# UCI Donald Bren School of Information & Computer Sciences

**2022**

# Showcasing Opportunity

Over a two-day period in October, more than 2,200 students attended the 4th Annual ICS Industry Showcase, which provided a venue for corporate recruitment, student engagement and networking, and faculty outreach for industry collaboration. Here, students from the Donald Bren School of ICS gathered in the courtyard of UC Irvine's Interdisciplinary Science and Engineering Building during the Industry Showcase's Recruitment Fair.
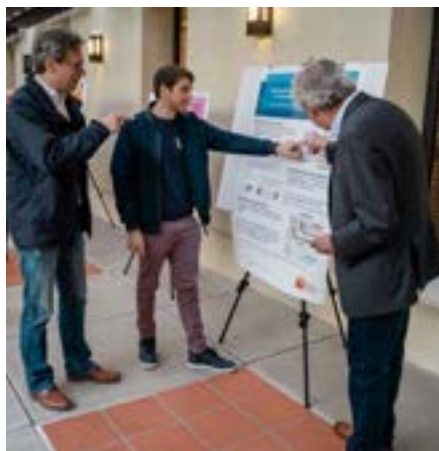
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## ON THE COVER

ICS students (clockwise from top left) Ed Slee, Tim Kashani, Nathan Lacsamana, Jingjing Wang, Gregory Sinaga and Zoi Meaders collaborate on the design of an immersive virtual reality (VR) escape room experience called "Toxicity Rising." The VR project started last fall during an experimental ICS course, Informatics 295/190: Climate XR, specifically designed to explore how extended reality (XR) technologies might motivate people to take action against climate change (see *bit.ly/ics-climate_xr*). Currently, more than 40 students are working to finalize the game, which revolves around players finding themselves trapped inside a factory, with no apparent way out. Escaping involves solving a series of interactive puzzles, all of which raise awareness about how our daily actions impact the environment.

## ICS REVIEW
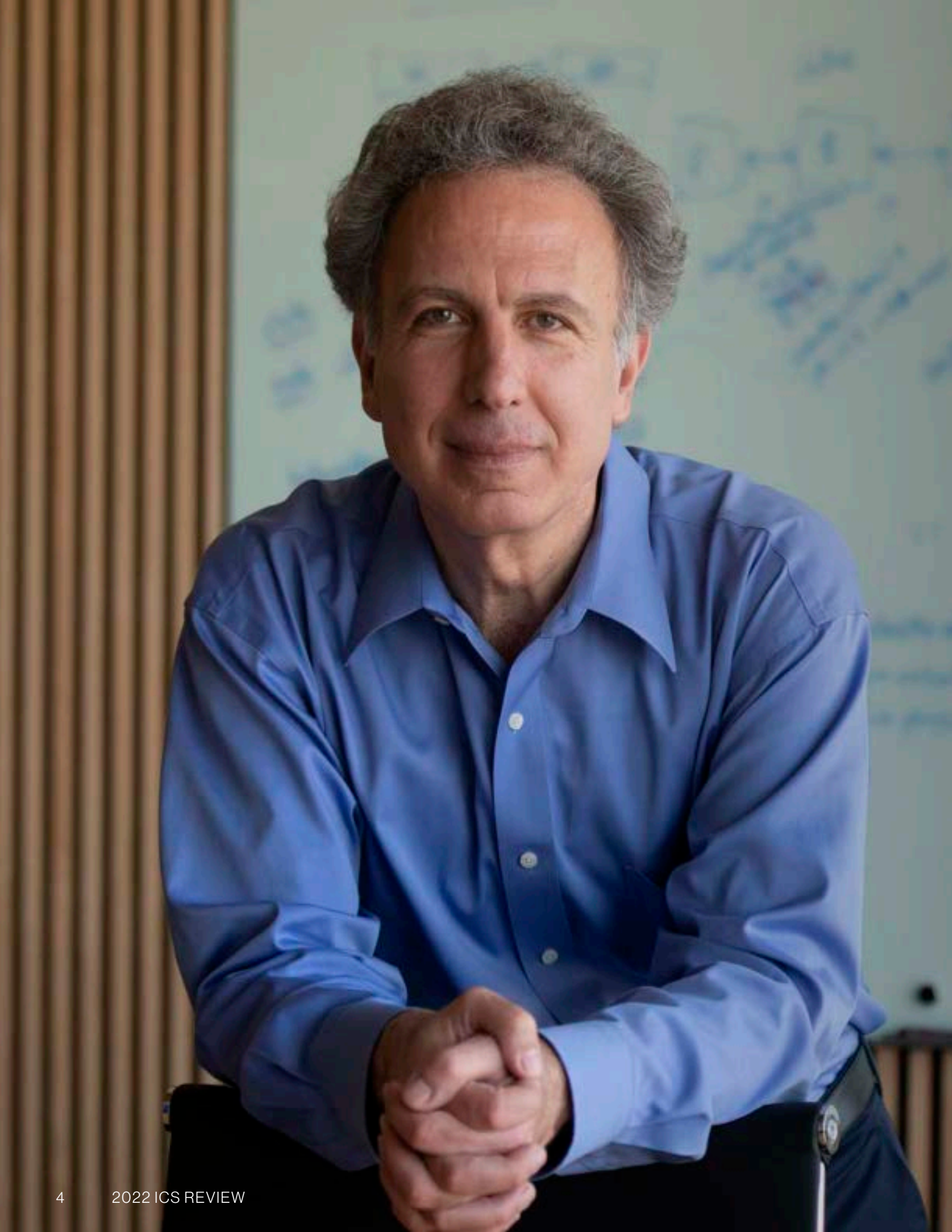
# From the Dean

**A**s we reflect on 2022, we are excited to share with you highlights of the numerous ways in which the ICS community impacts our world through learning and discovery in computing.

Throughout the year, our students, researchers and faculty have continued to expand the frontiers of computing and its applications, advancing human-centered artificial intelligence technologies, exploring immersive experiences for teaching computing and putting youth in charge of their digital future, launching innovative summer programs in data science for undergraduate and high school students, leveraging information platforms to provide disaster relief, harnessing clinical data to provide personalized care, and successfully transitioning technologies from the ICS research labs to the marketplace. I invite you to read about these and other stories in this year's *ICS Review*.

Student interest in our School continues to break records. For fall 2022 admission, we received more than 24,000 applications, an all-time high. Total enrollment for academic year 2022-23 exceeds 4,000 students, with about 3,000 undergraduate students, more than 600 master's students, and close to 400 doctoral students enrolled in our programs. On the faculty front, hiring has continued, with faculty joining us in the areas of software engineering, causal inference and reinforcement learning.

The year ended on a high note, with Paul (B.S. '74, M.S. '81) and Jo Butterworth reaffirming their longstanding commitment to our students through a transformative $35 million estate gift to support the student experience in ICS. Paul and Jo's inspiring gift will be used to establish an endowment that supports undergraduate scholarships, graduate fellowships and research initiatives in ICS, ensuring that our School remains on the forefront of research and innovation by continuing to attract the most talented students, regardless of socioeconomic background.

As always, I welcome your thoughts, feedback and insights as we work together to promote the success of our students and an exceptional environment for their education.

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

# ICS By the Numbers

## Degrees Granted 2021-22

**1,097**
B.S.

**102**
M.S.

**127**
Professional Master's

**42**
Ph.D.

**1,368**
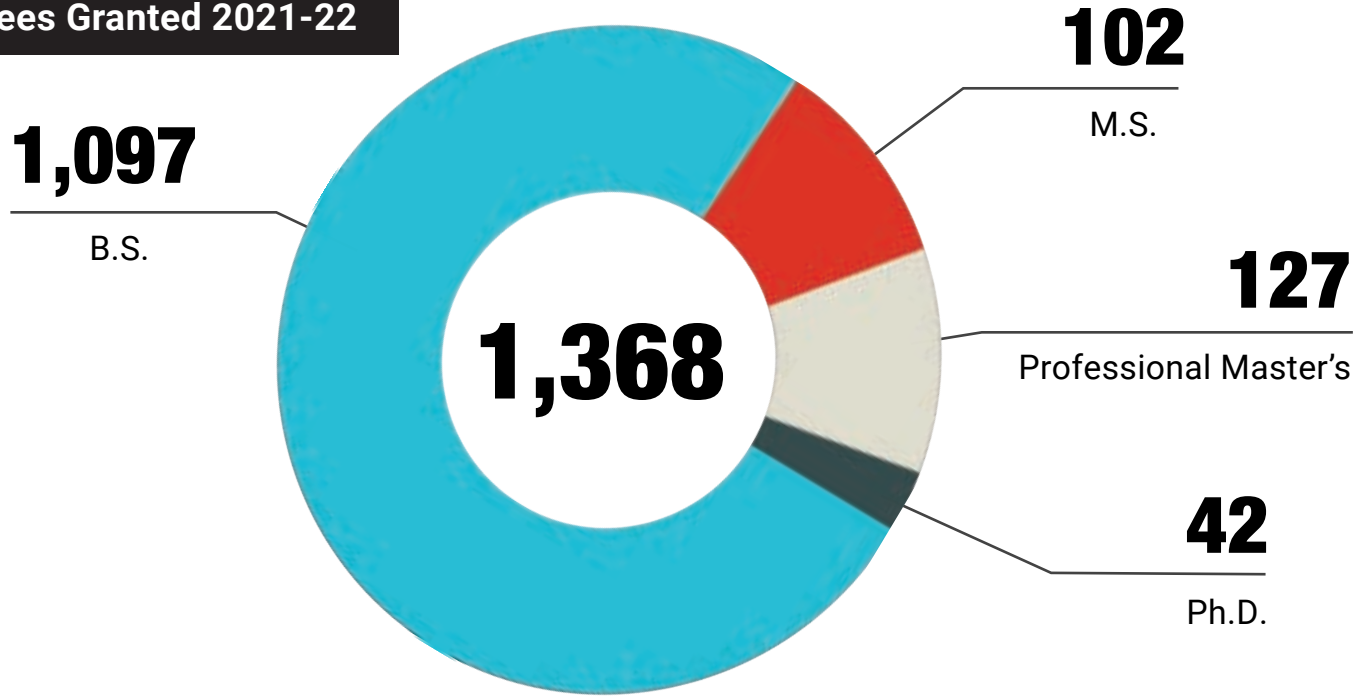
## Incoming Freshmen Fall 2022

**306**

**40%** First-Generation College Students

**30%** Female Students

**25%** Underrepresented Minorities

**5%** International Students

**15,000+**
Total ICS Alumni

FY22

**$28 Million**
New Research Awards

## Total Student Enrollment Fall 2022

**2,870** Undergraduates

**149** M.S.

**474** Professional Master's

**381** Ph.D.

**3,874**
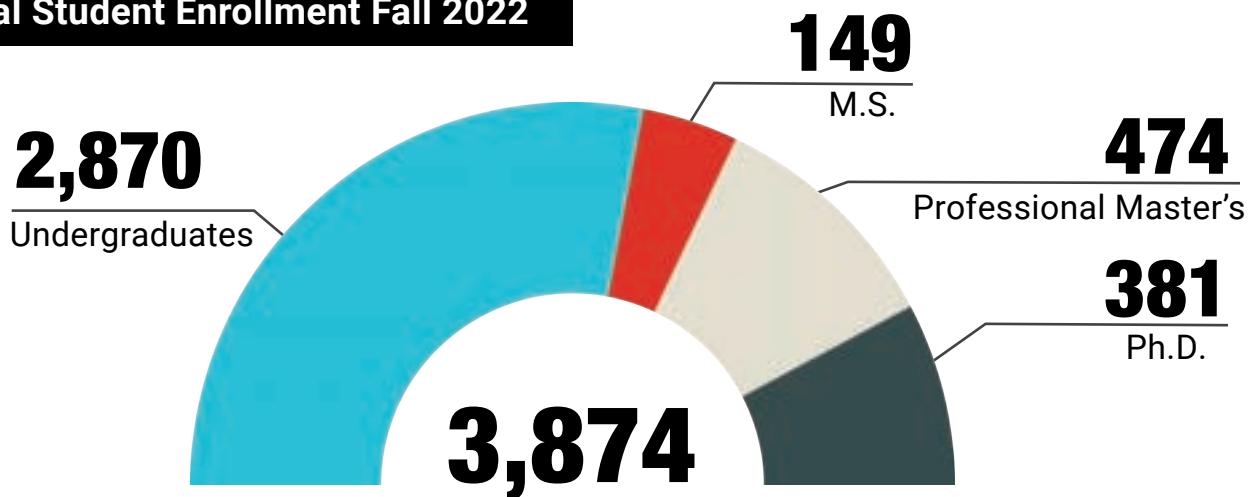
**25%** Female Undergraduates

**33%** Female Graduate Students

**15%** Underrepresented Undergraduates

| Tenure-Track Faculty | U.S. News & World Report | CSRankings.com |
|---|---|---|
| **96** | #9 Software Engineering and Game/Simulation Development undergraduate programs<br>#12 Computer Science undergraduate program among public universities<br>#14 Computer Science graduate program among public universities<br>#18 Statistics graduate program among public universities<br><br>*2022* | #5 Software Engineering<br>#7 Databases<br>#8 HCI<br>#12 Systems<br><br>*2018-2022* |

## 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

# Paul and Jo Butterworth Pledge $35.5 Million to ICS

The Butterworths' record gift will support programs fostering ICS student success and achievement.

*Photo by Roland Lane*

**A**lumnus Paul Butterworth (M.S. '81, B.S. '74), co-founder and chief technology officer of enterprise software developer Vantiq Inc., and his wife, Jo Butterworth, also a UC Irvine graduate, have named the campus as a beneficiary of their estate. The gift, valued at approximately $35.5 million, will support the Donald Bren School of ICS.

The largest gift to UCI from alumni, the donation will be allocated in a variety of ways, including awards, scholarships and fellowships for students and to finance new research initiatives and faculty chairs.

"We are enormously grateful for this generous contribution from Paul and Jo Butterworth to the Donald Bren School of Information and Computer Sciences," said Marios Papaefthymiou, the Ted and Janice Smith Family Foundation Dean of ICS. "This

gift will serve as a strong and enduring foundation for supporting student success in our school well into the future."

The Butterworths, longtime benefactors of UCI, are sponsors of the Butterworth Product Development Competition, which encourages and celebrates students' software innovations, teamwork and entrepreneurship.

A member of the UCI Foundation board of trustees since 2011, Paul Butterworth has held a seat on the UCI Audit Committee since 2017 and been on the ICS Dean's Leadership Council since 2005. He also won the UCI Alumni Association's Lauds & Laurels Distinguished Alumnus Award in 2005 and was inducted into the ICS Hall of Fame in 2015.

UCI Chancellor Howard Gillman said: "Paul and Jo Butterworth have been woven into the fabric of the University of California, Irvine for many years, and their contributions have been substantial and highly effective. With this new gift, they have further cemented their place among the greatest champions of students at our institution."

Jo Butterworth received her bachelor's of arts degree in 1975 from the UCI School of Social Sciences. Paul Butterworth first came to UCI in 1969 as an undergraduate in the School of Engineering. In his third year, he transitioned to computer science, graduating with a B.S. in that discipline in 1974. In the mid-1970s, UCI established a master's degree program in computer science, and Butterworth was one of its early graduates.

"UCI is where I began my career as a computer scientist and software engineer," he said. "While at UCI, I met another person who was a graduate student at the time, and we ended up working together well into the 1980s. You could say UCI is where all of my success really started."

Butterworth said he would not have been able to complete his college education without the monetary support he received as a student.

"I was considering not going to the university unless I received financial aid, because I didn't have any money. But when UCI came through with a package to help out, that made all the difference in the world," he said. "This is what inspired us to pledge support for students – so they can follow their dreams despite their financial situations."

> " *It's been amazing to see all of the changes that have happened [in computer science] over the past 50 years. Universities were the catalyst for all of this progress, because that's where the fundamental technologies were developed. That's why Jo and I are committed to supporting UCI and its students: Education is where we can have the biggest impact.* "
>
> **- Paul Butterworth**
> *M.S. '81, B.S. '74*

In addition to his role at Vantiq, Butterworth co-founded cloud platform development company Emotive and service-oriented architecture management firm AmberPoint, acquired by Oracle in 2010. He was a co-founder and senior vice president of Forte Software, acquired by Sun Microsystems. He also served in engineering and technology roles at Oracle, Sun and Ingres.

"I have been in the field of computer science for a very long time, and it's been amazing to see all of the changes that have happened over the past 50 years," Butterworth said. "Universities were the catalyst for all of this progress, because that's where the fundamental technologies were developed. That's why Jo and I are committed to supporting UCI and its students: Education is where we can have the biggest impact."

# Advancing Human-Centered AI

The HPI Research Center at UC Irvine, which officially launched in 2020, celebrated its long-awaited Grand Opening in November.

Yet Christoph Meinel, director and CEO of HPI, Germany, had a different perspective. "[COVID-19] forced us to have a silent start," he said during his welcoming remarks, adding that "it's lucky that we had to postpone the opening to a day [when] the main persons, the Ph.D. students of this center, are among us."

By the time UCI was able to host Meinel and other HPI researchers from Potsdam, Germany, including close to 25 HPI students, the event was more than a grand opening. It also was a symposium showcasing two years' worth of innovative AI research.

## Human-Centered AI

HPI at UCI is already funding 16 students, with five starting in 2020, another five added in 2021, and six new fellows joining in 2022. Sudderth was pleased to report that, working with HPI faculty supervisors at UCI, this "very talented, productive group" has already produced more than 50 research papers. The work is focused on three main areas:

- online and adaptive AI systems that, with little or no human-annotated data, can adapt to real-world environments;
- robust and safe AI systems that are more "self-aware" when encountering situations beyond their expertise; and
- human-centered AI systems that effectively explain (fair) decisions, communicate their reasoning, and build trust with human users.

"The goal of HPI at UCI is to foster discovery in human-centered AI technologies, combining the strengths of HPI and ICS in the areas of machine learning, data analytics and information management systems," said Marios Papaefthymiou, dean of the School of ICS, at the grand opening. "The center is not simply aimed at better AI technologies. It aspires to advance transparent and explainable AI technologies that are designed around humans."

**A**s much of the world shut down in 2020, our digital reality continued to grow. So although the grand opening of the Hasso Plattner Institute (HPI) Research Center in Machine Learning and Data Science at UC Irvine was on hold for 2 1/2 years, work to advance artificial intelligence persisted.

This HPI at UCI (***hpi.ics.uci.edu***) partnership began in February 2020, with HPI — dedicated to pioneering research into information technology — opening its newest research school at UCI's Donald Bren School of Information and Computer Sciences. "ICS is the only computing-focused school among California universities, which makes it an ideal place for this data science-focused effort," noted Erik Sudderth in his welcoming remarks at the long-delayed grand opening in November 2022. Sudderth, a professor of computer science and statistics in the School of ICS, also serves as director of HPI at UCI. "The first students started in April 2020," he continued, speaking of Ph.D. fellows at the center, "and if you think back to 2020, there was a little bit of bad luck there."

◄ *Some of the speakers from the two-day HPI at UCI Grand Opening (from left): Ph.D. students Felix Grzelka, Marta Lemanczyk, Dylan Slack, and Noble Kennamer; Professors Erik Sudderth and Michael Carey; and keynote speaker Andrew Wright.*

## Collaborative Visit & Symposium

Faculty and students in ICS have been involved in AI and machine learning research for decades, but the new HPI center is helping accelerate and advance that work by funding Ph.D. fellows and developing partnerships with similarly focused researchers in Germany. The in-person gathering aimed to help foster those partnerships. "We had some online meetings and interactions over Zoom [during the pandemic], but there was no way for those to substitute for the interactions you get from an event like this," explains Sudderth. "So it was great to have folks here."

To help HPI faculty and students to get to know their UCI counterparts, the visit began with a day of sightseeing and social activities. The more formal two-day grand opening began on Thursday, Nov. 3, 2022, in UCI's Interdisciplinary Science and Engineering Building. Faculty and students from ICS and HPI shared their research, starting with ICS Chancellor's Professor of Computer Science Sharad Mehrotra. Talking about his work for the Testbed for IoT-based Privacy-Preserving PERvasive Spaces (TIPPERS) project and for COVID-19 location monitoring, Mehrotra highlighted machine learning problems related to privacy concerns and systems development. Gerard de Melo of HPI then shared his research into natural language understanding, natural language processing and machine learning.

More than 35 students then gave 90-second lightning talks on topics ranging from deep learning for star/galaxy classification to reinforcement learning for revenue management. Next, a panel discussion on the future of AI and data science featured HPI's de Melo and Felix Naumann and ICS Professors Sameer Singh and Roy Fox. Chancellor's Professor of Computer Science and Statistics Padhraic Smyth moderated the discussion, which covered lofty expectations of AI in the next 10 years as well as worrying trends, the persistent problem of errors in data, and the significance of ethical practices and interdisciplinary perspectives.

The gathering on Friday, Nov. 4, took place at the Arnold and Mabel Beckman Center of the National Academies of Sciences and

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>
> **- Marios Papaefthymiou**
> *ICS Dean*

Engineering. During opening remarks, Meinel talked about this being the first generation to have a digital world and about the "burden and responsibility" of shaping this new world "in a way that fits with our human values." Arguing that it is not enough "to do business as usual," he explained the need for globally interconnected networks in creating a digital reality that "makes our world a better place." The talks, poster session and keynote speaker that followed then delved into the specifics of building and managing that digital world.

Distinguished Professor of Computer Science Michael Carey gave a talk on "AsterixDB: Scalable Infrastructure for Big Data Analytics," focusing on how to handle big data and adapt smaller-scale solutions to accommodate massive data sets. This multiyear research effort bridges the gap between the intuitive software tools that data scientists use to build and refine models, and the powerful but unwieldy interfaces provided by the huge databases arising in science and medicine.

Two UCI and two HPI students then presented highlights from their work. From HPI, Felix Grzelka presented his classification work for railway infrastructure safety, and Marta Lemanczyk talked about deep learning for computational biology. From UCI, Noble Kennamer discussed his research to optimize scientific experiments, while Dylan Slack talked about how machine learning models can be understood via natural language conversations.

Andrew Wright, principal software engineer

of Disney Digital Technology, gave a thought-provoking keynote on the gap between current data analytics and the insights people actually need to achieve their business goals. Emphasizing the importance of how academics interface with nontechnical people, he stressed the need to communicate the "big picture" outcomes of research innovation instead of technical details.

Everyone then moved out to the atrium for the poster session and a catered reception. The posters allowed students to provide more in-depth information from the lightning talks the previous day, and attendees could ask questions and further engage in discussion.

## Outcomes and Next Steps

"It was great to meet with a diverse group of researchers at HPI," says Slack, a fourth-year Ph.D. candidate. "I gained a diverse set of perspectives; got feedback, new directions and potential ideas to try out; and forged useful relationships that I can draw on in my work going forward."

Establishing new relationships was one of the main goals. "In the first couple years of the center ... we've done a ton of work on topics that are very relevant to HPI, and there's some overlap, but many projects have proceeded independently," says Sudderth.

"We're excited that we're starting to identify deeper connections with people at HPI, and we hope there will be a lot more continuing in the coming years."

Those connections expanded beyond the HPI event as well. "I had a wonderful time in Irvine," says Lemanczyk. "Discussions about the differences and similarities between the countries when it comes to picking research topics and carrying out research gave me a much better perspective on academia in the U.S. … I am looking forward to next year's visit of the Ph.D. students from UCI in Potsdam!"

Going forward, the expectation is that there will be two joint meetings with HPI researchers each year, and there are plans in the works for a student exchange program. "We aspire to accomplish a lot more," says Papaefthymiou, "establishing a closer and stronger relationship through extended stays of HPI researchers here at Irvine and UCI researchers over in Potsdam." He hopes that by combining perspectives and talents from researchers across the globe, HPI at UCI will cultivate true, human-centered solutions to data science problems. ICS

*HPI Ph.D. student Gerardo Vitagliano talks with Professors Felix Naumann of HPI and Padhraic Smyth of UCI.* ▼

# Realizing the Power of EdTech

ICS professors are leading an $11 million grant from the Jacobs Foundation to create a collaborative network called Connecting the EdTech Research EcoSystem (CERES) to study and improve digital technologies for children.

**M**uch of children's education and social lives moved online during the COVID-19 pandemic, accelerating an existing trend to move learning, work and play environments online. So as we move beyond the pandemic, how might we design digital technologies to better support child development and education? This challenge is at the heart of a more than $11 million grant awarded to UC Irvine from the Jacobs Foundation, a global leader in the field of child and youth development.

The funding supports a five-year effort to study and improve digital technologies for children, led by Candice Odgers, UCI professor of psychological science and of informatics, and Gillian Hayes, UC Irvine vice provost for graduate education and dean of the Graduate Division. The goal is to create a collaborative network called Connecting the EdTech Research EcoSystem (CERES, *ceres.uci.edu*). By bringing together global leaders in computer science, informatics, psychology, neuroscience, education, educational technology (EdTech) and beyond, CERES promotes evidence-based open science approaches and bridges the divide between science and the EdTech industry.

## The CERES Network

"The transformative gift from the Jacobs Foundation to UCI enables cutting-edge research on how all children and youth can be brought into the process of designing the technologies they use," says Hayes, the Robert A. and Barbara L. Professor of Informatics in the Donald Bren School of ICS. "It also allows us to better understand how good these technologies are at actually addressing real-world problems."

Hayes and Odgers leverage the work of their colleagues in developing CERES collaborations, pulling in ICS researchers from UCI's Steckler Center for Responsible, Ethical, and Accessible Technology (CREATE, *create.ics.uci.edu*) and the Connected Learning Lab (CLL, *connectedlearning.uci.edu*).

"CERES, while a global network that includes other universities around the world, works closely with ICS centers like CREATE and CLL to do innovative research in the broad area of child-centered technology," explains Hayes.

Stacy Branham, an associate professor of informatics involved in CREATE and CLL, brings her expertise in accessible technology

◀ *From left, Professor Gillian Hayes with CERES scholars Lucretia Williams, Elizabeth Ankrah, Lucas Silva and Arpita Bhattacharya. (Photo credit: Elizabeth Trujillo/BlushPix Photography)*

and universal design. "Digital technology of all sorts poses significant barriers to children with disabilities. The new CERES network integrates EdTech innovators, including people like me who focus on accessibility for children with disabilities," she says. "We have an opportunity to explore effective online education that integrates blind, d/Deaf, mobility disabled, neurodiverse, etc., children from the beginning, so every child can excel."

Branham, alongside Stephen Schueller, associate professor of psychological science and informatics, serves as a mentor for the first two cohorts of CERES scholars (one cohort started in 2021 and the other in 2022). These 34 CERES scholars are Ph.D. students and postdoctoral scholars, including Elizabeth Ankrah, Armando Beltran, Arpita Bhattacharya (now a professor at the University of Washington), Sohyeon Park, Lucas Silva, and Lucretia Williams from the Department of Informatics. "Academia has a tendency to become siloed, such that more established scholars tend to work within the bounds of their particular subfield, their particular institution and even their particular laboratories," says Branham. "CERES resists

this, creating a refreshingly interdisciplinary, cross-institutional space, so that scholars-in-training can connect with a network of senior mentors from around the world."

## Global Next-Gen Scholars

The CERES researchers and scholars are collaborating with EdTech companies, combining expertise in areas such as computer-supported collaborative learning and accessible education, to develop evidence-based strategies for reducing inequalities in access and identifying unique chances for intervention to support students. During a Fall Intensive workshop held Sept. 12-15, 2022 — the first in-person collaborative event of the training program — the scholars attended skill-building workshops, talks by venture capitalists and foundation leaders, and a panel session with EdTech companies.

"Our research generally spans across different disciplines, but we all share a passion for improving child well-being and education opportunities through the use of technology," says Ankrah, who is working with

◀ *A group of CERES researchers and scholars. (Photo credit: Elizabeth Trujillo/ BlushPix Photography)*

Arpita on technology for childhood cancer survivors and with Williams on mental health technology for minoritized young adults. "The coolest part about CERES is having the ability to not just talk about cross-disciplinary research but to talk to national and global researchers." This kind of cross-disciplinary research was highlighted in a panel at the Fall Intensive that focused on cutting-edge research methods. Panelists included Professors Branham and Schueller.

Silva, who is working on smartwatches for family bonding and well-being, is similarly excited about the global reach. "Getting that perspective of cultural influences in different academic communities and industries across the world is one of the strengths of CERES, which then brings all those different perspectives together and shares them among the different researchers and Ph.D. students."

During the Fall Intensive, Ankrah particularly appreciated the panel discussion on funding, facilitated by CLL Director Mimi Ito. "It focused on how to pitch your research to highlight its impact, especially when you're talking to industry funders."

Williams, who was in South Africa in May 2022 to run focus groups with a local researcher, really appreciated the industry presence. "It was very powerful to have the industry partners at the intensive, because that's where a lot of our research is going globally. We care about educational technology. We care about accessibility for children in education," she says. "So if we really care about impacting a certain space, we have to partner with everybody. That's how you have a big impact outside of academia."

According to Anamara Ritt-Olson, an associate professor in UCI's School of Public Health and the director of the CERES training program, that global impact beyond academia is key. "Our No. 1 goal is to create a network between innovative researchers and EdTech companies," she says. "We're working to transform the EdTech space to help kids all over the world." **ICS**

## Klaus J. Jacobs: Supporting Future Generations

Klaus J. Jacobs (Dec. 3, 1936-Sept. 11, 2008) was born into the well-known coffee dynasty in Bremen, Germany. In 1970, after earning an executive master's degree at Stanford University, he took over the management of Johann Jacobs & Co., moving the company's headquarters to Zurich in 1973. He acquired the Suchard and Tobler brands in 1982. Eight years later, he sold his majority share in Jacobs Suchard to the U.S. company Philip Morris. In 2001, Jacobs transferred his interests in Jacobs Holding AG to the Jacobs Foundation by means of a donation.

Jacobs received numerous honorary degrees in recognition of his exceptional efforts to promote education and youth development. In 2005, he received an honorary doctorate from the University of Basel. In 2008, he was admitted to the Honorary Senate of the Foundation Lindau Nobel Laureate Meetings in recognition of his commitment to education. That same year, Jacobs was awarded the Leibniz Medal by the Berlin-Brandenburg Academy of Sciences and Humanities for his contributions to promote science and research. He also received the highest honor his home city of Bremen confers: its Gold Medal of Honor, recognizing his commitment to youth development and his exemplary philanthropic contributions to the cause of scientific progress. (The above information was taken from *jacobsfoundation.org/jacobs-family*.)
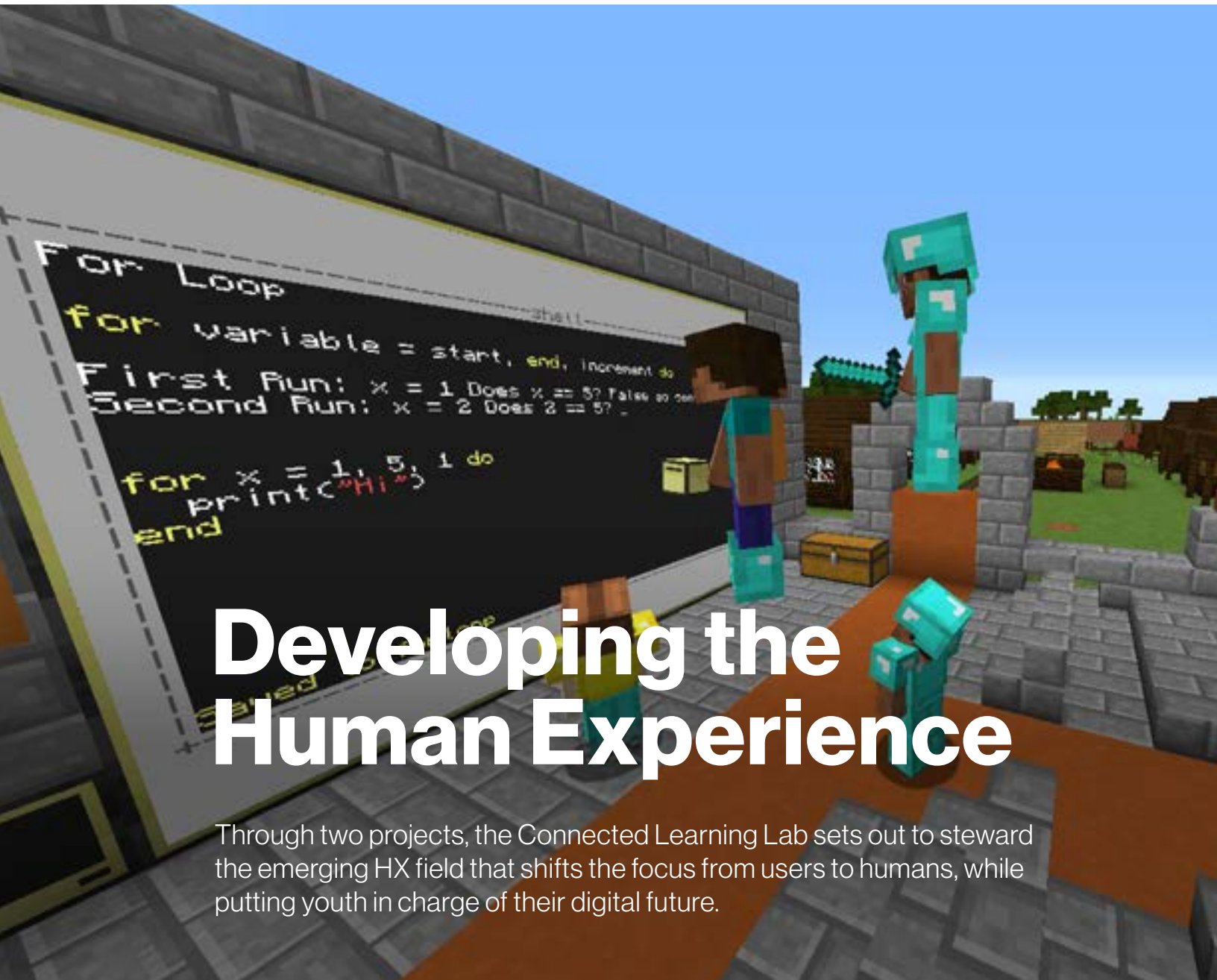
# Developing the Human Experience

Through two projects, the Connected Learning Lab sets out to steward the emerging HX field that shifts the focus from users to humans, while putting youth in charge of their digital future.

**T**echnology has become an integral part of not only our lives but our kids' lives. According to a 2021 report by Common Sense Media (***bit.ly/2022-Develop-Human-Exp***), kids aged 8 to 18 use screen media anywhere from 5 to 8.5 hours per day. While UCI's Connected Learning Lab (CLL, ***connectedlearning.uci.edu***) has always focused on how technology can lead to positive learning outcomes, CLL researchers also recognize the need for a broader examination of kids' relationship with technology. CLL Director Mimi Ito is thus partnering with others to introduce a new field of study, called human experience (HX), that shifts the focus from "users" to "humans" and puts youth more in charge of their digital future.

## The Human Experience Project

In October 2021, Ito co-authored a blog post, "HX: Centering Youth, Equity, and Human Experience in a Digitally Networked World," with Carrie James and Emily Weinstein of the Harvard Graduate School of Education; Informatics Professor Katie Salen Tekinbaş

◄ *Youth participants interacting on Discord and Minecraft.*

Supported by funding from Pivotal Ventures and the Susan Crown Exchange, the HX Project (*hxproject.org*) aims to develop an interdisciplinary and cross-sector field that pulls together well-being researchers, educators and practitioners; human-centered design and development experts; youth organizers; researchers in developmental and learning sciences; and leaders in internet research and governance.

"Our CLL team is doing a lot of the research and field-building part of the HX Project, which is a broad initiative that brings together folks in the commercial sector as well as in research and the social impact sector," says Ito. "HX aims to foster healthy and empowered relationships to technologies, so with this in mind, we've been doing this portfolio of projects around digital well-being and healthy relationships to tech."

## ExperienceCraft: Everyone Here Gets It

One such project is ExperienceCraft, a custom Minecraft server that provides a safe and supportive setting for grieving youth to play and connect with each other. Led by Salen Tekinbaş, this is a CLL collaboration between Experience Camps, a nonprofit that supports grieving children through summer camp programs and other year-round initiatives; Connected Camps, a nonprofit co-founded by Salen Tekinbaş that turns screen time into learning time; and researchers from UC Berkeley's Institute of Human Development.

"ExperienceCraft is a great example of an HX intervention," says Ito. It is a clinically informed, play-based online platform created by developers and educators at Connected Camps, in close partnership with a youth advisory board. The project is supported by the philanthropic investment of the New York Life Foundation, which provided a $100,000 grant. In addition, the Templeton World Charity Foundation provided $50,000 to further advance the work.

The foundation of the ExperienceCraft

of UCI's Donald Bren School of ICS; and Amanda Lenhart of the Data & Society Research Institute. The post introduces HX, explaining the effort to better align technology with human needs and outlining why young people are crucial to this work.

"As educators and researchers of youth culture and practice, we feel particularly strongly that positioning youth at the center of HX is essential," explain the researchers. "Youth are uniquely positioned to receive the benefits of HX and are underappreciated experts with whom we can partner to improve HX for all."

> **"** *Our CLL team is doing a lot of the research and field-building part of the HX Project, which is a broad initiative that brings together folks in the commercial sector as well as in research and the social impact sector.* **"**
>
> **- Mimi Ito**
> *Connected Learning Lab Director*

ecosystem is the connected learning framework, an evidence-based framework focused on designing learning experiences for youth that connect their interests and relationships to various opportunities. ExperienceCraft includes a custom Minecraft server, as well as an affiliated Discord server, for youth ages 7-14 who have experienced the death of one or more people in their lives. College-age mentors from Connected Camps, along with volunteers from Experience Camps, moderate on the servers.

The team ran a pilot from July 18-22, 2022, with approximately 30 kids participating. "We saw kids on day one start talking about their person who died [and] saw multiple instances of kids engaging with their grief through expressions of their identity," says Salen Tekinbaş. "They were also making meaningful contributions to the [Minecraft] world, which is really important for kids developmentally at this age."

Courtney Dubin, chief program officer of Experience Camps, was impressed. "If we had only five days to prove something, we proved that we opened a space that the kids wanted to come back to." The team reopened the server on Aug. 5, letting participants invite new people. They are now collaborating with the Boys & Girls Clubs of America, looking to offer ExperienceCraft at clubs in areas such as Detroit and Philadelphia. Dubin believes this project could inform other trauma-related work, including gun violence,

safety in schools and drug overdoses. "This work really has legs to help other areas in these environments, so I'm excited about the potential," she says.

## Recrafting Computer Science

Another project exemplifying the HX approach but targeting higher education is a three-year collaboration between researchers from UC Irvine and Carnegie Mellon University (CMU) led by Informatics Professor Kylie Pepper. The work is being supported through a $1.5 million grant from the National Science Foundation. The project, "ReCrafting Computer Science: Concretizing Computational Thinking Through Tangible Fiber Crafts," started in 2021 and has since launched computer science courses at CMU in fall 2022 and at UCI in spring 2023. The newly designed undergraduate computer science curriculum involves constructing and programming a robotic loom, offering a more tangible approach to computational thinking.

"Harking back to the first computers and the history of the Jacquard loom, where people would actually compute what that loom would do … we've been looking at new designs to do the complex engineering and CS tasks that a Jacquard loom does within an undergraduate course," says Peppler, who is leading the project along with Professors Melisa Orta Martinez and Carolyn Rosé of CMU. "Much of computer science gets abstracted onto the screen, so what if we bring it out into our physical reality, so the equations that you make get turned into the cloth that you're producing?"

Emphasizing physical connections is timely given the loss of in-person learning during the COVID-19 pandemic. "There is that thirst of needing to come back and have something physical," says Peppler, "because so much of our world is now digital." The course uses an open-source software-enabled robotic loom kit, called Robo-Loom, to provide hands-on computer science instruction with potential applications in a variety of areas, such as artificial intelligence and fashion.

ICS Postdoctoral Scholar Joey Huang, who recently received an NSF Postdoctoral Supplement Award of $250,000, is leading the team in developing course materials and fine-tuning the Robo-Loom prototype.

*ICS Postdoctoral Scholar Joey Huang demonstrates the Robo-Loom prototype for the ReCrafting Soft Technologies course.*

Last summer, she spent time in Pittsburgh, helping CMU faculty prepare for the fall 2022 ReCrafting Soft Technologies course. Throughout the winter, the team improved upon the course design, based on lessons learned at CMU. Peppler is teaching Informatics 190: ReCrafting Tech Information at UCI this spring.

Peppler and Huang, both CLL researchers, are leveraging their expertise in embodied learning and its effects on broadening participation in STEM. They suspect that broadening the view of what constitutes computational thinking — beyond the narrow idea of it being an activity that only occurs with computers — can encourage more women and people of color to explore computer science. "People think computer science is just coding all the time … but you can actually design amazing crafts and create something that's very beautiful through creative coding," says Huang. "I feel that's critical to show students, especially as most of them are still exploring their identity."

Regardless of the project — and these two are just a sampling — the goal is the same: support multidisciplinary teams in developing innovative, evidence-backed, human-centered programs. "Last year's HX announcement was really about having a shared terminology and a set of frameworks for working in this area," says Ito, "and about helping to steward an emerging field with positive youth technology engagement as the driving force."

# The Immersive Experience of ICS 10

**S**tudents who enroll in ICS 10: How Computers Work at UC Irvine don't just sit in a lecture hall and learn the basics of computing. They become fully immersed in a new digital reality. The general education course, taught by Informatics Professor Crista Lopes, is held both in person and in OpenSimulator, an open source virtual world.

"This allows me to simulate things that would be very difficult or pretty much impossible to do in the real world," says Lopes. "It gives the students a virtual 'hands-on' experience with the material that they would otherwise not have — so this is an experience, not just a course."

## Computing as an Experience

Students from all over campus — including business, biology, engineering and political science majors — create avatars, attend lectures, learn programming and build applications, all in this virtual world. Lopes stresses that she designed the course for people who aren't computer science majors, so not the typical ICS student (though she admits they too could benefit from such a course).

"These are students who pretty much just use their phones, so having to use a complicated piece of software on the

◄ *The ICS 10 course in OpenSimulator has an auditorium where students can watch the lectures.*

computer is a foreign beast for them, and many are already afraid of the course," says Lopes. "But a lot of the students really thrive."

The course is composed of lectures and homework projects. "The homework projects are what is really interesting to do in this environment," says Lopes. "Having the ability to build exactly the simulated hardware that I think they should be exposed to is a powerful thing."

Lopes first simulates a very simple computer — the memory, CPU, arithmetic unit, loading of the program, and low-level programming, tuning the level of difficulty to what she feels is most appropriate. "They're given a little computing machine, and it's slow on purpose because I want them to see what happens in those registers, when they load and fetch things from the register into memory and vice versa," says Lopes. "I want everything to be visible, and that visibility is something that is very difficult to do with real-world hardware."

Lopes also simulates the internet with a network project. "Students have to set up their virtual home routers and connect them to the street router. Then they have to organize themselves and configure the street routers to talk to the region router," explains Lopes. "So they set up all the connections of the internet and then they can send messages; you can actually see the messages, or pink spheres, flying around."

Criminology major Brianna Hernandez, who took the course in 2021, says the course is challenging yet engaging. "You made your own avatar and got to accessorize them in any way you wanted. You got to fly and travel from zone to zone and were living in a treehouse. The networking part of the project was fun, and I felt good about myself because I understood how to do it (with the help of the professor's explicit instructions, of course)," she says. "I would have never thought that I would be coding, or creating algorithms, nor understanding their functions and operations in computer systems." The course left a lasting impression. "The virtual world is something I will never forget."

Homework assignments include programming, flipping black and white tiles to learn binary, and working with a ternary wall with four values instead of two.

## Simulations as a Pedagogical Tool

As an early developer of OpenSim, Lopes has always wanted to teach a course using the virtual platform. "Simulations are really powerful learning devices that can add a lot of value," she says, noting that simulations are only useful if there is some sort of "physicality" to what is being taught. "This course really benefits from having simulated hardware."

Lopes admits that coding and creating the world was extremely time-consuming, but students are enjoying it. "Honestly, I think that simulations are an underappreciated and underused pedagogical tool." 🔲

*Class assignments include programming, learning binary and working with a ternary wall.* ▼

# Summer of Learning

ICS launches three summer programs focused on data science to better prepare undergraduate and high school students for data-focused careers and graduate school.

**D**ata scientist and statistician were among the top 10 jobs in 2022, according to *U.S. News & World Report*. The growing popularity of data-focused careers has created a demand for students who understand the immense challenges and real-world impact of complex data analysis. The Donald Bren School of ICS is already helping address this demand through a variety of undergraduate and graduate degree offerings in data science and statistics, but last summer it also hosted several new summer programs focused on data science.

The **SoCal Data Science** program (*socaldata.science*) started its weeklong summer bootcamp on June 20, 2022, followed by a six-week summer research project. The program is a collaborative effort among faculty from UC Irvine, California State University, Fullerton (CSUF) and Cypress College. The goal is to recruit, train and dispatch a diverse workforce of STEM and data science majors from the three partnering institutions.

ICS then launched the **Irvine Summer Institute in Biostatistics and Undergraduate Data Science** (ISI-BUDS; *stat.uci.edu/isi-buds*) on July 11. UC Irvine is one of only 10 universities in the nation to host this free six-week summer training course aimed at addressing the growing need for biostatisticians and data scientists.

Finally, the inaugural **ICS Summer Academy** (*summeracademy.ics.uci.edu*) welcomed a group of high school students on July 25. The two-week session, DATA — Data Analytics: Theory & Applications, let students explore the foundations of data science with real-world hands-on projects.

# SoCal Data Science

Led by Statistics Professors Babak Shahbaba and Mine Dogucu and Mathematics Professor Roberto Pelayo, the SoCal Data Science program is funded through a National Science Foundation grant, "Preparing a Diverse Workforce via Academic and Industrial Partnership." With $1.5 million in funding, spread across UCI, CSUF and Cypress College over the next three years, the goal is to recruit 120 fellows from the three campuses, offering targeted coursework and hands-on training, research opportunities, and career development workshops.

The program is off to a strong start, with 32 fellows selected from a pool of more than 200 applicants. This diverse cohort is 87% women and students from other historically underrepresented backgrounds. "Having such a diverse and strong group of students is amazing," says Shahbaba. "That was one of the goals of the program."

During the winter and spring, this first cohort of students took data science courses developed through the SoCal Data Science program and offered at UCI, CSUF or Cypress College. Then the students put their new skills to the test with a summer research project.

Students started with a bootcamp focused on exploratory data analysis, advanced R programming and generalized linear models. Then they broke into groups, diving into a real-world data analysis project. "It was six weeks of intense research," says Shahbaba. They were on campus at least three days a week from 10 a.m. to 4 p.m., working in UCI's Interdisciplinary Science and Engineering Building.

Shahbaba lined up a variety of academic and non-academic partners for the summer projects: Children's Hospital of Orange County, the Center of Hydrometeorology and Remote Sensing, the Fleischman Lab, the Fortin Lab and the Reich Lab.

"The program was an amazing experience for me because it really gave me a chance to apply skills I learned from my courses to real-world problems," says program fellow Giles Pierre Carlos, a data science major at UCI. "I was able to apply the techniques I've learned [and] build significant models for an extremely interesting area of neuroscience research." Students presented their work at the Undergraduate Research Symposium on Aug. 4, 2022, the last day of the summer program.

The SoCal Data Science team plans to build on the success of this first cohort, recruiting more highly motivated and deserving students. They also hope to strengthen ties with similar programs elsewhere in the U.S. to develop a strong community of data science learners who can meet the complex demands of increasingly data-focused careers.

# Irvine Summer Institute

ISI-BUDS is part of the Summer Institute in Biostatistics program offered through the National Heart, Lung, and Blood Institute and the National Institute of Allergy and Infectious Diseases. The program provides not only training in the fundamentals of biostatistics, data science and computing but also experience in conducting cutting-edge biomedical research. "The main goal is to excite students about careers and graduate school in biostatistics," says Statistics Professor Volodymyr Minin, who co-directs the program with ICS colleagues Dan Gillen, Babak Shahbaba and Mine Dogucu. "Careers in biostatistics are peculiar in the sense that a lot of them require a graduate degree, so there's a need for more training in this area," explains Minin. "However, biostatistics is rarely taught at the undergraduate level, so many undergraduate students do not know about career opportunities in this area."

Sarah Schlund, a senior at UC Santa Barbara double-majoring in statistics and data science and in geography, agrees. "ISI-BUDS offers the rare opportunity to gain biostatistics experience as an undergraduate and learn from the very impressive faculty at UCI, who have immense biostatistics knowledge and experience, both in industry and academic research."

The inaugural cohort of students, selected from more than 150 applications, came from a variety of schools across the U.S. The highly competitive program includes up to $500 in travel expenses, free housing and a meal plan (or a $2,500 stipend) as well as $600 for incidental expenses. The cohort was also a diverse group of students, with almost 40% coming from groups that are underrepresented in the quantitative sciences.

The program included career preparedness activities, including a workshop on the graduate school application process and a Q&A with Ph.D. students. People from pharmaceutical and biotech companies also came to talk with students about careers in the biotech industry.

"It was a very impressive group of students," says Gillen, chair of the Department of Statistics. "They did three weeks of courses, both on technical [and] soft skills, and then they jumped right into three weeks of real research, pounding out an amazing amount of work and giving wonderful presentations at the end of it."

Students started with lectures and labs conducted by six instructors and a statistics Ph.D. student teaching assistant. They learned how to design and analyze clinical trials; model infectious disease dynamics; and analyze big data in genomics, transcriptomics and imaging.

Students then worked under the supervision of research mentors. "The real heart of the program was the research projects, and that was only possible because of the dedication of the biomedical scientists whom we asked to participate," says Minin. "It was a smashing success because of their engagement with the students." In addition, four statistics Ph.D. students provided invaluable support during the project phase.

ISI-BUDS has secured funding for a minimum of five years, so planning and recruitment for summer 2023 is already underway. Visit *stat.uci.edu/isi-buds* for more information.

# ICS Summer Academy

**T**he ICS Summer Academy, DATA — Data Analytics: Theory & Applications, was designed for a younger audience. From July 25 to Aug. 5, 20 high school students were on campus Monday through Friday from 9 a.m. to 4 p.m., learning about data science methods and concepts through hands-on projects using (anonymized) health data from actual patients.

"Computer science is more than just programming. The whole idea behind the Summer Academy is to offer a selection of courses to help high school students explore the various areas and topics that comprise the ever-changing and growing field of computing," explains Computer Science Professor Magda El Zarki, director of the academy. "This first course offering really opened up the students' eyes to what it means to be a data scientist."

Mornings started with lessons from Professor Babak Shahbaba of UCI's Department of Statistics or from Professors Sam Behseta or Jessica Jaynes of Cal State Fullerton's Department of Mathematics. Students learned how to collect, process, summarize and visualize data. After a daily lunch break, UCI graduate and undergraduate students led small teams working on projects related to actual datasets drawn for biological and medical sciences. The teams made predictions using statistical models, tested scientific hypotheses using statistical inference techniques, and made decisions under uncertainty by applying statistical thinking.

"The best part of the ICS Summer Academy was the amount of content that I learned in the two weeks of the program and the capstone project," says Parsa Aghamohammadi, a sophomore at University High School in Irvine. "It was extremely interesting to put the skills I learned to the test." Aghamohammadi worked with fellow ICS Academy students Rustin Jafarkhani and Ryan Shahbaba on a project focused on predicting the severity of Alzheimer's disease, looking at the brain. They worked to answer the question, "Is the percentage of the combined volume of different subjections over the total intracranial volume associated with age, and how can we predict the severity of Alzheimer's disease?"

Arietta Goshtasby, a junior from Sage Hill High School in Newport Beach, was on a capstone team hypothesizing that emotional behavior can predict the severity of a patient's Alzheimer's disease. "Getting to do research at the graduate level was really exciting," she says. "The professors were friendly and knowledgeable, and I made important connections with people my age with similar interests. I also got to learn about all the resources UCI has to offer."

In future years, the ICS Summer Academy will expand its course offerings. Next year, in addition to the DATA course, a second course will be offered, focused on artificial intelligence and machine learning.

"The goal of the Summer Academy is to help students explore and get a better understanding of what it means to be a computer scientist and the exciting careers that one can pursue being one," says El Zarki. "We want to give them a good sense of the diversity and vastness of the field of computing — all the areas of expertise and knowledge that it encompasses and that make it so exciting."

# Building Smart Disaster Resilience

UC Irvine researchers develop and test NSF-funded CareDEX system, the first Internet of Things technology to aid disaster response for older adults.

▲

*Participants of the technology-enhanced emergency drill during the 2022 International Great ShakeOut at Walnut Village in Anaheim, a Front Porch retirement community.*

**U**C Irvine researchers in computer science, geriatric medicine and nursing have developed and successfully tested a new data exchange system to provide first responders with real-time, critical health information about senior care center residents, who are at greatest risk during disasters.

Called CareDEX: Enabling Disaster Resilience in Aging Communities via a Secure Data Exchange (*sites.uci.edu/caredex*), the system enabled first responders to locate, rescue and treat elderly residents in a successful test during last year's Great California ShakeOut earthquake drill on Oct. 20.

During this one-of-a-kind emergency drill, UCI researchers joined community partners from Orange County, the City of Anaheim, and the Front Porch Center for Innovation and Wellbeing for a cutting-edge, technology-enhanced earthquake drill at Walnut Village, a Front Porch retirement community, to demonstrate new technologies to help vulnerable seniors stay safe during these increasingly common disasters. In addition to local partners, UCI and local authorities were joined by personnel from the Federal Emergency Management Agency, the California Department of Forestry, and the Fire Protection Research Foundation.

"This earthquake drill is an excellent opportunity to collaborate with local partners to exercise technology that will enhance our community's resiliency to disasters," says Chad Thompson, City of Anaheim Fire and Rescue deputy chief. "CareDEX will not only benefit Anaheim residents, but will also provide first responders with real-time information we can use to protect lives and property in our community."

## The Vulnerability of Older Adults

Led by Professor of Computer Science Nalini Venkatasubramanian, the CareDEX smart-platform technology is the result of a multiyear, multidisciplinary collaboration at UCI that includes Computer Science Professors Nikil Dutt and Sharad Mehrotra; Dr. Lisa Gibbs, professor and chief of geriatric medicine; and Julie Rousseau, researcher and project scientist in geriatric medicine and gerontology. They worked together with City of Anaheim Emergency Manager Dr. Jannine Wilmoth to plan the deployment and testing of CareDEX at the Walnut Village Retirement Community for the Great ShakeOut.

"Older adults are our most vulnerable population during natural disasters," says Gibbs, a key partner in the CareDEX project's development. "Many of them have difficulty evacuating because of medical problems — such as mobility issues, vision impairment or dementia — and the period after evacuation is critical for those who require oxygen, dialysis and medications."

According to Venkatasubramanian, the project's principal investigator, "Over the years, our team has worked with disaster-response awareness, and one of the things that we realized, especially with the COVID-19 pandemic, is that when you look at disasters of any kind, a disproportionate number of older adults suffer fatalities and injuries." Consider these statistics:

- In 2020, over 80% of COVID-19 deaths were people 65 or older and 47% of them resided in elder care facilities.
- Of the 86 confirmed deaths in the 2018 wildfire that destroyed the Northern California town of Paradise, 77% were 65 or older. In 2005, 75% of those who died in Hurricane Katrina were 60 or older.
- Of the more than 6,000 lives lost to the 1995 earthquake in Kobe, Japan, 50% of the immediate casualties and 90% of subsequent deaths were people 60 and older.

"With our growing senior population and the increasing frequency and severity of natural disasters — including wildfires, earthquakes, hurricanes and even COVID — geriatric mortality is sure to escalate in the years to come," says Gibbs. "The time to plan and build natural disaster resilience is now."

## How CareDEX Works

The CareDEX information-sharing platform works by facilitating the rapid assimilation and exchange of information. It can be readily adapted for senior housing facilities and age-friendly communities where large numbers of older U.S. adults live.

"The technology can be used on a regular basis, but it also can morph to provide situational awareness during a disaster," says Venkatasubramanian. "It empowers organizations to gather, store and exchange information with response agencies to help protect and care for the elderly during natural disasters."

The CareDEX platform also provides authorized first responders with seamless access to information about living facilities (e.g., floor plans, operational status, number of occupants) and important data about the residents (e.g., health conditions such as the need for dialysis, oxygen, even personal objects to reduce anxiety).

This level of detail helps first responders improve response times and outcomes, especially by being able to immediately identify who needs specialized triage and critical care. During the recent test, the platform's data combined with sensors worn by residents of the senior care facility enabled first responders to identify and rescue an additional eight people who otherwise would have been missed.

## Calibrating the Response

Often the initial disaster is not what leads to death. "Fatalities are frequently tied to what happens afterwards — the lack of timely care for individuals who need dialysis or medication or the lack of power for oxygen-dependent patients," says Venkatasubramanian.

"You can't just send people who need extra care into an arena or convention center and expect them to do well," adds Gibbs. "Additional factors need to be considered to get them the right care and to the right facilities."

For example:

- How do you evacuate people quickly who need specialized equipment to keep them alive?
- How do you make sure older people have the resources they need to maintain their health after being evacuated?
- How do you help someone with dementia who may not understand that there is an emergency? Does the person have specific triggers that would cause them to become agitated or nonresponsive?
- If their residence is uninhabitable after the disaster, where do they go to live?

## Promising Results

"The pilot program showed us there is real potential for this system to make a substantial impact in future disaster response efforts," says Rousseau. "Our ability to perform the drill in real time at a senior housing facility was especially unique and that drill was shown nationwide over Zoom."

The CareDEX platform was developed with a $1 million Civic Innovation Challenge grant from the National Science Foundation in partnership with the U.S. departments of Energy and Homeland Security. Gibbs says the next step is to determine where CareDEX could best fit into the California and U.S. natural disaster response systems.

The foundation of the technology used in CareDEX is an Internet of Things (IoT) data management platform called Testbed for Internet of Things-Based Privacy-Preserving Pervasive Spaces (TIPPERS, *tippersweb.ics.uci.edu*), which Mehrotra and Venkatasubramanian have been working together to develop as part of a five-year, $5 million effort funded by the Defense Advanced Research Projects Agency. TIPPERS was used at the height of the COVID-19 pandemic, starting in spring 2020, to help track building occupancy, maintain social distancing and trace potential virus exposures on the UCI campus.

"The CareDEX information pipeline enables community partners to capture individual information about changing health conditions, injuries, medical needs and geolocation and to triage these older adults with first responders to help improve overall response," says Venkatasubramanian. "In addition, CareDEX integrates GIS tools to provide up-to-date region-level situational awareness for dynamic decision support, including data on the surrounding roads, transportation, healthcare facilities, hospitals, partner communities and emerging disaster impacts (wildfires, aftershocks, flooding and other potential sequela)."

Over last summer, the researchers also tested CareDEX during a special disaster drill exercise inside Donald Bren Hall that involved staff and roughly 30 residents from Walnut Village; first responders; volunteer UCI nursing, medical, pharmacy and public health students; Cal Fire; UCI Environmental Health and Safety; the Fire Protection Research Foundation; the Orange County Fire Authority; Anaheim Emergency Management and Preparedness; Anaheim Fire and Rescue; and the Irvine Fire Department.

"Whether earthquakes, flood, fires or other disasters, we have a mandate to prepare and reduce the injuries, loss of life and trauma that impacts the lives of our older citizens," says Gibbs. 

*A version of this article was originally published by UCI Health.*



*Anaheim first responders lead two senior residents to safety during the Oct. 20 technology-enhanced earthquake drill at Walnut Village.* ▶

# The Heart of Precision Health

The new UCI Institute for Precision Health harnesses the empirical data from UCI Health to provide an individually tailored wellness approach that advances patient control and improves outcomes.

**W**hat is the driving force behind UC Irvine's new Institute for Precision Health (IPH)? Launched in February 2022, IPH aims to harness the brave new world of health data to transform healthcare through research, training and community outreach.

IPH directors Drs. Dan Cooper, Leslie Thompson and Alpesh Amin bring remarkable experience in clinical care, translational research and basic science, and they are nationally renowned academic health center leaders. An overriding theme of the organization is to remediate disparities in access to care and treatment through innovations in the collection, curation and use of data, allowing the delivery of personalized care and long-term health management strategies (see, for example,

▲ *ICS Professors Zhaoxia Yu, Daniel Gillen and Kai Zheng co-lead two of the eight IPH operating units.*

"Leveraging School Fitness Data" on the next page).

Providing more personalized care and reconsidering health management, however, requires a deep understanding of a patient's genetic makeup, family health history, lifestyle and behaviors, environment and more. Methods and processes are needed to curate and analyze such data without jeopardizing patient privacy or prioritizing technology over people. This puts data — and the researchers in charge of curating and analyzing that data — at the heart of IPH.

## The IPH Consortium

Precision health involves collaboration across a wide variety of disciplines, and the IPH consortium focuses on many interrelated areas. IPH will strengthen synergies with existing UCI schools, centers and institutes, with eight operating units:

- **A2IR** (applied artificial intelligence research) applies machine learning to address clinical problems.
- **A3** (advanced analytics and artificial intelligence) improves health and well-being in ambulatory and inpatient settings and deploys AI solutions to healthcare.
- **Collaboratory for Health and Wellness** fosters collaboration across disciplines through the integration of health-related data sources.
- **Education and Training** crosses all of the units and helps practitioners and students learn about each of the components that comprise IPH — including statistics, machine learning, artificial intelligence, omics and bioinformatics — to better address disparities in health data.
- **Deployable Equity** aims to narrow the disparities gap in the health and well-being of underserved and at-risk populations.
- **SMART** (Statistics, ML, and AI Research Technologies) develops novel statistical methodology to integrate and analyze health records, molecular data and observational clinical outcomes.
- **End to End** (E2E) is the Omni Signal Data Quality & Completeness platform.
- **Precision Omics** translates genomic and other omic research results into clinical applications.

Two of these units are co-led by faculty from the Donald Bren School of ICS. The Collaboratory is led by ICS Professor Kai Zheng and Tom Andriola. Zheng is director of the Center for Biomedical Informatics in the Institute of Clinical and Translational Science, professor of informatics, and chief research information officer of the UCI Office of Data and Information Technology. Andriola is vice chancellor for information technology and data and chief digital officer for UCI and UCI Health. SMART is led by ICS faculty

Daniel Gillen, Chancellor's Professor and chair of statistics, and Zhaoxia Yu, associate professor of statistics. These two units help provide the data and statistical methodology needed to support the six other areas, which deal with translating scientific findings to influence practice in clinical and patient settings, and with broader themes of equity and education.

"The goal of IPH is to harness the empirical data coming in from UCI Health to improve healthcare for patients," says Gillen. "Ultimately, the heart of that is utilizing data that historically have not been collected for research purposes, including data from electronic health records. If you don't have the data, then you're not going anywhere."

### Leveraging School Fitness Data

An example of an underutilized health data resource is mandated school-based physical fitness testing that occurs in public schools across California in the fifth, seventh and ninth grade. Researchers from UCI's Pediatric Exercise and Genomics Research Center are beginning to access this data to better understand healthcare and access disparities throughout our community — disparities that were exacerbated by the COVID-19 pandemic. Two ICS students are involved in this work.

"Because these data are collected in virtually every public school in the state, the impact of poverty, the built environment, and pollution on physical health in children can be gauged in ways never imagined," says Dan M. Cooper, current interim executive director of IPH. "More importantly, we can begin to identify policies and practices that can advance health in children and use data to prevent disease across the lifespan."

## 8 Operating Units of IPH
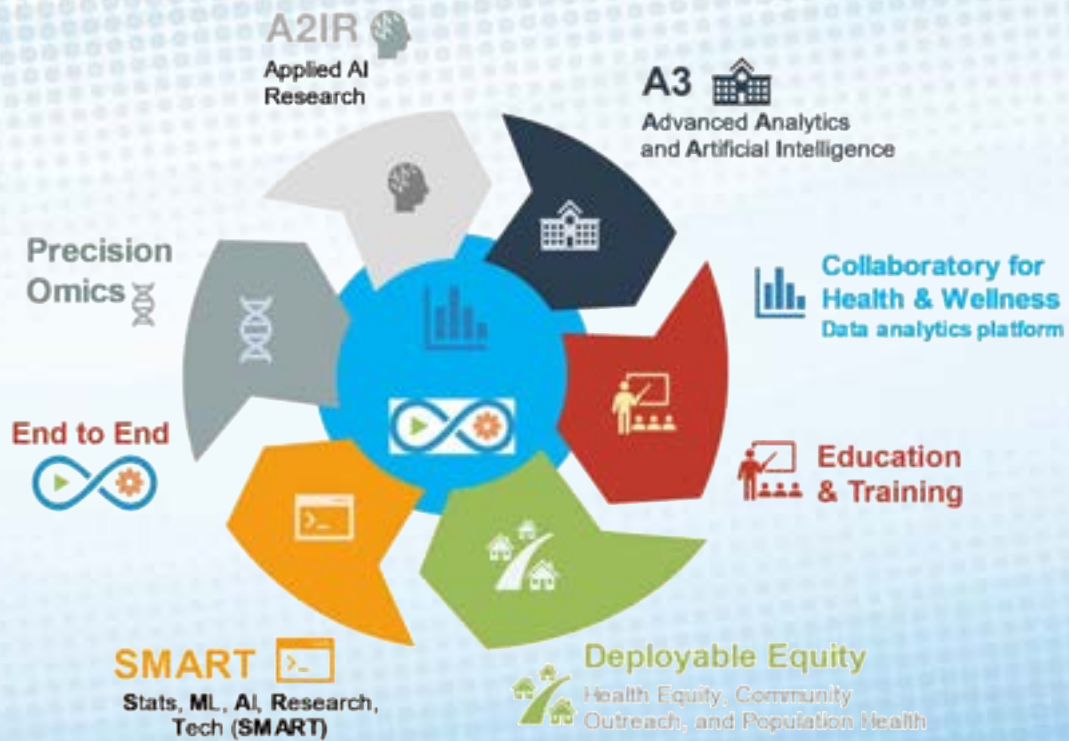


*Courtesy of UCI Health Affairs*

### Building the Infrastructure

Zheng agrees, explaining that the Collaboratory is building the infrastructure needed to advance precision health. "We're building the highway, i.e., computing platforms, and providing the fuel, i.e., data," he explains. "Researchers and practitioners are drivers that move passengers and goods to destinations to achieve the goal of accelerating scientific discovery and improving human health."

Zheng's team is working to integrate genetic data as well as environmental, epigenetic and behavioral factors based on where the patient lives and the kinds of available food, for example. "You need to include all sorts of data to find more precise, personalized treatments for each individual," he says, "both from the medical records data and then from genomic, imaging, social and behavioral, and environmental data."

He thus views the Collaboratory as a service. "We produce analytical platforms that can integrate and analyze vast amounts of data and then also curate data from our health system and from other health systems through data-sharing networks."

Zheng has been developing such platforms for over a year now, making medical data more accessible through UCI's research data warehouses. "We want to make sure that it's a very streamlined process. If someone wants to use our data, we give them access without imposing unnecessary hurdles," he says. "We preserve as much information as possible while protecting patient privacy."

His team is also working to expand the diversity of included data. "Machine learning models are trained on well-curated patient datasets that are generally from predominantly non-Hispanic white

> " *The goal of IPH is to harness the empirical data coming in from UCI Health to improve healthcare for patients.* "
>
> **- Dan Gillen**
> *Chair and Chancellor's Professor of Statistics*

patients," he says. "We want a more diverse representation of the data to reduce bias ... and ultimately to reduce algorithmic bias."

## The Interplay of Statistics and ML Technologies

While the Collaboratory focuses on data curation and accessibility, SMART is working on data integration and analysis. "We're more about technologies we want to use to analyze data, draw causal inferences and eventually predict new observations in people," says Gillen.

Developing methods for predicting disease origin and progression and identifying interventions require expertise in machine learning as well as in a host of statistical techniques, including causal inference, sequential testing, and longitudinal and survival analysis. "There's a lot of interplay between machine learning and statistics," says Gillen, highlighting a strength of ICS, which houses the Departments of Computer Science and Statistics, as well as Informatics.

In addition to collaborating with ICS colleagues, Gillen is partnering with researchers at UCI's Alzheimer's Disease Research Center (ADRC), where he leads the Data Management and Statistics Core. He's currently working to "harmonize" research data collected at the ADRC with clinical data collected at UCI's Medical Center. "You have to harmonize the data, borrowing from the strengths of each while also understanding the limitations of each." The ADRC has much

more structured and standardized data, but it's limited in scope.

"ADRC maintains a cohort of really well-defined patients that we bring back every year for research purposes," explains Gillen. "We give them standardized neurological testing, blood-based testing and serum cerebrospinal fluid testing." A majority of those patients are also seen at the UCI Medical Center, so there's the potential to consider how other factors, such as cardiovascular events, affect (or are affected by) dementia. "Being able to utilize the research data that we have in combination with their regular clinical data will give us the ability to understand other pathways that might impact dementia or how dementia impacts other pathways."

Gillen also stresses the human component, noting that precision health uses data to supplement, not replace, physician decision-making processes. "Healthcare is nowhere near a system where you just look at an algorithm and say, 'that's the way I want to treat this person.' Doctors will not do that," he says. "They're still looking at the person as a whole." The goal is simply to provide physicians with more information about a patient's unique needs and circumstances.

"The bottom line is we want to bring in as much data as possible so researchers can then apply ML and AI to learn about the origin, progression and outcomes of diseases on different types of populations," says Zheng, "and then use that knowledge for precision health, developing a healthcare strategy for each individual and, collectively, the population."

# FACULTY HIGHLIGHTS

### Chen Receives NSF CAREER Award for AI Security Research

In 2022, Assistant Professor of Computer Science Qi Alfred Chen received the prestigious National Science Foundation's Faculty Early Career Development (CAREER) award, which supports junior faculty serving as academic role models in research and education and leading advances in their field of interest. Chen will receive $523,400 over the next five years to fund his proposal, "Securing the AI Stack in Autonomous CPS under Physical-Layer Attacks: A Systems Perspective." His research focuses on AI security in the emerging Internet of Autonomous Things (IoAT), which includes various recent high-profile AI-enabled autonomous cyber-physical systems (CPSs) such as autonomous cars, delivery drones and robots.

### $3.7M NIH Grant Helps Diversify Clinical Research Participation

What is the best way to recruit participants to join a clinical studies registry, and can such registries help better diversify clinical research samples? These are two critical questions that UC Irvine researchers are tackling with a new National Institutes of Health grant, "Recruiting and Retaining Participants from Disadvantaged Neighborhoods in Registries." The work will be led by Daniel Gillen, Chancellor's Professor and chair of the Statistics Department, and Professor Joshua Grill from UCI's schools of medicine and biological sciences. The multidisciplinary team will focus on participant recruitment and retainment for Alzheimer's disease and related disorders (ADRD) research.

### Mandt Collaborates on $3.5M DOE Project to Study ML for Climate Science

The U.S. Department of Energy awarded $16 million to five research projects developing artificial intelligence and machine learning algorithms to enable greater scientific insight and new discoveries. One of the five projects, "Discovering Physically Meaningful Structures from Climate Extreme Data," is a multi-institutional effort led by Rose Yu, an assistant professor of computer science and engineering at UC San Diego. "The goal is to develop general-purpose machine learning methodology useful for climate science research," says Yu, who is collaborating with Stephan Mandt, an associate professor of computer science and statistics at UCI, and Pierre Gentine, a professor of Earth and environmental engineering at Columbia University. The project was awarded $3.5 million, with $1.2 million going to UCI.

### Smyth Explores ML for Disease Risk Prediction With $1.3M NIH Grant

Padhraic Smyth, Chancellor's Professor in the Computer Science and Statistics Departments, is co-principal investigator on a research project award from the National Institutes of Health. The $1.3 million project is an interdisciplinary effort involving computer scientists, statisticians and medical experts at both UCI and New York University. UCI computer science Ph.D. students Yuxin Chang and Preston Putzel will also be participating in this research. The four-year project will focus on the development of new

machine learning and statistical methods for building predictive models that use electronic health record (EHR) data to predict individual patient risk over time for clinical outcomes such as incidence of cardiovascular disease.

## Nan, Gillen Receive $1.87M NIH Grant to Study Statistical Methods for Alzheimer's Research

Two ICS professors are teaming up with researchers from UCI's Alzheimer's Disease Research Center (ADRC) on a new five-year multi-PI grant from the National Institutes of Health. The $1.87 million grant, "Statistical Methods for Alzheimer's Research," is co-led by Chancellor's Professor Bin Nan in statistics (contact principal investigator) and Chancellor's Professor and Statistics Department Chair Daniel Gillen. The work is a collaborative effort with ADRC Clinical Core Director David Sultzer and ADRC 90+ Core Director Maria Corrada-Bravo, both grant co-investigators. The team will produce novel predictive models for recurrent events when there are possible missing events. They will also produce a new survival analysis methodology that is robust to common assumptions and differential missingness patterns.

## CS Researchers Collaborating on $1.2M NSF Grant to Study Geometric Graphs

Michael Goodrich and David Eppstein, both Distinguished Professors of computer science, have been awarded a National Science Foundation grant to study algorithms for geometric graphs. They will be receiving $800,000 over the next four years for their work on this project, which is a collaboration with Computer Science Professor Stephen Kobourov of the University of Arizona. Kobourov will receive $400,000 over the next four years, bringing the total budget to $1.2 million.

## Informatics Team Improves Software Accessibility Testing Tools With $1.2M NSF Grant

When Informatics Professors Sam Malek and Iftekhar Ahmed, along with Ph.D. student Abdulaziz Alshayban, first studied accessibility issues in mobile applications, they found that close to 96% of the top 1,000 mobile apps in the Google Play Store had severe accessibility issues. To address this, Malek and Ahmed teamed up with colleague Stacy Branham, associate professor of informatics, who has been at the forefront of software accessibility research for many years. Now, with $1.2 million in funding from the National Science Foundation, the researchers plan to develop improved software accessibility testing tools that identify real-world issues — as opposed to current tools, which often flag superficial issues that, in practice, don't affect users with disabilities. Their new NSF project, "Automated Software Engineering Techniques for Improving the Accessibility of Software," creates a foundation for building innovative technologies, letting users with vision and motor impairments better interact with software.

## UCI Team Uncovers Key Brain Mechanisms for Organizing Memories in Time

In a scientific first, researchers at UCI, including ICS Professors Babak Shahbaba and Pierre Baldi, discovered fundamental mechanisms by which the hippocampus region of the brain organizes memories into sequences and how this can be used to plan future behavior. The finding may be a critical early step toward understanding memory failures in cognitive disorders such as Alzheimer's disease and other forms of dementia. The team's work is the subject of a paper published in *Nature Communications*.

## Faculty Accolades

Chen Li, professor of computer science, was elevated as an IEEE Fellow.

Statistics Professors Veronica Berrocal and Babak Shahbaba were named fellows of the American Statistical Association.

Nalini Venkatasubramanian, professor of computer science, was named a 2021 Distinguished Member of the Association for Computing Machinery.

The German National Science Foundation awarded Stephan Mandt, associate professor of computer science and statistics, its prestigious Mercator Fellowship.

UCI Provost and Executive Vice Chancellor Hal Stern, a Chancellor's Professor of statistics, received the 2022 American Statistical Association Founders Award.

Jessica Utts, statistics professor emerita, received the 2022 Samuel S. Wilks Memorial Award from the American Statistical Association.

Annie Qu, Chancellor's Professor of statistics, was named an Elected Member of the International Statistical Institute.

*Popular Science* magazine named Stacy Branham, associate professor of informatics, as one of its Brilliant 10 for 2021.

Sangeetha Abdu Jyothi, assistant professor of computer science, was named to the 2022 Rising Stars in Computer Networking and Communications list by N2Women (Networking Networking Women).

Chancellor's Professor of Computer Science David Eppstein won the 2022 SIAM Symposium on Simplicity in Algorithms Best Paper award for "Finding Relevant Points for Nearest-Neighbor Classification."

Paul Dourish, ICS Chancellor's Professor and Steckler Endowed Chair of Information and Computer Science, won the Lasting Impact Award at the 24th ACM Conference on Computer-Supported Cooperative Work and Social Computing for a 1996 paper he co-authored titled "Re-place-ing Space: The Roles of Place and Space in Collaborative Systems."

UCI Vice Provost for Graduate Education and Dean of the Graduate Division Gillian Hayes, Kleist Professor of Informatics, was elected to the Computer Research Association's board of directors.

Computer Science Professor Sandy Irani was appointed the associate director of the Simons Institute for the Theory of Computing at UC Berkeley.
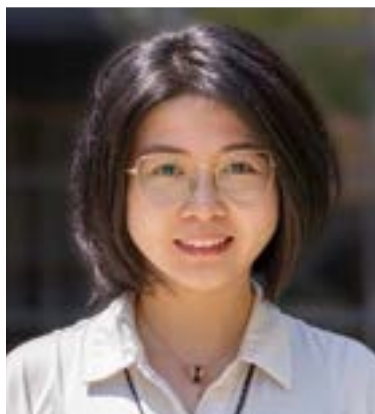
Michael Franz, Chancellor's Professor of computer science, and a group of current and former Ph.D. students and postdoctoral researchers from ICS won the Best Paper Award at the 2022 European Conference on Computer Systems for their paper, "PKRU-Safe: Automatically Locking Down the Heap Between Safe and Unsafe Languages."

# Introducing Our New Faculty for 2022

### Hengrui Cai
**Assistant Professor, Statistics**
**Ph.D., Statistics, North Carolina State University**

Cai has broad research interests in methodology and theory in causal inference, reinforcement learning and graphical models as she works to establish reliable, powerful and interpretable solutions to real-world problems. Currently, her research focuses on individualized optimal decision-making with complex data; policy evaluation in reinforcement learning and deep learning; and causal discovery for high-dimensional individual mediation analysis. Her work impacts a variety of fields, including precision medicine, customized economics, personalized marketing and modern epidemiology. For example, leveraging cutting-edge techniques in causal inference with reinforcement learning, Cai is working to develop an optimal individualized treatment rule, stored in electronic health records, for patients in intensive care units to ensure they get the right treatment at the right time. Cai has also worked with research teams at both Amazon and Merck. She joined the ICS faculty in July 2022.

### Mohammad Moshirpour
**Associate Professor of Teaching, Informatics**
**Ph.D., Software Engineering, University of Calgary**

Moshirpour's research interests include software design and development, software requirements engineering, machine learning, and software engineering training and education. He is the recipient of several awards for his work in developing tools and methodologies for software engineering practices and education, including the 2021 D2L Innovation Award in Teaching and Learning. Moshirpour is a senior member of the Institute of Electrical and Electronics Engineers (IEEE), and is the IEEE Chair of the Computer Chapter of the Southern Alberta Section. He was an associate professor, a software engineering teaching chair, and director of the master of software engineering program in the Department of Electrical and Software Engineering at the University of Calgary before joining the ICS faculty in January 2023.
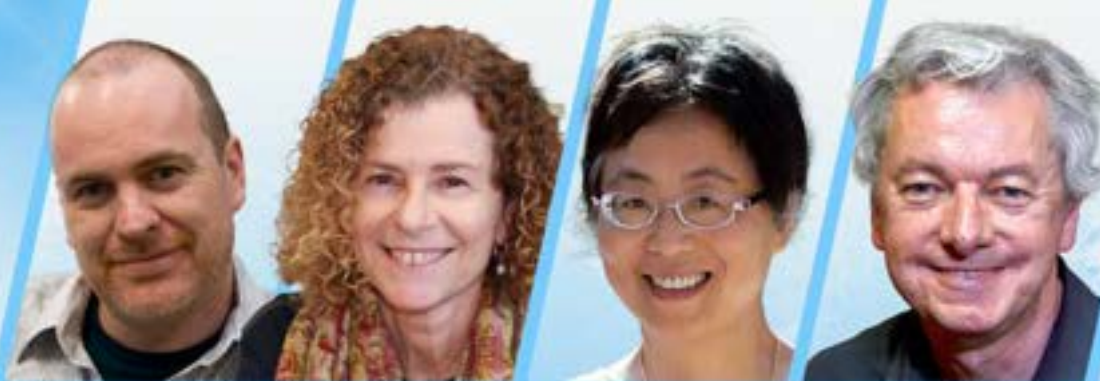
# Four Professors Named AAAS Fellows

In January 2022, UC Irvine announced seven new faculty members had been named fellows of the American Association for the Advancement of Science (AAAS) — an association that "seeks to advance science, engineering, and innovation throughout the world for the benefit of all people." AAAS fellows are "a distinguished cadre of scientists, engineers and innovators who have been recognized for their achievements across disciplines, from research, teaching, and technology, to administration in academia, industry and government, to excellence in communicating and interpreting science to the public."

Among the seven inductees at UCI were four researchers from the Donald Bren School of ICS: Rina Dechter of the Department of Computer Science, Paul Dourish of the Department of Informatics, Annie Qu of the Department of Statistics, and Padhraic Smyth of both the Department of Computer Science and Department of Statistics.

## Creating Responsible IT

Chancellor's Professor of Informatics Paul Dourish was recognized for his contributions to the field of human-computer interaction (HCI) and computer-supported cooperative work, particularly how historical and geographical contexts shape the design, production and use of information technologies. His research examines the social and cultural dimensions of data and digital practice, drawing on disciplines such as HCI, science and technology studies, media studies, and communication.

"I'm deeply honored to have been named as a fellow of AAAS, particularly at the moment when we have a pressing responsibility to bring scientific understandings and processes to a broad public audience," says Dourish. He currently serves as director of UCI's Steckler Center for Responsible, Ethical, and Accessible Technology (CREATE, *create.ics.uci.edu*). The center promotes research and education focused on creating technological futures that produce positive change in the world, with an emphasis on principles of equity, accountability and care.

"I was especially delighted," adds Dourish, "to realize that I'd been inducted alongside such an impressive number of ICS colleagues."

## Contributing to Automated Reasoning in AI

Distinguished Professor of Computer Science Rina Dechter was recognized for her contributions to computational aspects of automated reasoning and knowledge representation, including search, constraint processing and probabilistic reasoning, and for service to the computing community.

"I am very pleased to get this recognition

from the Association for the Advancement of Science," says Dechter, whose research is in the field of automated reasoning in artificial intelligence, with a focus on graphical models. Graphical models are used to accomplish many science, engineering and business tasks, such as scheduling, planning and learning, diagnosis and prediction, design, hardware and software verification, and bioinformatics. They are also instrumental for enhancing machine learning schemes.

"On the algorithmic side, we're currently working on harnessing the power of neural networks for function approximation to advance inference algorithms, in the spirit of the emerging field of neuro-symbolic AI. On the application side, we are applying our state-of-the-art algorithms for inference in graphical models to the computational protein design (CPD) problem," says Dechter. "In particular, we've developed a framework for continued adaptation of existing state-of-the-art mixed inference schemes over AND/OR search spaces we developed, which should help address the problem of protein design." Designing proteins to improve their interactions — for example, designing high-affinity monoclonal antibodies — is becoming increasingly important for advances in diagnosis and therapy options.

## Integrating Statistics and Machine Learning

Chancellor's Professor of Statistics Annie Qu was recognized for contributions to longitudinal data, high-dimensional statistics and machine learning as well as for exceptional service to the profession. "I am deeply honored and humbled by the AAAS fellow recognition," says Qu. "I am also very pleased to contribute to ICS and UCI and grateful to my students and my colleagues."

Qu focuses on solving fundamental issues regarding structured or unstructured large-scale data; developing cutting-edge statistical methods and theory for machine learning; and extracting essential information from large volume high-dimensional data. "My research can be applied in many different fields such as biomedical studies,

genomic research, public health research, and social and political sciences," says Qu. "We are developing causal mediation analysis in heterogeneity settings that provide new understandings in discovering personalized, effective intervention strategies." Such work could help identify, for example, early diagnostic epigenetic biomarkers to assess health disparities among populations exposed to traumatic stress.

Qu and her students are also developing dynamic treatment and data-integration schemes for mobile health. "We are working on estimating effective intervention regimes and real-time implementation to allocate limited resources to the most vulnerable individuals at optimal times for improving individual well-being and stress management."

## Building Foundations for Machine Learning

Chancellor's Professor of Computer Science Padhraic Smyth was recognized for contributions to the field of machine learning, particularly the development of statistical foundations and methodologies.

"My research area of machine learning has been thrust into the spotlight in recent years in terms of now being widely applied in many different types of high-profile application areas," says Smyth. "Along with my research group and collaborators, we are investigating different aspects of the robustness of machine learning models and asking questions such as do these models 'know' what they don't know? Are they unbiased and fair in their predictions? Can humans and machine learning models collaborate effectively?" Smyth and his team are addressing these questions using a variety of different ideas from computer science, statistics, mathematics and cognitive science.

"I'm delighted to receive this national recognition," says Smyth. "Having been a professor at UCI for over 25 years, I've been very fortunate to work with terrific graduate students and great colleagues — this type of fellow recognition would not be happening without all of their help."

# STUDENT HIGHLIGHTS

### Three ICS Students Awarded NSF Graduate Research Fellowships for 2022



Three students from the Donald Bren School of ICS received National Science Foundation (NSF) Graduate Research Fellowships, which recognize and support outstanding graduate students in STEM disciplines nationwide. Statistics Ph.D. student Thanasi Bakis' research interests revolve around Bayesian inference. Pratyush Muthukumar, a former computer science undergraduate pursuing his master's at Stanford University, is involved in AI research, specifically in the field of deep reinforcement learning. Samuel Showalter, a computer science Ph.D. student, is working to improve human trust in machine learning. Two additional ICS students, Mikaela Nishida and Hayden Freedman, received an honorable mention from NSF.

### Nour Receives Google Fellowship



Informatics Ph.D. student Nika Nour received a 2022 Google Fellowship to explore the effects of deepfakes. Google created its Ph.D. Fellowship Program for those who seek to "influence the future of technology." Nour, who was selected for one of six coveted fellowships in the area of human-computer interaction (HCI), is now honing in on her research into deepfakes — videos or images manipulated to misrepresent someone and present misinformation — and their effects on people and society.

### Chio Named ARCS Scholar, UC National Lab In-Residence Fellow



Computer science Ph.D. student Andrew Chio was selected by the ARCS Foundation as an ARCS Scholar, which supports outstanding students who are advancing science and technology in their research. His overarching research interests revolve around developing middleware systems for real-world problems, many of which additionally rely upon mathematical optimization techniques and applications of machine learning methods. Chio also received a highly competitive UC National Lab In-Residence Graduate Fellowship in 2022 for his project "Integrating Model and Data-Driven Methods in IoT-enabled Resilient Infrastructure," which will place him at the Los Alamos National Laboratory (LANL) this summer.

### Lu Awarded Steckler Family Endowed Fellowship



Informatics Ph.D. student Xi Lu was awarded the ICS Steckler Family Endowed Fellowship, which supports Ph.D. students who are committed to promoting the field of computing to women. Lu's research interests lie at the intersection of HCI and personal informatics as she studies and designs self-tracking technology that improves people's health and wellness. She also examines technology beyond individual-level interactions, seeing how specific sociocultural contexts influence people's situated needs and uses of everyday technology.

## Anderson Coto Receives Rosalva Gallardo Valencia Graduate Award

Informatics Ph.D. student María J. Anderson Coto received the 2022 Rosalva Gallardo Valencia Graduate Award, which is open to all ICS Ph.D. students. Anderson Coto's research brings together machine learning, HCI, education and team science to empower minoritized communities. Her goal is to become a professor while maintaining strong relationships with industry and non-governmental organizations.

## Ayala Awarded Eugene Cota-Robles Fellowship

Software engineering Ph.D. student Jessy Ayala has been awarded the Eugene Cota-Robles (ECR) Fellowship, the most prestigious diversity fellowship offered at UC Irvine. This award, named in honor of one of the earliest Mexican-American professors in the University of California System, puts students interested in careers in academic teaching and research on a fast-track toward completing their doctoral degree. Ayala's research is centered around addressing, exploring and revealing security concerns in real-world software and systems.

## Chen Receives J. Yang & Family Foundation Fellowship

Computer science Ph.D. student Ping-Xiang Chen was awarded the 2022 J. Yang and Family Foundation Fellowship. Established by Taiwanese-American entrepreneur Jackson Yang, the foundation offers fellowships and grants that benefit Taiwanese students in Southern California. Chen is currently working on building novel self-aware and adaptive computing frameworks that support the efficiency, reliability and scalability of autonomous systems.

## Goldstein Awarded La Verne Noyes Fellowship

Statistics Ph.D. student Isaac Goldstein received the La Verne Noyes Fellowship, awarded to graduate students who demonstrate outstanding academic achievement and are descendants of World War I U.S. Army or Navy veterans. Goldstein's research focuses on improving methods for modeling the spread of infectious diseases.

## UCI Takes 4th Place in Embedded Capture the Flag Competition

For the first time, a team of ICS students entered the MITRE Embedded Capture the Flag (eCTF) competition, going against 31 other teams. Led by Computer Science Professor Ian Harris and sponsored by UCI's Cybersecurity Policy and Research Institute, the team participated in the attack-and-defend exercise from January to April 2022, learning how to better design secure embedded systems and placing fourth overall. The team members were computer science majors Jalen Chuang, William Jeon and Zhuoyi Yang; computer science and engineering major Jacob Huang; data science major Jeein Kim; computer science master's students Lucas Chang and Chenhan Lyu; and computer science Ph.D. student Kush Dave.

# EVENT HIGHLIGHTS

## Celebrating the Class of 2022



UC Irvine's 57th annual commencement marked the long-awaited return of a traditional in-person graduation ceremony at the Bren Events Center, where the Donald Bren School of ICS conferred more than 1,100 undergraduate and 150 graduate degrees. During the ceremony, the ICS class of 2022 heard fellow classmate Kazeem Salaam, a computer science major, speak of roadblocks and resilience, culminating in this moment. ICS alumna Smita Bakshi, Ph.D. '96, also shared four principles of success to guide students as they embark on their next journey. "The graduating students this year have experienced too many challenges and have had to successfully transition twice — both into and out of remote classes," said Gopi Meenakshisundaram, ICS associate dean for undergraduate education. "The class of 2022, more than any other cohort, is uniquely equipped to handle many more challenges in the real world."

## Online Farmer's Marketplace Takes Top Prize at Butterworth Competition



The 2022 Butterworth Product Development Competition (**bbcomp.tech.uci.edu**), sponsored by UCI alumnus Paul Butterworth (M.S. '81, B.S. '74), was back in person again after two years, offering dozens of teams composed of more than 100 students a chance at $20,000 in prizes. Taking first place was Team Leprendo (Nina Nguyen, Dylan Riffle and Dan Ta), which built an online farmer's marketplace (**leprendo.com**) that brings specialty farm produce directly to consumers. Second place went to Team FoodPool (Sanghyun Byun, Arthur Lafrance, Patrick Wang and Kevin Xu) for their app (**foodpool.app**) that provides affordable food delivery to students. Team Consense (Richard DeAmicis, Lily He, Ado Ibori and Melissa Yuenn) took third place for their IoT system that leverages crowd-sourced data to make cities safer for cyclists.

## IGB Hosts Biomedical AI Symposium



UCI's Institute for Genomics and Bioinformatics (IGB, **igb.uci.edu**) hosted its Southern California AI Biomedicine Symposium on Oct. 14 to discuss the latest in AI research as well as the numerous applications of AI in the natural sciences. The daylong event included talks by UCI professors from the schools of biomedical sciences, medicine and engineering. It also featured four distinguished IGB alumni who have gone on to successful careers as faculty members in other universities or who are working in industry: Daniel Quang, Ph.D. '17, of DNAnexus; Jonathan Chen, Ph.D. '09, of Stanford University; Joshua Swamidass, Ph.D. '07, of Washington University in St. Louis; and Jianlin Cheng, Ph.D. '06, of the University of Missouri-Columbia. ▪

# 2022 Distinguished Speakers

View videos of the distinguished speakers below by visiting **youtube.com/UCIBrenICS**.
Stay informed about upcoming ICS events by visiting **ics.uci.edu**.

## Department of Computer Science Distinguished Lecturer Series

**Yinyu Ye**
K.T. Li Chair Professor of
Engineering, Stanford University
*"Geometric Aggregation of
the Social Welfare in Resource
Allocation"*

**Shafi Goldwasser**
Director, Simons Institute
Professor at UC Berkeley, MIT and
Weizmann Institute of Science
*"The Right to Deny Online
Activities"*

**David Forsyth**
Fulton Watson Copp Chair in
Computer Science, University of
Illinois at Urbana-Champaign
*"Learning Shading and Lighting
Without Ground Truth"*

## Department of Statistics Distinguished Lecturer Series

**Mike Daniels**
Professor, Andrew Banks Family
Endowed Chair, Department of
Statistics, University of Florida
*"A Bayesian Nonparametric
Approach to Causal Mediation
With Multiple Mediators"*

**Radford Neal**
Professor Emeritus of Statistics
and Computer Science, University
of Toronto
*"MCMC Training of Bayesian
Neural Networks"*

## Institute for Software Research Distinguished Speaker Series

**Darko Marinov**
Professor of Computer Science, University of Illinois at Urbana-Champaign
*"Combating Flaky Tests"*

## Steckler Center for Responsible, Ethical, and Accessible Technology Distinguished Speaker Series

**Lisa Nakamura**
Gwendolyn Calvert Baker Collegiate Professor of American Culture, University of Michigan
*"The Metaverse's New Diversity Industrial Complex"*

# ICS Project Expo Strengthens Industry Engagement While Showcasing Student Talent

**M**ore than 250 ICS students showcased their talent and networked with industry professionals on June 1, 2022, at the Second Annual ICS Project Expo (***ics.uci.edu/expo***). Held in the state-of-the-art Interdisciplinary Science and Engineering Building, the event was a culmination of months of hard work, offering students the opportunity to present projects completed for undergraduate capstone courses in informatics, computer science and data science, as well as for the Butterworth Product Development Competition.

These ICS undergraduates spent anywhere from 10 to 20 weeks experiencing hands-on learning, working on real-world projects and collaborating with industry partners. "The expo really ties together the four foundational elements of engagement that our programs offer — project experience, entrepreneurship, mentorship and opportunities for internship," says Jason King, ICS director of corporate relations. "The expo benefits project sponsors looking to recruit and showcases all the great work of our students."

Peter Colligan, senior executive manager and head of engineering for SAP's Industry Cloud, was one of 40 industry professionals who attended the expo. Speaking of SAP's goal of helping "to accelerate collaboration between academia, startups and industry," Colligan stresses the importance of these

◄ *Students presenting their work at the Second Annual ICS Project Expo.*

*Lecturer Darren Denenberg (left) and ICS Dean Marios Papaefthymiou (right) talking with students about their capstone projects.* ▼

types of events. "I get a chance to directly and informally interact with student teams and talk about the engineering skills and projects they care about. Those discussions can sometimes go deeper, where professors themselves step in and get a chance to highlight and validate ideas and common challenges with industry practitioners," he continues. "Very realistic and concrete outcomes have come out of this, such as ideas for future capstone projects, full-time employment work, or joint industry-research initiatives."

One of this year's top computer science capstone projects leveraged AI to create a personalized recommendation system for quick service restaurants (QSRs). For the "AI-Driven Personalized Menu Content for the QSR Drive Thru" project, the four-person student team partnered with Delphi Display Systems to develop a machine learning system that presents relevant items to users based on their preferences and dietary restrictions to improve the drive-thru experience. The team also presented their project and competed at the National Capstone Design Conference in Dallas on June 6, 2022.

"The capstone project gave me the confidence that after my four years of education, under the school of ICS, I am ready to tackle new and unfamiliar projects successfully and implement what I've learned," says Arian Namavar, who graduated in June 2022 with a B.S. in computer science and now works as a software developer at Nisum. "The ICS Expo was also a great opportunity to present our project [and] take ownership of our result. Seeing the progress other students made was another aspect that made me proud of ICS."

Informatics Lecturer Darren Denenberg was similarly impressed by the students' progress, noting that everyone "was able to achieve something great with their capstone," but he was most impressed by the AudioScribe team's cough diarization project that also went to Dallas to compete in the national capstone conference.

This year's Butterworth Competition winning project, Leprendo, was also on display at the ICS Project Expo, letting participants view the online farmer's marketplace.

"We're increasingly promoting the value of capstone projects, showing why regional and national companies should be involved with these programs and the talent pipelines they offer," says King. "Our programs are well-rounded, and the expo showcases the breadth of experience gained from an ICS education." 🖥️

# ICS Industry Showcase: A One-Stop Shop for Recruitment & Research Engagement

**E**xcitement over new job opportunities and the potential for innovation filled the autumn air, as roughly 2,200 students gathered in the courtyard of UC Irvine's Interdisciplinary Science and Engineering Building to talk with recruiters from 32 tech companies. In the evening, graduate students attended more intimate networking receptions. This was over two days, Oct. 4-5, 2022, as the Donald Bren School of ICS hosted its 4th Annual Industry Showcase (***industryshowcase.ics.uci.edu***), providing a venue for corporate recruitment, student engagement and networking, and faculty outreach for industry collaboration.

"Companies see the value and want to be a part of this showcase because it connects them to tech talent that is tailored to their specific needs better than a broad, university-wide event," says Jason King, director of corporate relations. "Our unique structure makes us stand out, and our numbers make us a great one-stop shop for recruitment."

▲ *Thousands of ICS students gathered outside the Interdisciplinary Science and Engineering Building for the 4th Annual Industry Showcase.*

ICS is home to more than 3,000 undergraduate, 600 master's and almost 400 Ph.D. students. It's also one of the few stand-alone computer science schools in the nation, housing the Departments of Informatics, Computer Science and Statistics. So the event unites companies in search of innovative tech solutions with students offering new perspectives and technical expertise in areas ranging from software and game design, to artificial intelligence and machine learning, to data analytics. Skills in these areas apply to many fields beyond the tech sector, from healthcare to transportation, and students learned about the wide variety of companies in need of their talent and knowledge.

"As a local employer, our relationship with the university is a critical partnership. … I was surprised at the amount of algorithm, AI and machine learning talent open to learning more about Masimo. We'll undoubtedly see several of these students at Masimo as interns or new grad hires in the future."

**– Philip Vickers, Technical Recruiting Manager, Masimo**

## Visibility and Recruitment

Each day began with two corporate information sessions. The first day, more than 120 students learned about Northrop Grumman, followed by a presentation by the global medical technology company Masimo. On the second day, 250 students attended a Google info session, which was followed by a presentation by the software company SAP.

King points out that the showcase offers visibility to both tech giants and smaller companies alike. "We level the playing field for smaller companies, giving them the same opportunity to meet with hundreds of potential candidates."

Masimo Technical Recruiting Manager Philip Vickers was pleased to be at the event, connecting with future employees. "As a local employer, our relationship with the university is a critical partnership," he says. "The students were prepared and exceptionally engaging throughout the day. I was surprised at the amount of algorithm, AI and machine learning talent open to learning more about Masimo. We'll undoubtedly see several of these students at Masimo as interns or new grad hires in the future."

By the afternoon, the courtyard had transformed into a marketplace of career possibilities. Each day, recruiters from more than 15 companies set up information tables and interacted with hundreds of motivated students. "We were so impressed with the students that showed up," says Rachel Syko, talent specialist at Flock Freight. "The students were so eager and were extremely interested in what Flock is doing to disrupt the transportation space. I am so excited to sit down with some hiring managers. We are excited to see what other partnerships can come of this in the future."

The students were similarly enthusiastic. "At the fair, I got the opportunity to interact and network with recruiters from many companies, from big ones like Meta and Google to more local ones like eQ Technologic and Numecent," says informatics major Michael Kurdahi. "I also made a lot of friends who have similar interests. This entire event made me really excited about my future, and it will always be memorable for me as being the first step toward launching my career."

## Graduate-Level Research and Networking

In addition to the information sessions and job fair, which many ICS undergraduate students attended, the showcase also featured two networking receptions for graduate students, held on the sixth-floor patio and conference room of Donald Bren Hall. On the first evening, around 350 participants attended the Master's Networking Reception. On the second evening, around 150 participants attended



"It was so beneficial for us to have a Ph.D.-focused event as we recruit for research specifically. We connected with great potential candidates. I look forward to more events with UCI!"

**– Melany del Carpio, University Talent Scout, Adobe**

the Ph.D. Networking Reception.

"It was so beneficial for us to have a Ph.D.-focused event as we recruit for research specifically," says Melany del Carpio, university talent scout of Adobe. "We connected with great potential candidates. I look forward to more events with UCI!"

While employment opportunities are an obvious focus, there's also the potential for research collaborations. "Of particular interest to ICS was the opportunity for Ph.D. and M.S. students to hold one-on-one technical conversations with industry representatives," says Tony Givargis, professor and chair of the Department of Computer Science, "which can lead to research engagement as well as internship opportunities."

## Opportunities for Innovation

The connections made throughout the two days of networking will launch careers and create partnerships that lead to real-world solutions. This was particularly evident to Syed Samiullah, vice president and regional information officer of Optum, a first-time ICS Industry Showcase participant.

"We spoke with roughly 500 students and [received] over 280 resumes," says Samiullah. "Where have we been in the past? We definitely need to be at these events!" He was pleased not only by the technical skills

*▲ Representatives from Meta, Optum and SAP talk to students during the Recruitment Fair.*

of the students but also their passion and drive to be a catalyst for change. "People are interested in [the] ability and the opportunity to make a difference," he says. "And so the conversation with many of the folks that I had the opportunity to connect with is, you can still make a difference and be part of [our healthcare solutions] team using your keyboard and a mouse!"

Samiullah, also a member of the Dean's Industry Advisory Board, had the chance to speak with ICS Dean Marios Papaefthymiou. "One of the conversations I had directly with Dean Marios is the opportunity that he's creating with the corporate world [by developing] talent that has a tendency to look at things from a very different lens," he says. "This is certainly a very significant tier-one school from a computer technology point of view for employers like us."

The goal is always to create a win-win situation from both an industry and academic standpoint. "As a leading academic program in computing, we're trying to set the bar high for mutually beneficial outcomes that revolve around corporate partners," says King. "The showcase is the culmination of our partnership efforts for outstanding recruitment and research collaborations." ⬛



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**– Syed Samiullah, VP and Regional Information Officer, Optum**

# Corporate Partners

The Corporate Partners Program enables companies to grow their relationships with ICS, while also being highly visible collaborators in moving the ICS mission forward. For more information, contact Director of Corporate Relations Jason King at *jason.king@uci.edu* or (949) 824-3088.

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# HALL OF FAME
## CELEBRATION
# 2022

▲ *ICS Hall of Fame Inductees Srinivas Mantripragada (left) and Rohit Khare (middle) with Dean Marios Papaefthymiou. (Peyman Oreizy not pictured.)*

**B**oats bobbing atop soft ocean waves on a warm spring evening set the perfect Southern California backdrop to celebrate exceptional Anteater alumni – in person for the first time since the COVID-19 pandemic hit. More than 225 alumni, faculty and community members of UC Irvine's Donald Bren School of ICS and Samueli School of Engineering gathered to induct six alumni at the seventh annual Hall of Fame event at the Balboa Yacht Club in Corona Del Mar on May 13, 2022. The three alumni from each school were selected for making a significant impact on their profession or bringing distinction to their alma mater, with 46 ICS alumni having now been named Hall of Famers since it was established in 2015. Learn more about the ICS Hall of Fame at *halloffame.tech.uci.edu*.

## Rohit Khare
**Ph.D. '03, M.S. '00, Software Engineering**

Khare is an entrepreneur and award-winning computer scientist researching software architecture, cybersecurity and decentralization. He currently leads product management at a stealth-mode cloud security startup in Irvine. He is a founder and president of 4K Associates, an alliance of internet standards strategy consultants, and he edited the *World Wide Web Journal* for O'Reilly & Associates. He spent a decade at Google after it acquired his startup. He then launched a new infrastructure for cloud computing, machine learning and social graph analytics. His first venture-backed startup, KnowNow, was spun out of UCI in 2000, after he developed internet standards at the World Wide Web Consortium and MCI's Internet Architecture Group.

## Srinivas Mantripragada
**Ph.D. '00, Computer Science**

Mantripragada is a seasoned product and technology executive with over 25 years of experience in technology strategy, product execution, architecture, go-to-market strategies and research. He currently is an investing adviser to multiple venture capital and private equity firms, and he sits on advisory boards for a dozen early- and mid-stage startups. Most recently, he was the chief technology officer and vice president of IBM Cloud Infrastructure, Platform and Watson Services. Before that, he was an entrepreneur-in-residence at Foundation Capital, a leading Silicon Valley venture capital firm focusing on cloud infrastructure, security, automation and big data analytics. He has also been vice president of technology at Infoblox, leading DNS infrastructure and security initiatives; director of advanced technology at Determina, an innovative cybersecurity firm that was acquired by VMWare; and chief architect at Barracuda Networks, a worldwide leader in web application security. Srinivas has co-authored more than 60 technical/product/research peer-reviewed publications and six patents.

## Peyman Oreizy
**Ph.D. '99, M.S. '95, B.S. '93, Information and Computer Science**

The final 2022 ICS inductee, Oreizy, wasn't present at the Hall of Fame celebration, so his brother accepted the award on his behalf. Oreizy is currently an engineering manager within Walmart's Health and Wellness group. He joined Walmart as a part of its acquisition of CareZone, a startup he joined as employee No. 4. At CareZone, he built end-user applications to help people manage their health and the health of their family members. Before that, he worked as an independent consultant, advising companies on architecture, building critical technology and hiring engineering talent. He started his career at Microsoft, working on the Windows operating system, leading an engineering team to deeply integrate communication and collaboration features into the Windows desktop user interface. Oreizy's graduate research was in the area of software architectural styles. He is best known for his work on leveraging architecture as the basis for changing systems during runtime. His papers have been cited over 6,000 times, and he has been awarded 13 patents. 🖳

# ICS Power Couple

Lloyd and Melissa Tullues '03 maintain successful careers in the gaming and entertainment industries, while staying engaged with ICS.

**A**t the 2022 Lauds & Laurels ceremony, the UC Irvine Alumni Association honored 23 accomplished individuals with the Distinguished Alumnus Award, including two graduates of the Donald Bren School of ICS. Melissa Tullues, senior director of IT program management at Electronic Arts (EA), and her husband, Lloyd Tullues, co-founder and CTO of Carbonated (*carbonated.com*), were recognized for their successful tech careers and continued engagement with ICS as mentors, speakers and research collaborators.

For almost 20 years, these two, who first bonded over an alpha-beta pruning homework assignment in an artificial intelligence class, have been successfully navigating the gaming and entertainment industry. Lloyd had extensive experience building video games for a variety of platforms and companies before co-founding the independent mobile/PC studio Carbonated in 2015. Melissa, who was at DirecTV and Headspring Consulting before moving to EA, has worked on diverse

software, from set-top boxes to medical devices to customer support technology. She has also been named on four "method and system" patents over the years.

Here, Melissa and Lloyd talk about why they love the fast-paced gaming and entertainment industries and what motivates them to stay engaged with their alma mater.

### Lloyd, how did you turn your passion for games into a successful company?

**Lloyd:** I started coding when I was young and always knew that I was going to make games, even if it took a while to get there. When I got to UCI, knowing that the games industry used quite a broad spectrum of technology, I curated my courses to cover as much of that spectrum as possible. Software engineering was especially important to me, as game development involves intensely large systems and architectures, and making sense of it all tends to be a challenge.

After UCI and building up my career

for a little over a decade, I finally got the opportunity to follow my dream of starting my own studio. And it turns out that running a company is much like game development in that it involves learning an avalanche of new things on the fly and adapting to changing markets, technology and platforms, and business models. It involves more soft skills — not nearly as much coding and looking at bits all day — but it's the same foundational skills of adaptation and knowing how to learn (quick).

I think people underestimate the amount of work it takes to be in this particular industry. We work a lot, we work hard, we work fast — it's intense — but it's also a lot of fun. I'm surrounded not only by incredibly smart engineers but also hyper creative and passionate folks (think artists, writers, etc.).

### Melissa, what sparked your interest in computer science and what do you like about working at EA?

**Melissa:** I joke that nobody should follow my example — I chose ICS as a major because I was an overachiever in high school and computer science sounded hard. So not the best way to pick a major, but when I started taking the classes, I discovered that I really love technology. I like building things and getting hands-on in figuring out how to solve a problem. And that just continued to evolve throughout my career as I changed from being a software engineer to more in the project/program management space.

I also realized that I love it when things are messy because I like to sort through a situation and bring people together, charging forward toward a common goal. I went through this exercise last year where I had to build a personal mantra, and mine ended up being, "Sorting through chaos to find a better way, together," which really encompasses everything that I love about my work at EA, where I'm working with a team to deal with a different challenge every day.

### How has your ICS education helped throughout your career?

**Lloyd:** In the games industry, we pull in

practically every aspect of computer science that you can think of to ultimately make a fun game. That covers the stuff you would normally expect in high tech — databases, services, transactions, etc. — but then you have areas where relatively few people have tangible skills in, like animation, physics, real-time networking, and making those all work in unison. Knowing what I was going to get myself into, I not only focused on covering as much of computer science as I could but also getting used to picking up new areas rapidly.

Imagine jumping from Java to Assembly. That's a big jump, but you have to dive in and be fearless because technology moves so fast that whatever you learned in school is practically already on its way out. So what do you take post-graduation to build a successful career? Adaptability. It's more about how you learn and pick things up.

### What motivates you to stay engaged with UCI?

**Melissa:** It's nice to help the community, and we get something out of it too — it fills my bucket to support women in tech ... When I was going through ICS, groups like Women in Information and Computer Science (WICS) were a vital part of my support system. WICS helped me find women mentors who made such a big difference by allowing me to see women in very successful careers while still having families and other things I wanted. So that experience deeply ingrained in me the importance of giving back and showing that representation.

Right now, I lead the women's ERG [Employee Resource Group] for EA in Austin, Texas. I'm also always available if a WICS alum or student wants to message me with questions on LinkedIn, or I'm up for joining a panel to share my journey. I come out of those experiences energized. I love my job, but sometimes we lose sight of the magic, so talking to a student and realizing how far our worlds have evolved gives me perspective too. The engagement can be big or little, but just getting involved is really important to us, especially now that we're raising kids and trying to nudge them as much as we can toward the STEM world.
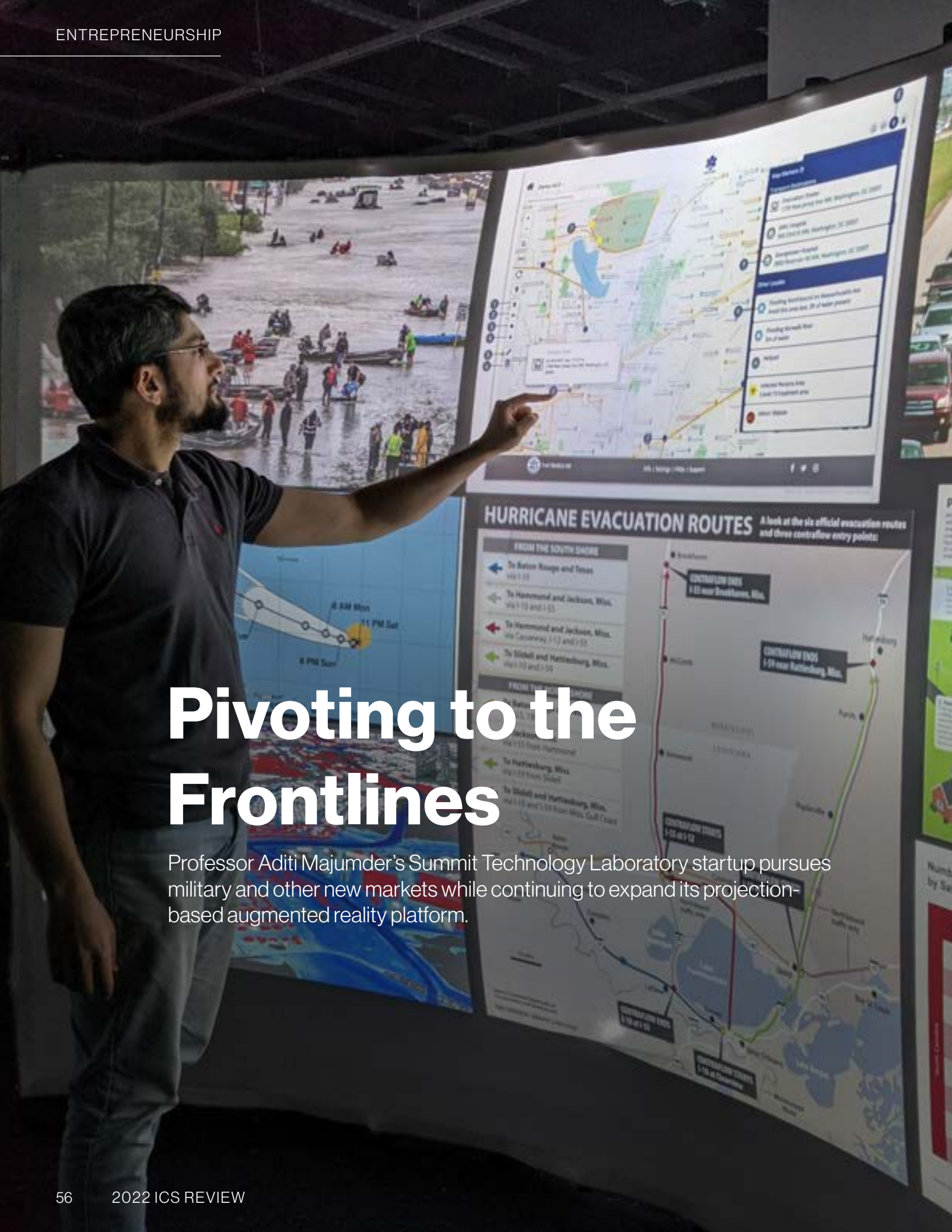
# Pivoting to the Frontlines

Professor Aditi Majumder's Summit Technology Laboratory startup pursues military and other new markets while continuing to expand its projection-based augmented reality platform.

**W**hen you think about the planning of a military operation, it likely conjures up images of a high-tech command and control center with rows of computers and wall-to-wall screens. But how that plan gets translated to troops on the frontlines is rather low tech, involving a makeshift "command center" usually set up in a tent at some remote location. So when Stephen Clark, a retired two-star major general from the U.S. Air Force who spent 32 years in service, first learned about the Decision Pod, he immediately saw its potential. The proposed product from Summit Technology Laboratory (STL, *summittechlab.com*) was an innovative platform for projection-based augmented reality.

"I took a look at the technology and started thinking, 'OK, when I was a squadron commander, would this technology have made a difference?' And the answer to that was yes," he says. "I would have spent a fair amount of money to get this large, immersive, mobile display, rather than trying to use a laptop or a single desktop display to conduct air operations over that magnitude of space. It was not a hard decision, and that's what got me involved."

So what started as a "cold call" on LinkedIn from Aditi Majumder, a professor of computer science at UC Irvine and founder of STL, eventually resulted in Clark joining the company as chief business officer. The two have since helped the startup pivot from immersive entertainment in museums to interactive displays that enhance situational awareness and collaborative decision-making for military and emergency management command and control — a pivot critical to helping STL survive the pandemic.

## Summit Technology Laboratory

The fundamental algorithms for the automated projection mapping software of STL were designed in the Interactive Graphics and Visualization (iGravi) Lab at UCI. In 2015, Majumder created STL to commercialize this cutting-edge technology for shared virtual reality (VR) experiences. In December 2016,

◀ *Front view of STL's Decision Pod.*

STL received $225,000 in National Science Foundation (NSF) Small Business Innovation Research (SBIR) funding, but Majumder struggled to find the right product market fit. "I have learned that finding the product market fit in any startup is the key challenge," she says.

STL eventually found its footing in the educational entertainment domain, providing several interactive prototypes for "Brilliance: A Night of Music and Light," hosted by the Segerstrom Center for the Arts in 2018. STL also provided an immersive inflatable dome for the Museum of Pop Culture in 2019. At the Discovery Science Center, STL created a large cylindrical projection-mapped display for a multi-user helicopter ride experience, and plans were in the works for projecting weather patterns in real time on a spherical relief of the earth mapped using four to six projectors.

Then the pandemic hit. "The projection mapped Earth would have been their centerpiece display, but they had to stop everything," says Majumder. "STL was about to fold."

## A Shift to Defense

Luckily, before the pandemic, Majumder had already started considering a move into the defense field. "I had a friend in the Army Research Lab with whom I had worked, and he told me about the military revamping its SBIR program." So Majumder participated in xTechSearch, a U.S. Army program seeking innovative technologies, and in October 2019, STL was one of 15 winning companies selected to attend the Association of the United States Army (AUSA) conference in Washington, D.C.

"That was a turning point for us, when we figured out there was this need for transportable large displays," says Majumder. "There are literally hundreds of temporary bases around the world for the Air Force, Army and Navy, and few of them have a large display because they're temporary. Nobody wants to spend millions of dollars for a massive operation center with LED/LCD panels that are heavy, fragile and cannot be transported easily."

So Majumder's team drafted a proposal for the Air Force SBIR, outlining plans for a

▲ *Aditi Majumder (third from left) and Stephen Clark (third from right) with members of the STL team. (Photo courtesy of Lori Brandt)*

portable display called the Decision Pod, and they earned $50,000 for a Phase I feasibility study. In December 2019, they submitted a proposal for Phase II worth $1.875 million and were supposed to hear back in spring 2020.

January 2020 is when Majumder reached out to Clark in search of someone who could advise the team on how to engage with the military. "It's a nice collaboration when you get the people who utilize the technology together with the people who design it rather than doing it in isolation," says Clark, who served as a deputy commanding general at the Joint Special Operations Command. "If I can help [the warfighters] do their jobs better, we can actually save lives." So even as the pandemic hit, closing most business opportunities for STL, Clark continued advising the company. Then, in April 2020, STL learned it would receive the $1.875 million.

## The Decision Pod

The team quickly got to work developing the Decision Pod, a 12-foot-by-7.5-foot collapsible display with eight projectors in the back, hard mounted into transport cases and requiring no tools for setup. "The Decision Pod comes in six cases on a third of a pallet, and in 30 minutes it's up and running with two airmen and very little training," says Clark. "We worked very hard with our design partners to keep it as simple as possible."

The system relies on computer vision via the use of multiple feedback cameras to aggregate, align and calibrate the projectors to project the visualizations on the display, conforming to its curved shape. Manually

setting up and mapping the projections can take hours, if not days, to complete, but the Decision Pod does it automatically in less than five minutes. "The technology behind it is really unique," says Clark, noting how it takes the VR out of the goggles. "It is cutting-edge stuff that's coming right out of the laboratory."

In fall 2020, as part of the SBIR program, STL's prototype was tested by an "end-user team" at an Advanced Battle Management Systems 2 Exercise at Nellis Air Force Base in Nevada. "They evaluated all different aspects of the prototype," says Majumder. "Before you can 'transition to acquisition,' you have to move through these tech evaluations. We got positive feedback on the usefulness of the STL prototype and also additional desired features."

STL took the feedback and strengthened their product over the next two years. In October 2022, Majumder and Clark went to Hurlburt Field in Florida, home of the Air Force Special Operations Command, to present a series of demos. "Now what we're trying to get is an ATO, authority to operate," says Majumder, "to ensure we are secure and have met the compliance to connect to the defense network."

In January 2023, the team participated in another defense exercise, gathering feedback once again. "We are uniquely positioned in that we are still on the UCI campus [housed in the Calit2 building], with a collaborative relationship with one of the

premier institutions in the country," says Clark. This means that, working together with researchers from UCI's Donald Bren School of ICS, STL is usually able to identify solutions to any concerns raised.

## A Suite of New Products

With the Decision Pod near completion, the team has already started building a host of new products. They've received millions more in funding to develop the Panalytics Pod, scaling to a 48-foot-by-7.5-foot panoramic 320-degree display. They are also researching how to move away from frames and structures to project directly onto a tent wall. "My Ph.D. student Muhammad Twaha Ibrahim was already working on moving objects, so STL has been instrumental in bringing in a UCI subcontract for $192,000 to explore displays on movable surfaces."

Majumder is thrilled to see STL helping fund UCI research. "I really wanted to tie in UCI, because so much of this research IP, licensed from UCI, is going into the commercial domain," she says. "I wanted to see our research in action."

The team is also exploring products for emergency management and disaster recovery as well as for the medical domain.

## A Symbiotic Relationship

The close connection between UCI and STL is a win-win situation when it comes to access to cutting-edge research and funding opportunities. Another bonus is internship opportunities. "There's a really symbiotic relationship," says Clark. Every quarter, students from ICS capstone courses in informatics and software engineering join STL.

"They love working with this kind of technology," says Majumder. "We've already had 16 interns from ICS. I always want to give back to ICS."

Majumder also serves as a role model for ICS students, as there aren't many female tech entrepreneurs. "Less than 2% of tech companies have a female founder," she says, "and especially in defense, there's not a lot of women."

Eventually, Majumder plans to step back and return to academia. "Once STL gets to a certain level, I won't be the person to lead it anymore," she says. "Stephen is very good at the business side, and he's also a visionary. At some point, we will expand our business side of the company and I will fully transition to chief technology officer in addition to sitting on the board." When that happens, she hopes to teach a course on entrepreneurship. ICS
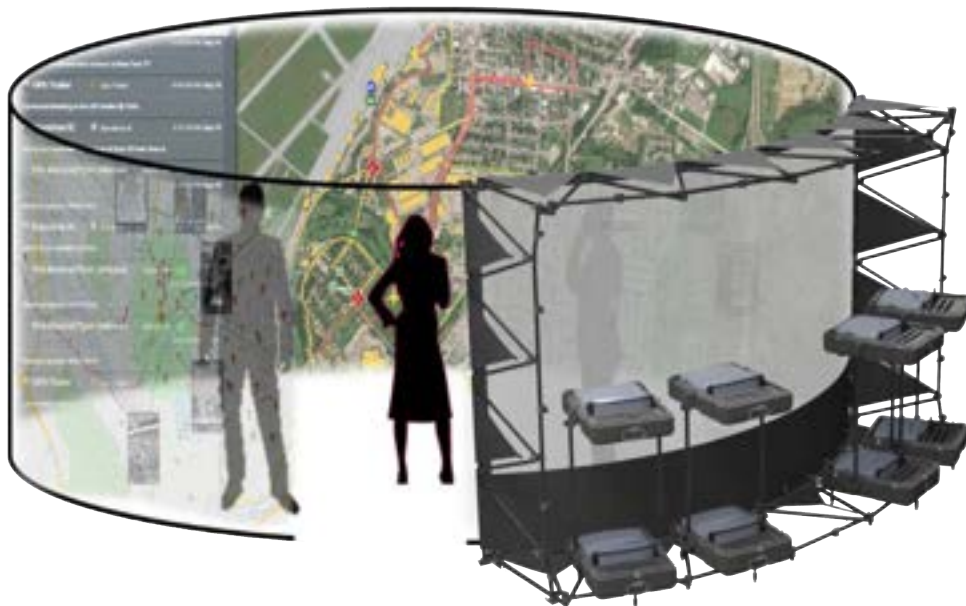


▲ *An illustration of the proposed Panalytics Pod display.*

# Honor Roll of Donors

Thanks to its generous supporters, the Donald Bren School of Information and Computer Sciences raised more than $22 million in gifts from industry, foundations, alumni, faculty and friends during the 2021-22 fiscal year. These gifts helped fund faculty research and teaching, undergraduate scholarships, graduate student awards, and other essential expenses. For more information on giving to support ICS, please visit **connect.uci.edu/ICS** or text UCIICS to 41444. You can also contact Executive Director of Development Carolyn Canning-White at ccanning@uci.edu or (949) 824-2122. ICS acknowledges the generosity of those who gave anonymously as well as the donors named below:

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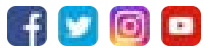Liya Yang
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# Serving Aces

In high school, Matthew Sah already envisioned himself thriving at UC Irvine, which is why he didn't hesitate to accept his offer to become an Anteater when he was recruited to play for the UCI Men's Tennis team the summer before his senior year. Little did Sah know that he'd go on to win the Big West Conference Championships last season (the first time in 11 years for UCI) and go on to play in the NCAA tournament.

Sah, a senior computer science major in the Donald Bren School of ICS, dedicates over 20 hours a week to athletics while still excelling academically — receiving the Academic Unit Award for having the highest GPA of any student athlete in ICS last June. Sah has also been recognized annually as a Scholar Athlete by the Intercollegiate Tennis Association since 2020.

In addition to playing tennis, Sah has been participating in a fellowship with the Make a Play Foundation, which helps prepare underrepresented student athletes for executive careers in various industries. Another way Sah gained real-world work experience was interning last summer for aerospace and defense company L3Harris Technologies as a full-stack software engineer in its Space and Airborne Systems Segment in Colorado Springs, Colorado.

Now, as he finishes his senior year, Sah plans to work toward a few of his goals: gaining more skills and knowledge from his courses, securing an internship offer for this summer and winning the Big West Conference Championships, again. After graduation, he plans to enroll in a professionally oriented master's program in software engineering, computer science or a related field at UCI before entering the workforce.

Read Matthew Sah's full story online:
*bit.ly/ics-serving-aces*