems, automobiles. The bad guys are waiting. 



Mamadou Diallo, Ph.D. '18, Wins Galileo Award for Cyber and Science & Technology

Since 2013, Mamadou H. Diallo has worked as a scientist at the Naval Information Warfare Center Pacific (NIWC Pacific), focusing on science and technology activities in the area of cybersecurity. Diallo, who received his B.S., M.S., and Ph.D. from UCI's Donald Bren School of Information and Computer Sciences, was recognized in 2020 for his outstanding contributions in the area of Cyber and Science & Technology (C/S&T) with an NIWC Pacific Galileo Award.

"To be considered for this award is a great honor and privilege," says Diallo, an NIWC Pacific scientist focused on cybersecurity. "It's an excellent morale booster that will encourage me to continue doing my best work." That work spans various areas, including security, privacy and trust in cloud and autonomic computing, big data and the Internet of Things (IoT); identity and access management (IdAM); secure computing and security requirements; trust management in decentralized applications; dependability in software architecture; and privacy policy languages.


"In addition to researching, developing and demonstrating cybersecurity systems and applications, my research team has produced multiple publications for conferences, journals, books and magazines," says Diallo. "My team has also produced three U.S. patent awards and multiple patent applications."

His team has collaborated extensively with researchers from academia, including from UCI. In particular, his team has worked with ICS researchers leading the TIPPERS (Testbed for IoT-based Privacy-Preserving PERvasive Spaces, tippersweb.ics.uci.edu) project. "I have led my team in collaborating with Computer Science Professor Sharad Mehrotra's research team in an effort to transition the TIPPERS system into the Navy." The system aims to protect the

privacy of individuals and enterprises in an increasingly interconnected world, and Diallo, working closely with the TIPPERS development team, successfully demonstrated the system on a U.S. Navy destroyer as part of the Trident Warrior 2019 experimentation and planned a second demonstration of TIPPERS in a U.S. Navy amphibious assault ship (landing helicopter dock – LHD) as part of the Trident Warrior 2020. Parallel to this activity, the team is currently investigating how TIPPERS can be used for COVID-19 contact tracing for the Navy.

Mehrotra is grateful for Diallo's "unparalleled perseverance, dedication and vision" in supporting the technology transition. "It has been an absolute pleasure working with Dr. Mamadou Diallo and his team at NIWC over the past four years as we transitioned the TIPPERS smart space platform, developed as a part of the DARPA Brandeis Program, to the U.S. Navy," says Mehrotra. He looks forward to continuing the partnership.

Diallo is similarly thankful for Mehrotra, who served as his ICS adviser, and for the education he received at UCI. "The scientific knowledge and work ethic I learned during my time at UCI are truly guiding me in my research activities at NIWC Pacific."

This continued collaboration with TIPPERS was recognized with the 2021 Naval Information Warfare Systems Command (NAVWAR) Innovation Award. "This award signifies the technological innovation of the TIPPERS system and its potential impact in the Navy systems and applications," says Diallo. "The NIWC Pacific research team recognizes the strong contribution of the DARPA performers on the TIPPERS project led by UCI in supporting the TIPPERS transition to the Navy. This is truly an honor for the UCI and NIWC Pacific research collaboration." 

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Informatics Capstone Team Develops Speech Therapy App for CHOC

A team of students from the Donald Bren School of Information and Computer Sciences helped change the landscape of telepractice with Amplify, an audible adventure game system designed to deliver interactive speech therapy to children with cerebral palsy and other mental and emotional disabilities.

The undergraduate team included informatics seniors Brian Cantwell, Michael Collins, Sharifa Jesmin, Jennifer Kwon and Eduardo Magdaleno. The students worked with sponsors Brian Cohn and Christopher Laine of software development company Adventure Biofeedback (adventurebiofeedback.com) to design and develop the pediatric speech therapy app for CHOC Children's hospital in Orange. Laine, an expert in oral-motor development, and Cohn, who specializes in health technology, created the Amplify prototype in 2018 as partners of the CHOC Research Institute.

Amplify makes speech-language therapy fun, engaging and easily accessible, creating a high level of interaction between a clinician and patient. Therapists set goals for their patients and, during a live virtual session, they listen and watch as the child practices sounds or words from home. If the therapist is satisfied with the progress, they allow the child to move on to the next level in the game.

The app was refined within the Informatics 191 Senior Capstone course taught by Hadar Ziv, associate professor of teaching. "Amplify was an outstanding project," says Ziv. "The team maintained a high level of both technical abilities and technical productivity and consistency, along with exceptional communication and proficiency in project management."

Bridging the Gap for Vulnerable Populations


Telepractice has been on the rise for several

years. Around 8% of American children ages 3-7 are diagnosed with a communication disorder each year, and speech-language services are projected to grow by 25% over the next decade. However, the COVID-19 pandemic propelled many health practitioners into online spaces sooner than anticipated. CHOC Research Institute had to expand telemedicine services and accelerate the development of digital tools when face-to-face visits became impossible. Developments like Amplify, which uses Google's AIY Voice Kit voice-assisted technology, help CHOC reach more families and provide continuity of care, no matter the distance.

Developing Amplify

The goal of Amplify's prototype was simple: gamify speech therapy in order to encourage and retain a child's engagement at home. Achieving this, however, required a monumental amount of work, which included developing exercises for established voice therapies, providing feedback on the at-home voice-assistant system, and helping to refine the overall Amplify system by analyzing voice data collection on the pitch, volume and clarity of pronunciation. Additionally, the team wrote choose-your-own-adventure stories for the interactive audible journey.

Supported by their sponsors at Adventure Biofeedback, the students progressed from initial designs, wireframes and mockups to application system diagrams, development, and, finally, user training and testing with CHOC speech language pathologists. "I'm impressed with what the team developed," says Cohn. "These students worked with us virtually during COVID, which is also impressive."

CHOC Research Institute plans to continue moving Amplify forward and will fund a small research pilot around the students' work. 

From Idea to Startup: Launching a Digital Diabetes Coaching Platform

Computer Science Professor Emeritus Ramesh Jain uses his entrepreneurial experience as a stepping stone for expanding human-centered computing into more human-centered healthcare with the launch of the AI-powered diabetes navigator DiaNavi.



As director of UCI's Institute for Future Health (IFH, futurehealth.uci.edu), Distinguished Professor Emeritus of Computer Science Ramesh Jain helps his colleagues better translate research into patient-centered healthcare technology. In fact, his own experience in launching a startup around a digital health coach for diabetes patients can serve as a model for others.

Blending Computer Science and Endocrinology

At a meeting in 2017 focused on the current state of healthcare, Jain met Dr. Ping Wang, who was a professor of endocrinology in UCI's School of Medicine at the time, but has since joined the faculty at City of Hope. They agreed that by combining their varied and deep expertise, they might be able to produce something novel. "He is a diabetes expert, and I have the computer science perspective," says Jain. "There is much

work being done to apply AI in various areas of healthcare, and we thought that it could be very interesting for us to work together."

Diabetes is a chronic disease that affects an estimated 415 million people, or nearly one in 11 adults, globally. About 90-95% of these people are afflicted with Type 2 diabetes, which is often managed through lifestyle improvement in areas such as managing weight, nutrition, sleep and exercise. By combining their skillsets, Jain and Wang hoped to leverage real-world lifestyle tracking to generate personalized health treatment strategies for diabetes management.

The two researchers, along with Hyungik Oh, a computer science Ph.D. student advised by Jain, discussed numerous ways of applying Jain's expertise to help Wang's patients. After many productive sessions, they focused in on developing a digital health navigator for people with diabetes, utilizing AI to provide scale and knowledge. In 2019, with assistance from UCI



The DiaNavi interfaces for monitoring nutrition, sleep, stress and glucose levels.

Beall Applied Innovation (innovation.uci.edu), their collaboration led to a U.S. patent application filed by The Regents of the University of California with Jain, Wang and Oh as inventors.

Moving From Patent to Product

The idea was pushed from concept to venture when Jain and Wang met Dean Yoost, a trustee of the UCI Foundation. “We had each met Dean previously, and he showed a lot of interest in our collaboration,” recalls Jain. “Dean has a keen eye and has been an entrepreneur, so he has the experience to back up his knowledge. He really pushed us to bring this idea to life by forming a company and hiring a team that could make it happen.”

That’s when DiaNavi (dianavihealth.com) was founded. They recruited Nick Hu, a biomedical engineer and entrepreneur with experience building several medical technology startups, as the CEO. Hu helped formulate a path for turning ideas into a product and raising seed money. They licensed the patent held through UCI and began developing their AI-powered diabetes navigator.


In March 2020, just before the COVID lockdowns began, DiaNavi began beta testing its DiabEZ app, which integrates clinical guidelines into the user’s everyday life by providing the user with precise, personalized suggestions. Several early reviews gave the app five out of five stars. “It pulls my glucose data, exercise data, sleep data and everything else in the background and then gives me a simple snapshot of how I’m doing and where I can improve,” noted one user who listed many of the factors that impact a person’s

glycemic response, a key marker for people with diabetes.

Intertwining Research and Technology Transfer

This type of roadmap – taking research through technology transfer to a company – is exactly what Jain envisioned for IFH back when he founded the institute. “The common practice is that first you do research and then you do some more research ... and then you see how to translate it to practice,” he says. “But [with] smartphones and wearables, [it] doesn’t make sense to do that because some research cannot be done until you gain actionable user feedback. I envision IFH as a veritable eddy of really smart faculty, clinicians and students at UCI partnering with industry and entrepreneurs to bring their work to life.”

Developing and nurturing a smooth translation process from research to the real world is not easy. It’s especially difficult when it comes to people’s lifestyles – which “can’t be observed in a lab with rats or monkeys or fruit flies,” stresses Jain. “Researchers need to get out of the lab and start engaging with real-world data from real-world people.”

The goal is for more interdisciplinary research collaborations to germinate from IFH and flower in partnership with industry. “That is my dream,” he says. “If you look at U.S. healthcare today, it is centered around insurance companies and healthcare providers. Where is the person?” Jain hopes his own entrepreneurial experience acts as a stepping stone for expanding human-centered computing into more human-centered healthcare. 



Fellowship Fulfills Promise to Give Back

Alumna Rosalva Gallardo Valencia (Ph.D. '12, M.S. '09) fulfills a wish made years ago by funding a graduate award for ICS students.

Rosalva Gallardo Valencia (Ph.D. '12, M.S. '09), a native of Peru, first came to UCI in 2006 after receiving a fellowship. She left her job as a software engineer in Lima to pursue her Ph.D. in ICS. “For the first three years, I didn’t have a car,” she says, recalling how it took her two hours by bus to get to Ikea — less than 10 miles from campus — to buy items for her apartment. “And with all the stress of working on my Ph.D., I really wanted to see my family, but that was something I just couldn’t afford.”

Finding Balance

As Gallardo Valencia worked fervently on her candidacy exam during her third year of studies and served as a teaching assistant for 100 students, her adviser, former Informatics Professor Susan Sim, learned about the Miguel Velez Fellowship for Latin American graduate students. “She saw my struggles financially and applied on my behalf,” says Gallardo Valencia, who knew nothing about the

fellowship application. When Sim showed her the acceptance letter, she could hardly believe she had been awarded \$10,000. “So do I use this for tuition or books,” she asked, “or to attend a conference?” She was shocked to learn there were no restrictions on the funding.

“The first thing I did was buy a car and also a ticket to go back home to see my family,” says Gallardo Valencia. While she did use some of the funds to buy books and attend conferences, she says the initial purchases were just as important to her academics. “It took a huge weight off my shoulders and had such an impact on my well-being.” Everything — from running errands to grocery shopping — became so much easier with a car that she had more time and energy for her studies. Similarly, she found she could better focus on her work after taking a break to visit her family. “It’s good to have a balance,” says Gallardo Valencia, “but sometimes you don’t have the resources to have that balance.”

The fellowship had such a positive influence on her life that she vowed to return the favor. “I don’t

know when or how,” she recalls telling herself, “but someday, I want to offer a fellowship to help other students.”


Creating Opportunities

Today, Gallardo Valencia is a data analytics program manager for Partner Developer Relations at Google. Through Google.org, the philanthropic arm of Google, she returned to Peru a few years ago to collaborate with Laboratoria, an organization that trains low-income Latin American women as front-end developers and UX designers. Before joining Google, Gallardo Valencia was an engineering manager at Intel.

Gallardo Valencia is also a co-founder of the Network of Professional Peruvians in Science and Technology in Silicon Valley (**PeruSV.org**), a group of Peruvian tech professionals committed to closing the technology and innovation gap in Peru. PeruSV is a co-organizer of Techsuyo, an annual conference for Peruvians in the U.S. working on science, technology and innovation. After holding conferences at Stanford and MIT, Techsuyo held its first conference in Peru in 2019, with 300 attendees from industry and 700 students. The goal was to inspire those in high school and college to pursue careers in STEM.

“When I tell my co-workers and friends about these events through Techsuyo and PeruSV, they sometimes ask how I find these opportunities, and I tell them, ‘I don’t find opportunities — I create them!’” So it was only a matter of time before Gallardo Valencia fulfilled her dream of creating a fellowship for ICS graduate students.

“Studying at UCI opened so many doors for me,” she says. “The great education that I received enabled me to work at Intel and now at Google, and because of that, I am in a position to share my story, to amplify my voice and to share with other Latinos that they too can dream about doing similar things.”

So in 2019, with the help of Debra Brodbeck, retired assistant director for UCI’s Institute for Software Research, and Informatics Professor André van der Hoek, she fulfilled her promise by establishing the Rosalva Gallardo Valencia Graduate Award. The \$10,000 award is open to all Ph.D. students in ICS, with a preference for those studying software engineering. To learn more and give to the Rosalva Gallardo Valencia Graduate Student Award in Software Research, visit bit.ly/RosalvaFund. 



A Chain of Giving Back

Adriana Meza Soria became the first recipient of the Rosalva Gallardo Valencia Graduate Award in February 2020. Inspired by Gallardo Valencia, Meza Soria, whose research focuses on voice-based knowledge capture and delivery in design meetings, also wants to share her research in software engineering with Mexican institutions. She has started this journey by giving seminar talks, principally at schools in her hometown, Tijuana, Mexico. Meza Soria has received a lot of support for her efforts to give back to underrepresented communities from UCI’s Mexico Graduate Research Education Program (MGREP), where she has volunteered since 2018.

Furthermore, just as Gallardo Valencia was moved to help others after receiving the Miguel Velez Fellowship, Meza Soria similarly feels inspired to return the favor. “To Rosalva, I want to say thank you for caring and for supporting students just as you were supported as a student,” she says. “It’s not only the economic support I have received, but also giving me that example of helping someone else. Now, I want to help someone else too ... so it’s like a chain of giving back.”



Hooked on Computing

Alumnus Greg Hopwood, Ph.D. '78, invests in future graduate student success by establishing the ICS Innovation Endowed Fellowship.

Greg Hopwood, Ph.D. '78, was one of 14 esteemed Anteaters honored at UCI's 50th annual Lauds & Laurels awards gala in September 2021, which took place a year late because of the global pandemic, for his long career as a leader in computer technology and his contributions to UCI. Hopwood transferred to UCI when it first opened in 1965, one of just 400 juniors in the 1,500 student body on a campus with more wide-open space than buildings. And while there was no Donald Bren School of Information and Computer Sciences back then, there were faculty and classes available to satisfy Hopwood's already strong interest in computing. While earning his B.S. in math, he was able to work in the new UCI computing facility, and after graduating in 1967, he programmed missile flight simulations at a local aerospace firm. However, he didn't stay away from UCI for long.

When ICS became its own department in 1968, Hopwood returned as one of the first students to join the Ph.D. program. He earned his degree in 1978 and spent the next few decades in the computer industry as a software programmer, system architect, program manager, webmaster and executive. He also co-founded a cloud-based software company with his brother in 2004, where he served as chief technology officer until they closed the company in 2015.

That same year, he was inducted into the ICS Hall of Fame as an inaugural member. Now, seven years into retirement, Hopwood admits he is still hooked on computing. Here, he talks about the early days of UCI and his motivation for helping future ICS students.

What first sparked your interest in computers?

In 1964, I learned how to program a DEC PDP-1 computer in assembler language. I input the program on a teletype machine and kept a copy on paper tape. It was fascinating to coax a machine to perform a task I dreamed up. Being a general-purpose (as opposed to a special-purpose) computer, it could produce answers to problems it had never seen before. Magic! What excitement every day (sometimes through the night) in the lab trying new coding sequences. Better than teaching your pet a new trick! Soon I learned how to program a Burroughs B5000 in the ALGOL language. More magic. I was hooked on computing before my 20th birthday. Now, more than 50 years later, the excitement is still there.

What were UCI and ICS like in the early days?

In the fall of 1965, the campus opened to students for the first time. The inner ring consisted of six buildings [and] there was neither landscaping nor

paved walkways between them. When it started raining, the facilities team put down plywood sheets so we could stay out of the mud on our trek between buildings.

ICS was not yet a department but early faculty pioneers like Julian Feldman and Fred Tonge taught beginning courses for the new students. Computing resources consisted of an IBM 1410/1440 and an IBM 1401. Students would interact with them via a dozen IBM Selectric-based terminals programming with an early advanced time-sharing system language called JOSSI [JOSS Irvine], which was similar to BASIC. This was very remarkable in an age of paper tape and punch cards. I can still remember my password on that system. I helped out in the labs, assisting other students to use the system. Later, I would operate the computer at night running batch jobs for professors and staff. The input would be via punched cards and magnetic tapes. The computer had an early version of removable disc drives (10 megabytes each) with hydraulic head actuators. A rag in the drive innards was useful for collecting small oil leaks.

My work for the computing facility was very instrumental in helping to build my experience base outside of the classroom. I came to understand what was going on at the other end of the wire connected to the terminals.

How did your ICS education help you throughout your career?

My UCI/ICS education, combined with work experience in the computing facility and with research projects, provided many opportunities to explore a wide range of interests: not only mathematics and computer sciences, but also fine arts, history, social impacts of computing, and physics. For example, I did a project for the UCI auto pool to keep track of the mileage of each car in the pool. I decided to learn FORTRAN. I read the FORTRAN manuals and programmed the task. Later, after graduating with a bachelor's degree in math (there was no ICS degree program in 1967), my first job at an aerospace firm involved programming in FORTRAN and simulating the physics of missile flight. There had been no course in physical simulation of rockets at UCI, but my education allowed me to adapt to the new challenge when I was tasked to work on such a simulation.

This scenario happened again and again over the next 50 years as I moved into many new ventures. At UCI, in my undergrad and graduate

programs, I worked with seven different models of computers, four networking models, the new (at that time) semiconductors, hardware maintenance and repair, logic board design, and 10 different programming languages. UCI provided the opportunity for this breadth of experience, which proved to be extremely useful later in life.


Can you share any memorable ICS moments or tell us about an influential professor?

Julian Feldman with his wife, Rita, generously opened their home to frequent gatherings of students, faculty, staff and visiting professors. These occasions fostered a sense of common purpose and camaraderie in the early ICS years. Julian also got me interested in studying the economics of computing: how to value computing resources in teaching, research and commercial environments. Thinking about these ideas early in my career helped me make grounded decisions in my business relations as a developer, salesperson, marketer or customer. I also am very grateful for Julian's support as my dissertation adviser.

Fred Tonge was an excellent instructor in the programming languages and systems areas. He brought enthusiasm and expertise to the subject matter that transferred to his many students. Fred also served on my dissertation committee; I valued his counsel.

Dave Farber and I shared many hours carpooling to and from Santa Monica. I learned a lot about computer architecture and networking from Dave, and he was a big influence on my future career.

The ICS Innovation Endowed Fellowship, established to support graduate students producing socially relevant, innovative work, was initially set up through a generous gift from you and your wife. What motivated you to establish this fund?

I feel very fortunate to have received financial assistance during my time at UCI. From teaching assistant stipends, part-time programming jobs, NSF assistance and working on research grants, I was able to graduate without any debt and begin working in industry well prepared to take on a new life outside of UCI. For this I am grateful. As others had helped me, I wanted to help future ICS students to learn, create and contribute to our society. 

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David Gonzalez	Kelly Lee	Olga Putica	Rabia Turan
Michael Gorlick	Kevin Lee	Bailey Putney	Chisa Ueda
Pankaj Goyal and Liji	Andrea and Sam Levering	Peiyong Qu	Jessica Utts
Gopalakrishnan	David Levine	Hao Quach	Rosalva Gallardo Valencia
Paul Grad	Quinnton Levine	Ravisankar Ramanujalu and	André van der Hoek
Daniyel Granchich	Richard and Carrie Levine	Sharmila Narayanaswami	Rebecca Vo
Gregg Greayer	Chen Li and Julie Zhao	Abilash Rangoju	Todd Wagner and Sarah Tull
Maury Gridley	Yi Li	Miriam Raphael	Michael and Taemi Wang
William and Amy Gross	Zhaomin Li	Heike Rau	Wenguang Wang and
Jimmy Gu and Lucy Shao	David Lim	Carlos Redona	Yanping Zhao
Carlos Cortes Gutierrez	Guianina Lim	Huimiao Ren and	Zuoyue Wang
Amir Haghighat	Bryan Linebaugh	Xiaoqing Pan	Randy Weber
Jonathan and Jennifer Hahn	Jay and Sue Littman	Victor Rollinger	William and Judy Weinberger
Mark Hammond	Asher Litwin	Carmen and Dana Roode	Kyaw Win and Moneta Moe
Scott Hendrickson	Rui Liu	Roden Rosaldo	Timothy Winkler
Howard Henry	Xinrong Liu and Tieniu Li	Lynda and Laura Roush	Albert and Fumie Wong
Miguel Herrera	Robert Long	Lawrence and Jean Rowe	Judy and Chun Wong
Arthur Hitomi and	Cristina Lopes	Cat and Eric Rupp	Pauline Wong
Ginger Thorpe	Jack Louie-Der	Daniel and Lynne Russell	Tedrick Wong
Van Hoang and Trung Huynh	Glen and Marjorieann Lowe	Henry and Susan Samuelli	Jerome and Catherine Wood
James and Trinidad Hobbs	Heidi Ly	Sherry Samuels	Timothy Woog
Martin Hodgett	Kaiyi Ma	Ethan Sanchez	Daniel Woolley
Marsha Hopwood	Dale and Ronald Marcikic	Debjit Das Sarma	Xiaoping Wu and
Alice Hsu	Maria Martin	Iniyavan Sathiamurthi	Chaoyang Fan
Michael and Cindy Huang	David Mathews	Kultej and Harneet Sawhney	Zhiming Wu
Richard Huang	Goran Matijasevic	Tawny Schlieski	Bob Xu and Michelle Ding
Kristin Huerth	Margaret Matthews and	Jacob Segal	Daniel Xu
Daniel Hwang	Adam Beneschan	Daniel Seo	Sui Xu
Tariq Ibrahim	Joseph McRae	Modesto and Romena Sevilla	Tianbing Xu
Sanjay and Sonal Jagad	Vijesh Mehta	Babak Shahbaba	Ming Yan
Shabnam Jalakian	Vesna Memisevic	Pratik Shetty	Chao Yang
Buenalie Jenkins	Leslie and Raymond Meyer	Jianlin Shi and Rong Xiao	Kewei Yang and Grace Xin
Emory Jiang	Kim Miller	Sergey and Svetlana	Zihao Yang
Zhijun Jiang and Tong Lin	Matthew and Lisa Miller	Shlosman	Wilson Yap
Nithin Jilla	Sally Mills	John Silver	Amy and William Yu
Peter Kammer and Hye Choi	Jeffrey and Maggie Minhas	Vivek Sinha	Hao Zhang
Timothy and Pamela Kashani	Jody Mizrshi	Kristine Slaughter	Xuexi Zhang
Terrance and Kerry Keen	Steven and Jenny Mizusawa	John Smith and Mary Anne	Yi Zhang
Urjit Khadiikar	Keith Mogensen	Anthony-Smith	Yi Zhao
Pasha Khosravi	Patrick and Janet Moore	Katherine Smith	Yaoliang Zhou

Stacey Nicholas Donates \$5 Million to UCI in Support of Diversity and Inclusiveness

Gift will aid recruitment, retention and graduation of underrepresented STEM students.



A \$5 million gift from UCI Foundation trustee Stacey Nicholas in 2020 endowed and renamed a program serving both the Donald Bren School of Information and Computer Sciences and The Henry Samueli School of Engineering – the Stacey Nicholas Office of Access and Inclusion (OAI). The OAI program supports the recruitment, retention and graduation of students from historically excluded populations who are underrepresented in science, technology, engineering and math.

Nicholas is an electrical engineer who earned her bachelor's and master's degrees at UCLA. She founded the Irvine-based Opus Foundation, which promotes STEM education outreach and the arts. Active on various dean's advisory and executive boards for UCI's engineering and ICS schools, she is a strong advocate of programs encouraging students from diverse backgrounds to pursue STEM education.

"It's so important to support underrepresented students so they'll have the same chance of success as their more fortunate peers," says Nicholas. "Engineering can be a transformative path for these students, as well as for their families and communities. They will bring new perspectives to the world's most critical problems and truly represent our diverse nation. They will serve as role models for others and empower future generations. Now more than

ever, our country and the world need these brilliant and talented engineers to better the lives of all of us going forward."

Since its 2014 inception, OAI has instituted several efforts aimed at high school, community college, and incoming and existing UCI students to build, maintain and improve the pipeline of high-quality students from underrepresented populations.

Gender diversity in UCI's engineering and ICS schools has increased over the past five years, with a 39% rise in female enrollment in engineering and a 50% jump in ICS. In the same time period, overall enrollment of underrepresented undergraduates has grown by 29% in engineering and 50% in ICS. The schools also have instituted faculty recruitment programs, developed a strategic plan, partnered with outside organizations, and created an infrastructure in support of diversity and inclusiveness.

"OAI has been instrumental in helping us grow our underrepresented student population and in providing fundamental resources to ensure that faculty and students succeed on campus," says Ted and Janice Smith Family Foundation Dean of ICS Marios Papaefthymiou. "Stacey's generosity and vision will enable us to continue pursuing our goal of increasing diversity in the STEM fields at UCI."

A Home for Research Partnerships

New campus building reconfigures interdisciplinary collaboration to tackle some of the future's most complex issues.

The newly opened Susan & Henry Samueli Interdisciplinary Science and Engineering Building (ISEB) at UC Irvine was conceived with one goal in mind: providing a place where researchers in disparate academic fields could work together to address grand challenges, principally in human health and the planet's climate crisis.

Faculty, students and staff moved into the facility last summer after 3 1/2 years of construction. Made possible by seed financing from Susan and Henry Samueli, through the Samueli Foundation, combined with resources from the UC Office of the President and UCI, the gleaming, six-story edifice of glass, steel and concrete adds more than 200,000 square feet of laboratory, office and meeting space to the university.


"With its Ring Road connecting the various schools in a continuous loop, UCI was designed from its very beginnings more than half a century ago as an incubator of cross-disciplinary research and collaboration," says UCI Chancellor Howard Gillman. "Our long-held desire to get the best minds together to solve problems and make discoveries has come to a whole new level of fruition with the opening of the Interdisciplinary Science and Engineering Building, one of the largest such structures constructed at any university this century."

Henry Samueli, co-founder of semiconductor maker Broadcom Corp., says, "As ground was being broken for this fabulous new facility, Susan and I were hoping for a structure that would provide an engine for cross-disciplinary research and innovations to benefit society, and we feel

very strongly that goal has been achieved."

Researchers from nearly every UCI school will eventually work in the facility, but the bulk of the initial occupants will come from the Donald Bren School of Information and Computer Sciences, The Henry Samueli School of Engineering and the School of Physical Sciences. Currently, ISEB houses ICS lab and office space for the Institute for Software Research, the Data Science Initiative, the Cybersecurity Policy and Research Institute, and the Center for Statistical Consulting, as well as classroom space for the professional master of software engineering program.

"We thought that if we could bring people from various subfields of engineering, physical sciences, and information and computer sciences together and have them converge on major problems in energy, environment, climate and health, then perhaps we could make transformative advances on our biggest challenges," says Pramod Khargonekar, UCI's vice chancellor for research. "That's how this building concept has come together."

Designed with UCI's state-of-the-art Smart Labs technology, ISEB is one of the tallest structures on campus – and one of the largest interdisciplinary science and engineering buildings west of the Rockies – and is expected to be the 21st consecutive construction project at UCI to achieve LEED Platinum certification. In addition to providing much-needed work and research space, ISEB features an auditorium, a colloquium room, classrooms, numerous indoor and outdoor meeting and event venues, as well as a forthcoming café on the ground floor. 

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Mixed Majors

Born and raised in Cupertino, California, Joseph Wong began playing the violin at age 5 and was entering Bay Area competitions by 11. Now a fourth-year Anteater pursuing bachelor's degrees in computer science and music, Wong is an award-winning violinist who has played live twice at New York City's Carnegie Hall and currently serves as concertmaster of the UCI Symphony.

While his passion for the arts started early, it was two programming classes (Intro to Java and AP Computer Science) at a STEM-focused high school that drove him to pursue a computer science degree at UCI's Donald Bren School of Information and Computer Sciences. "Having both creativity and communication skills from arts combined with logical reasoning skills from STEM makes me stronger at both," says Wong.

Last summer, Wong was a software engineer intern at Syntiant Corp., and he currently supports his peers as a lab tutor in various ICS courses. He has also participated in the International Collegiate Programming Contest with ACM@UCI and multiple hackathons – including HackUCI, where Wong helped build the award-winning Listen app.

Wong plans to graduate during the 2022-23 school year and wants to work full-time as a software engineer. On the side, he hopes to continue playing in an orchestra and discover ways to integrate his STEM and music experiences in his life. "The skills I have gained from both fields of study will serve me well in my career," says Wong.



Read Joseph Wong's full story online:
bit.ly/ics-mixed-majors