

MULTICAST

THE DEPARTMENT OF COMPUTER SCIENCE AT THE UNIVERSITY OF ROCHESTER

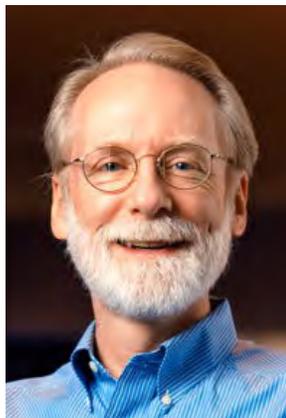


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HAJIM
SCHOOL OF ENGINEERING
& APPLIED SCIENCES
UNIVERSITY of ROCHESTER

2021–2022 in Retrospect



Michael L. Scott

As I write this, I am beginning to recover from COVID-19, the scourge that has impacted so much in our world for 2-1/2 years now, and which I managed to avoid personally until this past week. My sympathies to all who have contracted it, and to those who have lost family and friends. Condolences as well to all those impacted by the war in Ukraine and by all the other conflicts and catastrophes with which we seem to be bombarded on an almost daily basis.

Here in URCS, 2021–2022 was a bit less chaotic than the year before, though it certainly doesn't feel "normal" yet. Fall classes were mostly in-person, with a fair amount of remote participation. The Delta wave in January sent us all back to online instruction for a month, but the rest of the spring was much like the fall. The building still feels kind of empty most days, but people are beginning to work more at the office, and meetings are beginning to happen in person again. I very much look forward to more social interaction in the fall.

Beyond the impact of COVID, the year was marked by unprecedented staff and faculty turn-over. As noted in last year's Multicast, Jim Roche, our long-time Lab Manager, retired in October of 2021; James Allen retired in July of 2021; and Muthu Venkitasubramaniam resolved a long-standing "two-body problem" by moving to Georgetown University. This year, the departure list was longer: Eileen Pullara, our long-time Department Administrator, retired in April of 2022. Undergraduate Coordinator Elaina McKie took a position at the Greene Center for Career Services. MS Coordinator Jennifer Brennan took a position at the Medical Center. PhD Coordinator Emily Tevens got married (congratulations!) and moved to Texas. Among the faculty, Robert Kostin moved to RIT in August of 2021. Sandhya Dwarkadas moved to the University of Virginia, where she became CS Department Chair in July of 2022. Henry Kautz also retired in July. Rich Sarkis, who taught an incredibly popular Python programming course for years, took a job in industry. Dan Gildea moved to half-time status, ramping back his research program but remaining active in teaching. Whew! Fortunately, these departures have been balanced by a host of exciting hires.

On the faculty, Anson Kahng, who we hired in 2021 on a one-year deferral, has joined us after his postdoc at Toronto. Hangfeng He has joined us from the University of Pennsylvania. Both Anson and Hangfeng are in joint positions with the Goergen Institute for Data Science. Chris Kanan has moved from the Imaging Science

Program at RIT into a tenured position in URCS. And Andrew Read-McFarland, who finished his PhD with Daniel Stefankovic this spring, has joined us as an Assistant Professor of Instruction.

Several people were instrumental in covering instructional gaps during these transitions: Andrew Read-McFarland covered CSC 170 while still a PhD student; fellow grad student Alan Beadle covered 252; Michael Chavrimootoo taught both 280 and 282 over the summer. Notably, Michael also taught 280 the summer before, and received the University's Curtis Award for Excellence in Undergraduate Teaching by a Graduate Student. Finally, Eustrat Zhupa covered 210 as an overload. Many, many thanks to all these folks for helping us make it through.

In other faculty actions, Zhen Bai's appointment as Assistant Professor was renewed, Eustrat Zhupa and Joe Loporcaro were promoted from Lecturer to Assistant Professor of Instruction, Chenliang Xu received tenure as an Associate Professor, and George Ferguson was promoted to Full Professor of Instruction. Congratulations to them all!

This past spring, we graduated 156 BA/BS students, 18 MS students (less than usual, due to travel restrictions), and 9 PhDs with several more PhD defenses having occurred this summer. Demographics for the program are relatively stable. We have 120 or so incoming first-years planning to major in CS. Incoming MS and PhD enrollments are at 53 and 14, respectively.

Across all degree programs, the current student population is about 27% female, 3% Black, and 5.5% Latinx/Hispanic. These numbers are still far from representative of the US or the world, but they're much better than they were a decade ago, and the department remains committed to building an increasingly inclusive program and culture. UR WiCMiC (Women and Minorities in Computing) has some 200 members and sponsors an amazing array of programs. 31 URCS students attended the Virtual Grace Hopper Celebration of Women in Computing in Fall 2021; we look forward to sending a large delegation this fall in Orlando, Florida. We also sent students to both the regional and national meetings of the National Society of Black Engineers (NSBE) this year. With leadership from Sree Pai and Zhen Bai, the department adopted a formal plan for Broadening Participation in Computing, verified and available online at https://plans.bpcnet.org/UniversityOfRochester/ComputerScience_DepartmentalBPCPlan.pdf.

We had a record 12 undergraduates complete senior honors theses this year, and undergraduate research in general is at an all-time high. Mandar Juvekar, who worked on multiple projects both within and beyond the U of R, took Honorable Mention in the Computing Research Association's national Outstanding Undergraduate Researcher Award competition.

On the faculty, Jiebo Luo was elected a member of Academia Europaea. Sree Pai received an NSF CAREER award. I was

elected a Fellow of the AAAS. Work from 20 years ago, in which I assisted Sandhya Dwarkadas, David Albonesi, and our PhD students Rajeev Balasubramonian, Greg Semeraro, and Grigorios Magklis, took the Test of Time Award at HPCA 2022.

Among alumni, Maged Michael shared the 2022 Edsger W. Dijkstra Prize in Distributed Computing. Amanda Stent was selected to lead the new Davis Institute for AI at Colby College. Bob Wisniewski was named an Intel Fellow. Mohammad Zaki was named an ACM Fellow.

Two UR teams coached by Daniel Stefanovic advanced to the regional level in the International Collegiate Programming

Competition. One of these teams (Vladimir Maksimovski, Thanh Bao, and Loc Bui Dung Le) advanced to the North American Championship and came within two places of qualifying for the world finals. Many other graduate and undergraduate students—far too many to mention here—received local and national awards.

As we look to the coming year, there is much to be grateful for and to be excited about. Department research is thriving, despite the pandemic. Newly secured external funding this year exceeds \$5 million. The Randal Nelson Graduate Student Fund continues to grow—its balance is now well over \$40,000—and

alumni giving in general is up. There are exciting new collaborations with the Warner School of Education and Human Development and with the Laboratory for Laser Energetics. AI and AR/VR are top priorities in the University's strategic plan. We are approved to hire three new tenure-track faculty members and one instructional faculty member this coming year.

I hope you enjoy this issue of *Multicast*. Please consider paying us a visit. We'd love to be in touch.

Yours,

Michael



Farewells

Henry Kautz, Professor, Retires after 15 Years with URCS

by Jiebo Luo



Henry Kautz joined the Computer Science Department at Rochester in 2007, after spending seven years as a faculty member at the University of Washington, Seattle. He served as the CS Department Chair from 2008 through 2015. From 2018 to 2022 he served as Division Director for Information & Intelligent Systems (IIS) at the National Science Foundation, where he led the National AI Research

Institutes program. He was a professor in the Department of Computer Science and was the founding director (2014-2018) of the Goergen Institute for Data Science at the University of Rochester. He has been a researcher at AT&T Bell Labs in Murray Hill, New Jersey, and a full professor at the University of Washington, Seattle. In 2010, he was elected president of the Association for Advancement of Artificial Intelligence (AAAI), and in 2016 was elected chair of the American Association for the Advancement of Science (AAAS) Section on Information, Computing, and Communication. His interdisciplinary research includes practical algorithms for solving worst-case intractable problems in logical and probabilistic reasoning; automated planning; models for inferring human behavior from sensor data; pervasive health care applications of AI; and social media analytics. In 1989 he received the IJCAI Computers & Thought Award, which recognizes outstanding young scientists in artificial intelligence, and 30 years later received the 2018 ACM-AAAI Allen Newell Award for career contributions that have breadth within computer science and that bridge computer science and other disciplines. At the 2020 AAAI Conference, he received both the Distinguished Service Award and the Robert S. Engelmore Memorial Lecture Award. In 2022 he received the Most Impactful Paper Award from the ACM Intelligent User Interfaces Conference.

Kautz is an internationally renowned expert in artificial intelligence, pervasive computing, and health care applications, and his research has been cited more than 34,000 times (h-index is currently 79) according to Google Scholar. He is a fellow of the American Association for the Advancement of

Science (AAAS), the Association for Computing Machinery (ACM), and the Association for Advancement of Artificial Intelligence (AAAI), for which he has also served as president.

In his retirement, Henry Kautz is director of AI Planning at AIM Intelligent Machines, a start-up founded by his former URCS PhD student Adam Sadilek, where he will lead the design and implementation of high-level planning algorithms for fully autonomous earth-moving systems aimed to bring scalable, low-cost autonomy to earthmoving and other construction equipment in order to handle global challenges such as terraforming for adaptation to climate change and rebuilding cities devastated by war.

Sandhya Dwarkadas Best Wishes, Sandhya!

by Chen Ding and Michael Scott



It was with equal measures of appreciation, admiration, and best wishes that the department said goodbye to long-time faculty member Sandhya Dwarkadas, who this summer moved to the University of Virginia to chair their computer science department.

Dwarkadas was the Albert Arendt Hopeman Professor of Engineering, with a primary appointment in computer science and a secondary appointment in Electrical and Computer Engineering. Her research lies at the boundary of hardware and software. Her past projects include distributed shared memory (Treadmarks, Cashmere, InterWeave, InterAct), adaptive cache and processor systems (MCD, ARCH, and DT-CMT), and multicore processor communication and synchronization. Focusing on coordination, communication, and sharing, these projects address the never-ending challenges brought by rapid advances in underlying technology and even faster increases in the demand for capacity, efficiency, connectivity, and security in modern applications. She has collaborated not just with colleagues in computer science and electrical and computer engineering, but also with biologists and physicists on the River Campus, biostatisticians and radiologists at the UR medical school, and computational scientists at LLE, as well as many others in academia and industry in and outside the United States.

Dwarkadas has been the principal or co-principal investigator for 20 National Science Foundation (NSF) research grants totaling \$8.5 million, starting with a prestigious CAREER award in 1997. She has coauthored more than 100 refereed publications, with a total of over 13,700 citations, and an “H index” of 51 — that is, 51 papers cited at least 51 times each, as reported by Google Scholar. She is the coinventor on 12 (by 2016) granted US patents. She received the 2020 Edmund A. Hajim Outstanding Faculty Award and has been named a fellow of the Association for Computer Machinery (ACM) and of the Institute of Electrical and Electronics Engineers (IEEE), for her contributions to “shared memory and system reconfigurability,” in both software and hardware to improve the efficiency of parallel and distributed computing systems.

As chair of the CS department from 2014 to 2020, Dwarkadas led the computer science program through a dramatic increase in undergraduate enrollments. She worked closely with the architects and oversaw the move in 2017 into the newly completed Wegmans Hall. Eight new tenure- and teaching-track faculty members were recruited during the period, and the expansion has bolstered the department’s strengths in traditional areas of artificial intelligence, computer systems, and theory, in new and recent specialties in data management and human-computer interaction, and in education programs and interdisciplinary research. Two of those hires were women.

Dwarkadas has led, both locally and at the national level, efforts to increase diversity in the field of computer science. Through her work as the department chair, the University of Rochester became one of 15 universities participating in the BRAID (Building Recruiting and Inclusion for Diversity) initiative, funded by Facebook, Google, Intel, and Microsoft, and administered by the Anita Borg Institute. The department received \$30,000 a year for multiple years, funding a variety of new initiatives and allowing many students to attend the annual Grace Hopper Celebration of Women in Computing. From 2010 to 2016, the percentage of women in our

undergraduate population grew from 5% to 30%. The department’s WiC-MiC (Women in Computing and Minorities in Computing) student group increased from about 30 members to more than 200 students by 2016. It was awarded the University’s 2020 Meliora Values Award for Equity. Nationally, Dwarkadas co-chairs the Computer Research Association Committee on Widening Participation (CRA-WP), chairing the Graduate Cohort workshop for Women, and administering the Borg Early Career Award (BECA). As she explained in an issue of the CRA-Women Newsletter, “given the still small percentages of women in PhD programs in computing, it is imperative to provide them with the support that might help retain them in the research pipeline.”

Dwarkadas joined the department in 1995, after finishing her PhD in electrical and computer engineering and postdoctoral study in computer science. She was one of the principal designers of the influential TreadMarks system, which enabled scientists to identify the genetic link to Parkinson’s disease, as mentioned in the 1998 address before a joint session of Congress by President Clinton: “In the 1980s, scientists identified the gene causing cystic fibrosis; it took nine years. Last year scientists located the gene that causes Parkinson’s disease in only nine days.” TreadMarks eventually became the basis of Intel’s Cluster OpenMP.

Working with her colleagues, especially those in the systems group, Dwarkadas made the department a collegial and close-knit environment for both faculty and students to thrive. She found it most rewarding working with her students, where “each contributes unique strengths and enables me to explore new areas based on their specific interests” and “it is always a reward and something to be proud of when they get a complete dissertation in place.” One of her students, Rajeev Balasubramonian, now a professor in the School of Computing, University of Utah, commented for this article: “Sandhya has been an amazing mentor throughout my career. It took me a while to ramp up on research as a first-year PhD and she was incredibly encouraging and flexible. I always appreciated her availability and the collegial/friendly tone

she helped set within the systems group. Her support and the freedom she gave me to pursue different research directions were the reasons I look back so fondly at my PhD stint at Rochester. I constantly strive to emulate her advising style and her dedication to students.” Rajeev was elected an IEEE Fellow last year for “contributions to in-memory computing and memory interface design.” Eleven other doctoral students have graduated with Dwarkadas as advisor or co-adviser. They include Chunqiang Tang, an engineering director at Facebook; Deqing (Luke) Chen, a senior data scientist at Microsoft; Umit Rencuzogullari, a senior technical leader at Cisco systems; Xiao Zhang, a senior software engineer at Google; Hemayet Hossain, a principal architect, and Hangzhou Zhao, a CPU architect, both at Nvidia; and faculty members Srinivasan Parthasarathy at Ohio State University and Arrvindh Shriraman at Simon Fraser University. Her most recent graduates are Sharanyan Srikanthan at Intel, Xiaowang Dong at Google, and Divya Ojha at Nvidia.

In her spare time, Dwarkadas enjoys yoga, badminton, salsa dancing, gardening, cooking, and spending time with family and friends. At the 2016 department retreat, amidst brainstorming and discussion was a culinary lesson, where the then new faculty member, John Criswell, picked up cooking as a hobby.

In 2016 when interviewed by URCS alumna Amanda Stent and asked her source of inspiration, Dwarkadas said “My mother, [for] her indomitable courage in the face of all odds and her energy and will to participate and contribute to life.”

Eileen Pullara Happy Retirement!

After 50 years with the University of Rochester, Eileen Pullara retires. Her energy is surely missed around here but her retirement is much deserved. She had a long and dedicated career and was honored with Witmer Award in 2021. You can read more here, on page 5: <https://cs.rochester.edu/assets/pdf/newsletter-pdfs/newsletter-2021.pdf>.

ROC HCI

An Inclusive Computing Lab



by Zhen Bai and Ehsan Hoque

in on our weekly group meeting to customized research experiences based on students interests and skills that intersect HCI and AI. In particular, the ROC HCI group has a long tradition of hosting highly accomplished undergraduate students from historically marginalized communities in STEM and computing through the Ronald E. McNair fellowship (Ashley Tenesaca '20, Luke Gerstner '18, Famous Clark '16), Xerox Fellows (Zoe Tiet '14, Luis Nova '15, Gazi Naven Ahmed '18) and numerous NSF REU programs.

INCLUSIVE COMPUTING INITIATIVE

Dr. Ehsan Hoque and Dr. Zhen Bai, coleaders of the ROC HCI group, initiated an Inclusive Computing Program In the 2020–21 academic year. This program was sponsored by the Google exploreCSR award and aimed to engage a diverse body of UR undergraduate students in computing research. Thirty students from diverse backgrounds (55% female, 43% BIPOC, 40% LGBTQ+, 33% first-generation college, 7% students with accessibility needs) were selected to join the first cohort of the Inclusive Computing Program. Eleven of them joined research projects at the ROC HCI group. Students in the cohort engaged in several research activities throughout the academic year, centered on a two-hour orientation workshop that showcased research topics in different computing research areas, 40 hours paid hands-on research activities, two roundtable discussions with previous/existing researchers from marginalized communities in research, and UR alumni from Google on career path, graduate education, and professional development. An analysis of the pre- and post-self-reported survey responses indicated that there was an increase in students' "self-efficacy," "research skills," and "sense of belonging" and a decrease in "imposter syndrome." For more details about the workshop, visit <https://inclusive-computing.roc-hci.com>.

Over the years, computing has become so ubiquitous that it now touches on (almost) every aspect of society. CS education has evolved from theoretical foundations, artifacts, and systems at scale to ensure that our inventions work for everyone without causing harm. This change has further diversified the computing skills and awareness one must have for a successful career in computer science.

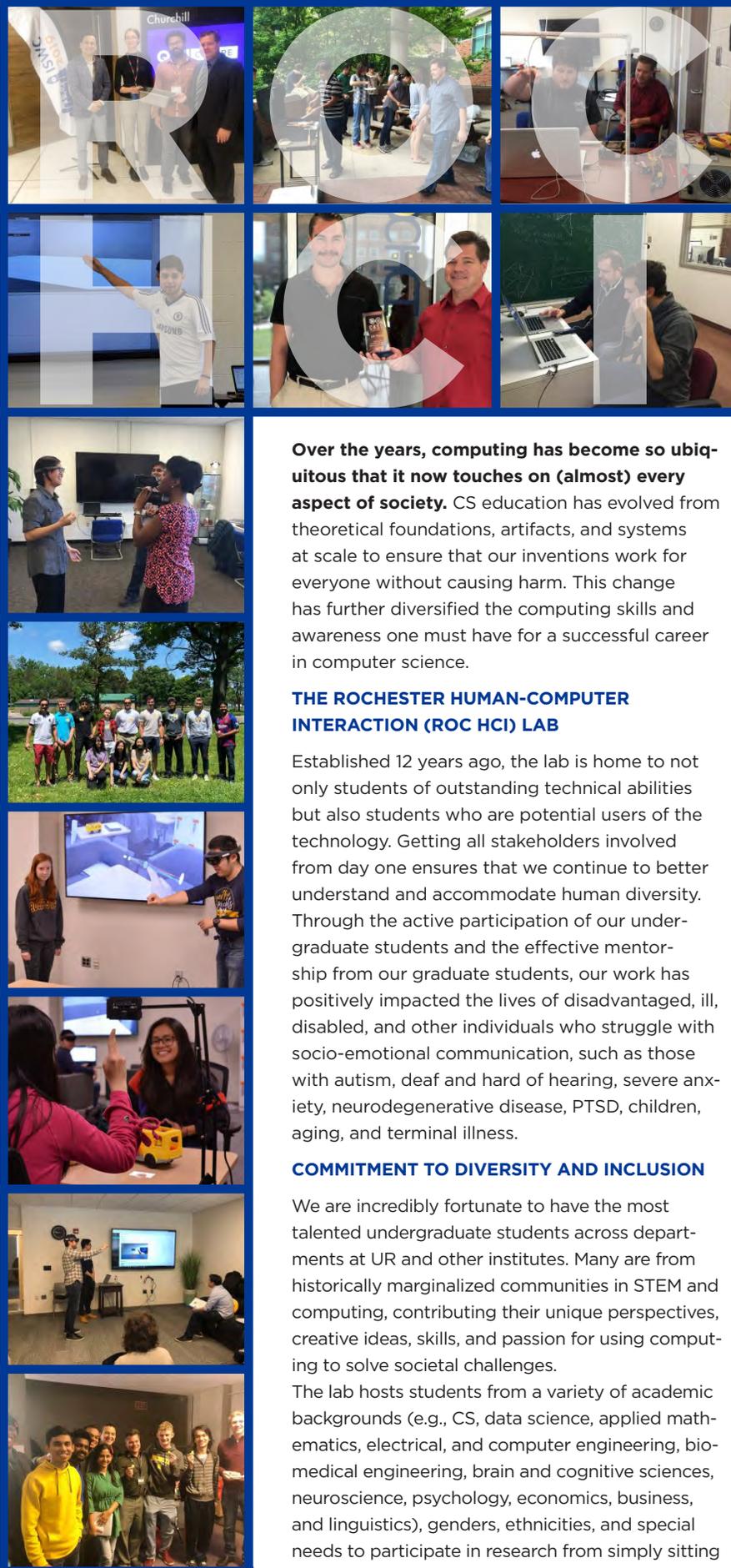
THE ROCHESTER HUMAN-COMPUTER INTERACTION (ROC HCI) LAB

Established 12 years ago, the lab is home to not only students of outstanding technical abilities but also students who are potential users of the technology. Getting all stakeholders involved from day one ensures that we continue to better understand and accommodate human diversity. Through the active participation of our undergraduate students and the effective mentorship from our graduate students, our work has positively impacted the lives of disadvantaged, ill, disabled, and other individuals who struggle with socio-emotional communication, such as those with autism, deaf and hard of hearing, severe anxiety, neurodegenerative disease, PTSD, children, aging, and terminal illness.

COMMITMENT TO DIVERSITY AND INCLUSION

We are incredibly fortunate to have the most talented undergraduate students across departments at UR and other institutes. Many are from historically marginalized communities in STEM and computing, contributing their unique perspectives, creative ideas, skills, and passion for using computing to solve societal challenges.

The lab hosts students from a variety of academic backgrounds (e.g., CS, data science, applied mathematics, electrical, and computer engineering, biomedical engineering, brain and cognitive sciences, neuroscience, psychology, economics, business, and linguistics), genders, ethnicities, and special needs to participate in research from simply sitting



HCI Group Accolades

Our undergraduate research assistants have made exceptional contributions to our research projects, leading to numerous coauthored publications at premier international conferences and journals.

- **Honorable Mention at the ACM Interaction Design and Children (IDC) Conference:**
Ashely Tenesaca, Wanyi Hu, Xiurong Yu, Peirong Hao
- **Computing Research Association (CRA) Outstanding Undergraduate Research Award:** Jianyuan Zhong '21, Boyu Zhang '21, Ashely Tenesaca ('20, '21), Vivian Li '18, Mitchell Gordon '16, Joyce Zhu '16
- **Excellence in undergraduate research award:** Boyu Zhang '21, Victor Antony '21, Ashely Tenesaca '21, Jianyuan Zhong '20, Minh Tran '20, Vivian Li '18, Joyce Zhu '17, Mitchell Gordon '16
- **Wells Award of Hajim School of Engineering and Applied Sciences:**
Melissa Wen '20
- **UR Women & Minorities in Computing Leadership Award:** Ruki PV '20, Vivian Li '18, Tergel Purevdorj '16
- **Outstanding senior:** Shagun Bose '20, Gabby Stillman '20
- **Suzanne J. O'Brien Book Award:**
Sangwu Lee '23, Duy Nguyen '19,
- **Valedictorian of graduating class of Computer Science:** Tergel Purevdorj '16
- **Phi Beta Kappa honor society:**
Sangwu Lee '23, Minh Tran '20, Melissa Wen '20
- **Entrepreneurship Award:** Anis Kallel '17, Morgan Sinko '16

It has been a pleasure to see our students heavily sought after by the top computer science programs, including those at MIT, Stanford, UC-Berkeley, Mila Quebec AI institute, University of Washington, University of California San Diego, Cornell University, Johns Hopkins University, University of Maryland, the University of Southern California, as well as companies such as Google, Apple, Microsoft, and Spotify.

New Faculty



Anson Kahng

Kahng joins the Department of Computer Science and Goergen Institute of Data Science as an assistant professor after serving as a postdoctoral fellow at the University of Toronto. His research examines theoretical problems in computational social choice, specifically the aggregation of individual preferences to make collective political or economic decisions. He combines theoretical and empirical tools to solve real-world problems, incorporating ideas from theoretical computer science, artificial intelligence, and human-computer interaction. He is specifically focused on topics at the intersection of computer science and democracy, where he has worked on topics such as liquid democracy, virtual democracy, and participatory budgeting.



Hangfeng He

He joins as assistant professor in the Department of Computer Science and the Goergen Institute of Data Science at the University of Rochester. Hangfeng earned his PhD at the University of Pennsylvania, where he worked with Dan Roth and Weijie Su. Before that, he received his bachelor's degree from Peking University in 2017. Hangfeng's research interests include machine learning and natural language processing, with a focus on incidental supervision for natural language understanding, interpretability of deep neural networks, and reasoning in natural language.



Andrew Read-McFarland

Read-McFarland received his BS in computer science and math from Denison University in 2017. He earned an MS in computer science from the University of Rochester in 2019. In 2022, he completed his PhD in computer science at the University of Rochester. During his time at Rochester, he received the Edward Peck Curtis Award for excellence in graduate student teaching. He taught CSC 170 in fall of 2021 and is excited to start teaching full time.



Christopher Kanan

Kanan joins as an associate professor. Chris's research is in the area of artificial intelligence and deep learning. Chris was previously an associate professor at the Rochester Institute of Technology. In addition to his work in academia, he has significant experience in industry. He led the development of the first FDA approved AI system for helping pathologists diagnose cancer at the startup Paige.AI, Inc. Before becoming a professor, Chris worked at NASA's Jet Propulsion Laboratory. He received a PhD in computer science from the University of California at San Diego in 2013, an MS in computer science from the University of Southern California in 2006, and a BS in philosophy and computer science from Oklahoma State University in 2004. Chris is an NSF CAREER award winner.



Featured Graduate Alumnus

Benjamin Van Durme

by Lenhart Schubert

Benjamin Van Durme '01 (BS), '10 (PhD) is an associate professor in computer science with a secondary appointment in cognitive science. He is a member of the Center for Language and Speech Processing (CLSP) and leads natural language understanding research at Johns Hopkins University's Human Language Technology Center of Excellence. (engineering.jhu.edu/faculty)

Can we start with your current thinking about your research? Much of your work, both in your doctoral research and since you joined JHU, has been concerned with computational semantics, including derivation of commonsense knowledge and inferences from textual data. How do you assess the status of that key AI area, and what challenges are you currently tackling?

I am currently interested in complex tasks that may involve multiterm interactions with users. This includes tasks like conversational information retrieval (helping a user find multiple documents or videos that together will address a complex information need), task-oriented dialogue (such as helping a user perform complex meeting scheduling), and legal reasoning (helping policy makers determine whether proposed regulations will introduce loopholes in the federal tax code). Outside of formal linguistic inquiry, I believe that "semantics is as semantics does": find a real problem that you believe

requires new work in semantics, then try to solve that problem while remaining theory agnostic. Increasingly we see large language models (LLMs) able to tackle hard problems in language understanding. These language models, like GPT-3 from OpenAI, are based on training very large neural networks (billions of parameters) with massive hardware, on large snapshots of the web. There is productive work in how to employ these models to go do useful things, just as there is productive work in finding scenarios where LLMs are not sufficient on their own (where maybe we still need explicit semantic structures). I work in both areas.

Tell us a little bit about your role at JHU and more broadly in the research community—your research group, your major activities in the department and other JHU entities, and your connections to researchers or projects elsewhere.

I am an associate professor in computer science with a secondary appointment in cognitive science and serve as the technical advisor to the JHU Human Language Technology Center of Excellence (HLT-COE). I also manage a research team at Microsoft Semantic Machines. My interests are broadly in AI, with my research concentrated on language. I have a collection of 14 signed bottles and 1 can, representing 15 completed PhD students. I have 14 in progress.

I have served as the PI on various programs: DARPA DEFT, LORELEI, AIDA, and KARIOS, and IARPA MATERIAL (coPI), and BETTER. I have an ongoing effort at the HLTCOE called "InFACT": Information Fusion for Advanced Content Triage. All of these efforts focus on helping professionals work with large amounts of unstructured content, primarily text in different languages. This leads to new science in information extraction, semantic parsing, information retrieval, methods for annotation, and lately some work in event recognition from images and video. Frank Ferraro—previously a URCS undergraduate and my JHU PhD student—is now an assistant professor at UMBC and is one of the collaborators on this work. Aaron Steven-White—previously a JHU postdoc and now UR assistant professor in Linguistics and Computer Science—is a regular partner along with his URCS students (Siddharth Vashishtha, Will Gantt, Weiwei Gu). Aaron spearheaded a collaborative NSF award between UR and JHU, which is part of our broader efforts in Universal Decompositional Semantics (<http://decomp.io>) and Aaron's MegaAttitude project (<http://megaattitude.io>). Collaborators also include a number of research scientists at JHU CLSP and the HLTCOE, including Craig Harman who was previously a URCS undergraduate and UR research staff. I recently won an award from the NSF for "Computational Statutory Reasoning." This will support our ongoing work in understanding federal corporate tax policies and associated legal cases. This is an interesting topic wrt semantics, in that there will never be lots of data to train a model, even while the task has high social impact, and it benefits from a highly accurate understanding of language.

Semantic Machines focuses on collaborative communication with Microsoft products such as within Office, where language is meant to be just another modality in addition to a keyboard, mouse, or touchscreen. My team is concerned with how to build increasingly more complex conversational AI experiences quickly, with small amounts of developer and annotation time.

How has your thinking about AI evolved in the course of your scientific career? What impacted the directions of your interests and career the most, at the various stages of that career, including your undergrad studies, graduate studies, stints in industry, and involvement with HLTCOE and Microsoft Semantic Machines?

I was recruited to UR in the '90s as an undergraduate under an early admissions process, to focus on optical engineering. "Lasers are the future!", they said, to a younger Ben in the small Western New York town of Dansville. Once at UR I quickly decided lasers weren't for me, but I had really enjoyed the book "I, Robot". Four years later I graduated with dual degrees in computer science and cognitive science. I owe a lot to my trajectory to Rochester's "Big Picture" AI outlook, small class sizes, a focus on undergraduate research experiences, and overall excellent faculty. I was able to pursue independent studies or otherwise work with many generous faculty, including George Ferguson, Chris Brown, Dana Ballard, Henry Kyburg, Mitsunori Ogihara, and Len Schubert. Leaving UR I thought of AI as a holistic enterprise across many specialties, a series of modules that included logical KR&R connected to Vision and separately Language.

I was accepted to various PhD programs but decided none matched my poorly defined interests. I ended up in a Lockheed Martin AI lab as a research engineer building prototypes of spoken systems, writing dialogue trees around late '90's ASR technology. They thought since I was from Rochester I had worked with James Allen, one of the few I did not interact with as an undergraduate! I was at least able to recruit Nate Chambers to the group as an intern. At Lockheed I became interested in how the constraints of a conversational domain should practically limit the salient concepts and thereby the explicit language observed from users at each step of a dialogue. So I left Lockheed to pursue

dialogue research at CMU, initially as a "quick MS" before returning to industry. Grants adjusted at CMU while I was in-flight, so I found myself doing question answering research: first with a large effort in information retrieval and question answering (under IARPA AQUAINT) and then a pilot effort of Paul Allen's Vulcan which years later grew into AI2's Project Aristo (which includes UR alum Kyle Richardson). Even more than at Lockheed the IR and QA effort taught me how much engineering matters in having an AI system that actually does something useful. Under the Vulcan effort I worked on semantic parsing for a science textbook, where we assumed access to subject matter experts (scientists) that could debug the output of our initial analysis. This was my first taste of what is now called human-in-the-loop AI, which I believe is one of the most important and historically least explored topics for impactful AI research.

Dan Gildea then started a position in URCS after writing pivotal articles on semantic role labeling; this and Len Schubert's take on formal semantics and common sense was enough to pull me from staying at CMU for a PhD to return to the land of ice and snow (as my now-wife calls it, Sara Eleoff Van Durme, UR alum). I spent years thinking about formal representations with Len, studying linguistic semantics with Greg Carlson (I was a joint PhD in Linguistics), and conferring with Dan. I also spent time in Florian Jaeger's lab in BCS, which taught me corpus linguistics. Intellectually I loved formal semantics, that it promised a "right" way to understand language. Interning at Google for two summers taught me how light amounts of hacking combined with large amounts of data could override months or years of formal consideration. This thinking applied in other places: I began a line of research with fellow student Ashwin Lall on randomized algorithms, where intuitions on how probabilities would interact with large data could be tested empirically, then proved post-hoc. Something that came from my PhD that has lately been picked up by the community is the concern of "reporting bias": that brute force data mining on large collections of text (or images) will result in frequency distributions that may not align with real world probabilities or human common sense. E.g., the frequency of descriptions of car crashes, motorcycle crashes and

airplane crashes in language does not align with how frequent these events are in practice. This is obvious in hindsight but is so inconvenient to researchers that it needs to be explicitly stated: simply memorizing all the content you can scrape online does not guarantee probability distributions that will directly enable solving general AI.

I left Rochester for Johns Hopkins at the end of 2009. This was during the financial meltdown that left most jobs scarce, and so a number of great researchers in various topics all started at this time as the JHU HLTCOE was expanding. I was able to collaborate with senior researchers like Ken Church who had just been at Microsoft Research, and junior colleagues like Mark Dredze (ML+NLP), Aren Jansen (ML+Speech), Glen Coppersmith (Applied Graph Theory), Chris Callison-Burch and Matt Post (Machine Translation). JHU does not have a broad AI tradition but is well known for Speech and Language. And so my interests in general AI took a back seat. I was involved in projects with many great colleagues, and eventually led the language understanding portion of the HLTCOE. With Jansen we developed the world's fastest speech-based retrieval engine. With Coppersmith and Church we led multiple summer workshops on cross-cutting work in communication graph analysis informed by graph structure and language content. With Callison-Burch we developed what is my highest cited project, the ParaPhrase DataBase (PPDB), which fused my interest in randomized algorithms for big language collections with machine translation pipelines. The HLTCOE is what drove my scientific and societal interest in helping professionals deal with large content collections.

With NSF support for workshops, post-docs, and graduate student fellowships, I have continued to pursue projects in less application-oriented language understanding, including work in script induction, decompositional semantics, and general reasoning with language. This work has evolved from data mining on the structured outputs of NLP pipelines, to working with large LMs directly, but continues to be concerned with understanding what kinds of higher-level information about the world is present in large amounts of language data. As the commu-

nities are converging in methods, I have started advising students with interests in similar topics in computer vision.

There are currently two major paradigms that animate discussions about natural language processing in AI: the paradigm based on training deep learning systems on massive amounts of data, and the paradigm of implementing the kinds of symbol manipulation processes that have proved useful in analyzing the structure and meaning of utterances, and in making inferences from explicitly represented knowledge. Do you think that both of these approaches will be important in further developing intelligent, linguistically competent, useful systems, and if so, how should they be combined? What else might be needed for achieving genuine intelligence, and broadly competent, beneficial functioning in machines?

It is amazing today how quickly we can prototype AI applications. This is based on: large publicly available models; a culture of clean publicly available source code; and increasingly easier to use AI software libraries. What is less clear is how to build trustworthy applications that a user will allow to take real actions on their behalf. I joined Microsoft part-time a couple of years ago (joining my JHU colleague and previous URCS professor Jason Eisner). We work a lot with models like OpenAI's GPT-3 and Codex. While it is amazing what you can do with just a few examples, being amazed is different from being willing to fully trust it with your bank account or email history. I'm excited about the next years of research that combine large LMs either with a human in the loop (collaborative problem solving); or with explicit (verifiable) symbolic reasoning approaches. A few years ago, with Matt Post (UR PhD classmate), we published a series of papers on lexically constrained decoding, building on Matt's initial work in this area for Machine Translation. In short, this means doing efficient bookkeeping while searching over possible strings that a language model finds most probable, in order to explicitly require certain words do, or do not, appear in that string. Since then I've pushed in related directions at JHU and at Semantic Machines, where we have been publishing on grammar-constrained semantic parsing for task-oriented dialogue. As are some others in the field, I am excited by how we

can fuse explicit NLP symbolic algorithmic thinking into LM decoding processes to drive the best of both worlds: humans providing more or less explicit guidance to large data driven models.

Regarding general intelligence, I believe some of the popular discussion on this topic is focused in the wrong direction. Often when people say general intelligence they mean human-equivalent intelligence, or beyond human intelligence, as if there were a linear scale. Instead, I am comfortable saying that a model like GPT-3 is a cognitive artifact, which is capable of some tasks in ways that surpass my own, while it is incapable of performing others. Under this view the human brain is simply another cognitive artifact. It is one we care a lot about understanding, but it is just one of various reasoning devices with its own strengths and weaknesses. And so back to "semantics is as semantics does": rather than trying to build a general intelligence, I like to have a specific task to solve. It might be that some techniques will be helpful in solving one task better than a human would, where some other task requires a different approach.

While I was an undergraduate Mary Hayhoe of BCS sponsored me to attend a AAAI symposium at Stanford on the topic of AI and Gaming. 20+ years later I am now at Microsoft returning to this interest in the task of Non-PlayerCharacter (NPC) dialogue, enabling believable conversations with synthetic characters in games that advance a storyline. This "single task" is my best proposal for triangulating what a language person might need out of a definition of general intelligence.

What advice would you have for undergrad and grad students who would like to make a career in AI, in particular NLP, in terms of what to focus on, and the pros and cons of industry and academia in that regard?

Mathematicians developed theories of information and computation, electrical engineers designed the circuits, computer scientists built the software. Each era had AI researchers. Each community is still making important contributions to AI. The next step on the trajectory will be cognitive scientists, who will develop the processes for understanding cognitive artifacts that are growing beyond our ability to analyze as values in matrices or as lines

of code. Susan Calvin, chief robo-psychologist, is a central protagonist of "I, Robot." Her role was to debug AI. This job title is worth taking seriously. A background in math and computer science, as well as cognitive science, will be beneficial to understanding future models. On training such models, I expect that some background in human child education would be worth adding to an otherwise engineering focused course load. Regarding human-machine collaborative problem solving, a background in social science could be useful. How do humans work well together? Presumably a human will hope for the same experiences as when working with a machine. Overall the message is: Math and science remain important, but try to stand out. AI is really popular, so what interesting new take are you going to bring to the discussion?

Regarding industry and academia: industry pays better; academia allows for a more stable long-term agenda. If you can get a job in industry that will let you pursue your passion then don't feel bad about being outside the ivory tower, and there are a lot of these kinds of jobs right now. AI is not going to "bust" like in previous cycles, the technology now works enough to power real solutions. But like web development in the 90s and small company IT departments in the 2000s, the technology will become so important and pervasive that "AI specialist" will no longer be a guarantee for a job. Rather than knowing about AI or NLP specifically, consider adding a specialization in a real-world problem that excites you, like law, or health, or entertainment.

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Featured Undergraduate Alumnus

Russell Bent

by Lane A. Hemaspaandra



Dr. Russell Bent leads Los Alamos National Laboratory's Advanced Network Sciences Initiative.

Russell received his computer science BS and his history BA from the University of Rochester in 2000 and received his computer science MS and PhD degrees from Brown University in 2002 and 2005. He has authored more than 100 book chapters and peer-reviewed conference and journal articles as well as the book *Online Stochastic Combinatorial Optimization*. Russell has been the PI on about \$22 million in grants and, in addition, has been co-PI on about \$62 million dollars of grants.

Russell's long-term interests are in combinatorial optimization and its applications, and he for many years has been a leader in the study of infrastructure networks. He has mentored or co-mentored more than a dozen postdocs and almost two dozen students, and is active on program committees, editorial service, and meeting organization. In addition to his LANL position, Russell is an adjunct professor at the University of Michigan. He has been the recipient of half a dozen important awards, including an R&D 100 Award and two LANL Distinguished Performance Awards.

It is a tremendous treat to be interviewing you. Let's jump right to your remarkable work. Many of your recent papers are on improving the resiliency of such systems as electric grids, natural gas networks, computer networks, water distribution systems, and more. That list at first sounds like the stuff of disaster movies, until one realizes that your teams are trying to help prevent terrible failures, or at least to have systems be able to

weather them as well as possible. Could you describe to us some examples of the flavor of your research, and the types of algorithmic and mathematical tools that your research teams employ?

Great question, and one that I could go into at great length. I have (at least) two interrelated research focuses: optimization and critical infrastructure networks, like electric power, water, and natural gas. Optimization is a computational and mathematical field focused on solving problems of the form minimize $f(x)$ such that $g(x) \geq 0$, where x is a collection of variables representing decisions that can be made, f is a mathematical function for evaluating a choice of x , and g is a set of mathematical functions for defining valid choices of x . Such problems can be computationally easy to solve, e.g., x 's variables are over the real numbers; g and f are linear, or computationally hard to solve, e.g., x 's variables are over the integers; g and f are not convex. Given this definition, many of the problems that need to be solved in infrastructure systems are naturally modeled as optimization. For example, in disaster preparedness, you might want to decide how to best operate (or design) your network (the x), to keep the disruption as small as possible (the f), subject to engineering limits on what a system can do (the g).

Aside from disaster preparedness, I have studied several other problems in the infrastructure network domain, including

reducing the carbon emissions of energy systems, designing networks to meet resilience requirements, identification of critical failure points, anomaly detection, etc. Most of these problems fall in a "hard" class of optimization problems, which are often referred to as mixed integer nonlinear programming problems, or MINLP for short.

With most infrastructure optimization problems, we start by trying to solve them using "off-the-shelf" methods and use them as a starting point to identify the research gaps in the existing state-of-practice. I think some of my most satisfying research moments are when we develop a new algorithm to solve a specific problem and then extract an insight from the approach that contributes back to a fundamental algorithm in optimization. One of my favorite examples is our Alpine solver for MINLP, which was inspired by the disaster preparedness problem and ended up computationally outperforming the state-of-the-art on standard optimization problem benchmarks by up to two orders of magnitude.

In thinking about some of our most application-specific impactful work, I think I am most excited by our Severe Contingency Solver. In power systems, one of the hardest problems to solve is finding a feasible operating point after a large-scale disruption (loss of multiple power lines, generators, etc.). This is really important as you don't want the entire power grid to

collapse every time parts of the system fail! Commercial computational methods typically require a lot of manual intervention to converge on a solution, but our approach has largely closed this problem in a fully automatic way, and it received an R&D 100 Award a few years ago.

I want to strongly stress that this work is the product of a team of incredible researchers here at LANL, and for any reader who is interested in learning more about how infrastructure networks are modeled in optimization, I would recommend one of our open-source libraries as a great starting point.

During the COVID crisis, the world has been plagued with “global supply-chain failures.” I read somewhere that supply chains need to be very cost-efficient, and that the competitive importance of cost-efficiency may naturally have disincentivized costly design choices needed to make the networks more robust with respect to low-probability but wildly disruptive events, such as a multiyear global pandemic. (This seems a rather different case from, for example, planning a utility network that may be a monopoly or at least may be more centrally planned.) Perhaps this is not really on top of your focus area, but is this something you, as an expert on planning for high-challenge cases, have insights into? Is this arguably a flaw, or a troubling feature, of the free-market system itself?

While I have limited familiarity with the specifics of supply-chain modeling, like infrastructure networks, supply chains are an example of very complicated, human-engineered systems. And the design of these systems is often challenged by mutually exclusive performance objectives. For example, it is very difficult to make a supply chain robust to high-impact, low-probability events without making goods and services prohibitively expensive. Thus, models that rely just on cost can yield solutions that are vulnerable to extreme events.

This motivates the development of computational models that have the different requirements “baked in” from the start. We often use robust optimization techniques, where requirements on robustness are encoded as part of the model. In other words, find the least cost system design that operates successfully 99 percent of the time, where “99” is a parameter of the model. This parameter then becomes an important knob to tune for formally evaluating cost and robustness, so that an informed decision about such tradeoffs can be made.

The teams you lead draw on techniques from a wide range of fields—from CS to IE/OR to mathematics to physics to engineering. What is it like to lead teams with such diverse skills, and to what extent do you need to personally become well-versed in, or even expert in, those many fields?

This is one of the more interesting aspects of my career. The problems we study are inherently interdisciplinary, which has exposed me to people and scientific areas that I might not ordinarily have crossed paths with. While I have not needed to become an expert in all those fields, I have found that having at least an undergraduate level understanding of each field is critically important for being able to communicate and collaborate across domains. For example, in the field of optimization, there are many formal methods for simplifying a problem so that it becomes computationally tractable and preserves a theoretically meaningful connection to the original problem. The first time I men-

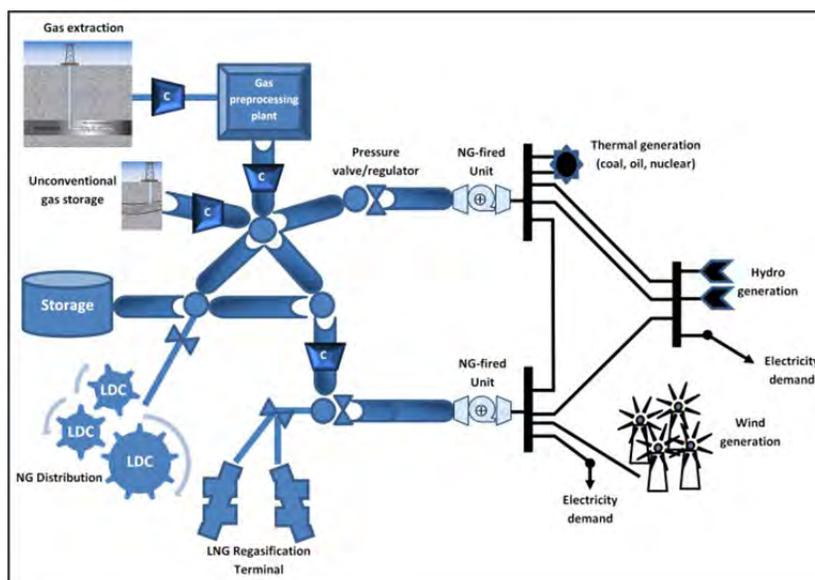
tioned that such methods could potentially disobey known physics to some of my physicist colleagues, this led to some very interesting conversations about the merits of such methods! ...at least until it could be explained that while a solution may violate the laws of nature (an anathema!), such a solution could still provide valuable insights about the problem.

In your work, you study critical infrastructure issues across a rich range of settings. How did these settings come to be the ones you studied? Are there any cases where you realized some infrastructure network faced challenges before those maintaining it foresaw the stresses you modeled? And, stepping back, what advice would you give younger researchers on how to identify—before the herd—promising, important problems to study?

For early-career computational science researchers, I think it is important to forge close collaborations with experts in the problem domain. Such collaborations make it easy to brainstorm ideas and gain an understanding of where the open problems and challenges are. Certainly, I have found that critical infrastructure is a rich source of interesting problems for the computational sciences.

The sheer scale of the support for the research projects you’ve led—more than \$80 million in grants—is stunning. Did you need to develop broad business/management skills in addition to your scientific skills, and if so, how is your time balanced between the former and the latter roles? Which do you enjoy more?

Yes, supporting research projects at this scale makes management skills incredibly important. However, much of what I have learned has come through experience rather than formal training. That being said, balancing between managing projects and actively pursuing science is probably one of the hardest things for me to do. My passion is to get into the technical weeds. However, managing a large portfolio of projects provides an opportunity to make an impact far beyond what would be possible for



me as an individual. So, to keep this balance, I try to focus my “hands on” research on one or two things at a time while providing higher-level guidance, ideas, and direction elsewhere—trusting the teams to handle the (fun) details.

Most of our students know of academia and industry as potential places to end up. Can you tell them how working at a national laboratory such as Los Alamos National Laboratory compares with those two settings?

This is an interesting observation that I tend to agree with. As compared to industry and academia, the national laboratories are often a relatively unknown option for a career in computer science. For me at least, the national labs have provided an opportunity to combine some of the best elements of both industry and academia. I get to work closely with students and postdoctoral researchers through internships and collaborations with university partners, I self-direct my scientific career by competing for grants, and I get to see the research make an impact on really hard problems that are challenging the nation.

You graduated from URCS two decades ago. Does it seem like yesterday or forever? Do you have any memories you'd like to share? And do you have any final thoughts or suggestions that you'd like to share with today's URCS undergraduate and graduate students, to help them have their own best careers?

It is a little bit of both—there are times when I feel like I could step back onto campus without missing a beat, and there are other times when I realize that the students I work with today were not even born when I was an undergraduate.

I have quite a few memories that I could share, but I will focus on the undergraduate research course I took while at U of R. Prior to taking that course, the thought of research as a career had never crossed my mind. My experiences in that course were instrumental in setting me on the path I am on today, so I have some really fond memories of that class—in particular, having an assignment that we did not know until after the fact was an unsolved problem! That particular assignment really highlighted what it meant to be a researcher.

In terms of advice, first, I would recommend taking advantage of all the experiences and options that can be explored as an undergraduate, as any of one of them could set you on the path to a surprising future. Second, team class assignments, as fun (or frustrating) as they can be, are some of the best opportunities for learning how to work with others and develop a critically important skill for all levels of your career.

Thank you very much, Russell!

Student Awards

- **Michael C. Chavrimootoo** received an Edward Peck Curtis Award for Excellence in Teaching by a Graduate Student.
- **Nathaniel Webber '23** received a 2022 DAAD RISE Fellowship. Nathaniel interned this Summer at the University of Lübeck's Institute of Computer Engineering to study “human-centered swarm behavior.”
- **Justin Pimentel '23** received the Benjamin A. Gilman International Scholarship to study computer science in Spain.
- **Sidhant Bendre and Neil Yeung '23** received 3rd place in Forbes Competition for BuddyBank.
- **Abdoul Rasmene Maiga '25** received a Projects for Peace grant. Abdoul has been working on the project Stronger Together Initiative: A Three-Steps Approach to Heal the Hearts, Empower Women & Youths, and Unite Guinea.
- **Mandar Juvekar '22** received CRA Honorable Mention.

Nate Webber '23 in Germany for Summer 2022



Nate Webber received a DAAD Rise scholarship to spend the summer working with the Swarm Robotics lab at Universität zu Lübeck.

In Nate's words, “I've been contributing to research on a sub-project of the larger EU-funded program known as ChronoPilot. The overall aim of the program is to investigate subjective human time perception through the lens of biometrics (e.g., brain waves, EKG data), and ultimately to manipulate said perception by providing physical stimuli. The program is still

fairly new, so a lot of the work being done is more in the exploratory stages. More specifically, I have been working with the Swarm Robotics lab here at Universität zu Lübeck, where they are researching using these biometrics to interact with/change the behavior of swarm robots. As I mentioned, the project is fairly new, so most of my work this summer has been in contributing to code infrastructure that will be needed for running formal experiments later on (sadly my time here will be over by then). I started out the summer knowing almost nothing about robotics, so I spent a while getting acquainted with the tools and robots that they are using here in the lab and learning some of the concepts behind swarm-driven behaviors. I then developed a set of scripts that are able to connect over Bluetooth Low Energy to biometric sensors like the Polar H10 and receive and decode the data. From there, the scripts can publish the code to ROS (Robot Operating System), where that data can be observed and reacted to by one or more robots on the same network. I've also developed a few proof-of-concept swarm behaviors to demonstrate this functionality. For instance, there could be a behavior where a robotic swarm detects a high level of stress from a human operator (determined by something like a heightened heart rate), and then slows down and disperses away from the operator to give them space to calm down. Like I said, I have not been involved in any formal experiments since the team isn't quite ready to conduct any of those, but the code I have written will be used in formal research, and I may even receive some acknowledgements for it (fingers crossed, haha).”



HAJIM SENIOR DESIGN DAY

April 29, 2022

by Sara Klinkbeil

Seniors in the Hajim School of Engineering & Applied Sciences display their projects during the school's annual Design Day in a tent on the Engineering Quad.

Jack Yu

Abstract Buffered Persistence with Buffered Pronto

Mentors: Michael L. Scott and Sandhya Dwarkadas

Abstract: This project implements a buffered variant of the Pronto framework used for developing persistent data structures. By relaxing the persistence requirement and processing operations in NVM in bulk, Buffered Pronto is able to achieve 1.2x to 6.7x performance increase while limiting data loss within 1 ms.

Paul Ouellette

Translation Validation for the QBE Compiler Backend

Mentors: Sreepathi Pai and Chen Ding

Abstract: QBE is a small optimizing compiler backend written in C. This paper applies two formal methods techniques to its verification. It leverages two existing tools—Alive2, a translation validation tool for LLVM, and the C Bounded Model Checker (CBMC). I built a translation validation tool called QBE-TV for the QBE intermediate language. QBE-TV translates QBE IL to C and then LLVM IR and uses Alive2 for translation validation. An analysis of previous QBE bugs shows that QBE-TV is able to find invalid IR transformations. The paper additionally demonstrates the use of CBMC for verification of constant folding in QBE. The CBMC verification helped find two new bugs in QBE's constant folding pass. Fixes for both bugs were contributed to QBE.

The spring 2022 semester produced our highest number of Honors Research Scholars at 12 students. Four scholars shared their work at the Hajim Senior Design Day. Jack Yu and Paul Ouellette share their experiences.

How did you come about your work? And what was your experience like with the subject matter and/or mentor?

Jack: I started my research not knowing anything about persistent memory. Much of it was me going through the literature, trying to build up the knowledge needed to understand it. Eventually, I was able to form some opinions of my own. My advisor, Prof. Michael L. Scott, and the other Ph.D. students within the department were very generous in guiding me along the way.

Paul: My work involved applying some existing techniques for compiler verification to an open-

source compiler. I enjoyed sharing some of my work and bug fixes with the project.

Describe your day/the atmosphere at the Hajim Senior Design Day. How was your experience sharing your work with your peers and other interested parties?

Jack: Senior design day was a lot of fun. Not only are you introducing your research to people who understand Computer Science, but you're also showing it to people in different scientific fields or just interested in science. It's an eye-opening experience trying to make your work as easy to understand as possible without requiring all the technical knowledge.

Paul: Everyone was really excited to learn about my project at Design Day. It was a challenge to explain my work to non-computer-scientists.

What advice or encouragement do you have for other students interested in undergraduate research?

Jack: Just send out that initial email. Many students worry that they don't know any professors well enough to reach out to them. I felt that way initially as well. I reached out to Professor Michael L. Scott after taking one online course with him and knowing nothing about persistent memory, yet he was still kind enough to provide me with the research opportunity. As long as you hit "send" on that self-introduction email, you'll have a greater chance of making it than you believe.

Paul: Even if you're not planning on going to graduate school, research is a great way to learn more about your area of interest, especially if it's not covered much in your courses.

Please provide a brief update of where you are now post-grad and how this work has influenced you.

Jack: I am currently doing an internship at Corning, Inc., where I optimize and test various high-performance scientific applications. After that, I will be going to UCLA for a PhD. My experience working with systems and persistent memory has taught me how to identify bottlenecks in application performance and find ways to resolve them.

Paul: I am now working as a compiler engineer at Texas Instruments.

To see design day projects, visit hajim.rochester.edu/senior-design-day/csc/.

Contribute to the Randal Nelson Graduate Student Fund

To honor Professor Randal Nelson, who passed away suddenly in April 2020, we have established the Randal Nelson Graduate Student Fund. This fund will provide support for graduate students in the Department of Computer Science for needs such as research funding, academic fellowships, and conference attendance costs.

Nelson's legacy will live on through this fund, and we are truly grateful for your



thoughtful support in his memory.

Donations in Randal's honor can be made at <http://uofr.us/nelson>.

Staff Updates

Welcoming New Staff

Nick Quattrocchi (MS Coordinator) succeeds Jennifer Brennan in the master's coordinator position. Nick received his BA in business and history in 2008 and an MA in history in 2010 from Providence College. He has worked in a variety of positions, including sales, bookkeeping, lending, and real estate paralegal services, with an emphasis throughout on customer service. He is excited to be returning to an academic environment and looks forward to working with our MS students. Please join me in welcoming him to the department!

Robin Clark (PhD Coordinator) returns! Robin previously worked in URCS as the Department Coordinator from 2015 - 2017. She then went to the Department of Chemistry for a handful of years as Graduate Coordinator. We are very excited to have Robin back on board!

Sarah Mills (UG Coordinator) succeeds Elaina McKie in the undergraduate program coordinator position. Sarah joins Sara Klinkbeil in managing the undergraduate program. Sarah received her BS in aerospace engineering (minor in music) from West

Virginia University in 2014. She then earned an MA in theological studies from Northeastern Seminary (the graduate school affiliated with Roberts Wesleyan College) in 2018 and an MS in education policy from the UR's Warner School in 2021. For the past year she has been working at Warner as a program evaluator, analyzing student surveys and other data in support of NSF-funded undergraduate programs at UR and RIT. She presents a near-ideal mix of STEM background, interdisciplinary skills, and experience with UR systems, assessment, and data analysis.

Ian Ward (Programmer Analyst) fills Dave Costello's previous role as a programmer analyst. Ian spent five years deploying networks across the Pacific as a member of the United States Marine Corps. Since leaving the military in 2017, he has worked as a programmer, system administrator, and IT technician. In 2020—after 10 years, six schools, and 290 credit hours—he managed to earn a BS in computer science from CSU Long Beach. Ian's excited to be back home in Rochester and is looking forward to working for the department.

Staff Moves

Amanda Rigolo, formerly the department staff accountant, has moved into the academic operations manager position. Amanda has been with the department for three years. Amanda received her MBA from RIT in May 2022.

Jenna Price, formerly our department coordinator, has moved into the staff accountant position. Jenna has been with the department for four years.

Dave Costello has been promoted to manager of Computer Systems, Resources, and Technologies.

Congratulations and best wishes to our PhD coordinator, Emily Tevens! Emily married Panos Markopoulos in June 2022 in Greece. Emily and Panos have relocated to San Antonio, Texas, where Panos has taken a faculty position at UT San Antonio. Emily will also be working at UT San Antonio as the program manager in the Student Success Center of the Alvarez College of Business.



Meet the URCS Programming Contest Team

By Daniel Stefankovic

Computer science alumni Thành Bao, Loc Bui, and Vladimir Maksimovski will be representing the University of Rochester at the International Collegiate Programming Contest (ICPC) in Dhaka, Bangladesh, in November 2022.

International Collegiate Programming Contest (ICPC) is the oldest and most well-known programming contest in the world. The competition takes place over several rounds (local, regional, world finals). In the most recent year more than 50,000 students from over 3,000 universities participated in the contest. In each round, teams of three college students try to solve as many problems as possible. An interesting feature of the contest is that the three students have only one computer—this facilitates collaborative problem solving and coding.

The team members were University of Rochester undergraduate students in the years 2018–2022. They have worked together as a team since 2021, participating in NENA 2021, NENA 2022, NAC 2021, NAC 2022. They achieved very impressive results in the North American Contests (NAC), placing 13th in 2021 and 19th in 2022 (the complete results can be viewed at <https://nac21.kattis.com/contests/nac21/standings> and <https://nac21.kattis.com/contests/nac22/standings>).

Reaching this level of performance required a significant amount of practice. The team met regularly every two weeks, solving problems from previous competitions for several hours. The team members also practiced individually, mainly on Codeforces, where you can follow their handles: ReaLNero, Aced-by-B, and heklo. Every person has a different approach to learning, I hope you will find hearing about diverse approaches by our successful team members valuable.

Bao: I get the list of all problems ranging from 2000 to 2300 difficulties and plow through them one by one (if I can't solve a problem, I just read the tutorial and then code it up).

Vlad: I generally avoided reading solutions, since I have a feeling that if you figure it out yourself, the “trick” will stick a lot better than if you were just given the solution.

Loc: I didn't have a chance to practice much, but courses like CSC 282 and CSC 284 did help me to ramp back up and also learn new things like Flow, Matching, FFT . . . which was definitely for the ICPC competitions later.

Recent PhD Graduates

LELE CHEN

High-Fidelity Talking Avatar Video Generation

Staff Research Scientist, Innopeak Technology

Faculty Advisor: Chenliang Xu

MD KAMRUL HASAN

Multimodal Representation Learning and its Application to Human Behavior Analysis

Research Scientist, Facebook

Faculty Advisor: Ehsan Hoque

LISA JIN

Hierarchical Graph Decomposition for Natural Language Generation

Research Scientist, Meta

Faculty Advisor: Dan Gildea

GENE KIM

Corpus Annotation, Parsing, and Inference for Episodic Logic Type Structure

Visiting Assistant Professor,

University of South Florida

Faculty Advisor: Len Schubert

WEIJIAN LI

Relation-Based Learning for Healthcare and Beyond

Applied Scientist, Amazon

Faculty Advisor: Jiebo Luo

DIVYA OJHA

Redesigning Caches to Resist Side Channel Attacks

Senior Computer Vision Architect, Nvidia

Faculty Advisor: Sandhya Dwarkadas

ANDREW READ-MCFARLAND

Sampling and Decision Problems with Connectivity Constraints

Assistant Professor of Instruction,

University of Rochester

Faculty Advisor: Daniel Stefankovic

YAPENG TIAN

Audio-Visual Scene Understanding Towards Unified, Explainable, and Robust Multisensory Perception

Assistant Professor,

University of Texas at Dallas

Faculty Advisor: Chenliang Xu

WEI XIONG

Guidance-Driven Visual Synthesis with Generative Models

Research Scientist, Adobe

Faculty Advisor: Jiebo Luo

Alumni Updates

Alumni Moves

- **Lambert Wixson PhD '94**, Principal Applied Scientist, Zillow
- **David Coombs PhD '92**, Director of Strategic Development, University of Maryland (UMD) Applied Research Laboratory for Intelligence and Security (ARLIS)
- **Christopher Eveland PhD '03**, VoxEQ Inc.
- **Nate Blaylock PhD '05**, Canary Speech
- **Tongxin Bai PhD '12**, Beijing Academy of Artificial Intelligence (BAAI)
- **Chetan Bhole PhD '13**, software engineer, LinkedIn: Search and AI team
- **Tagyoung Chung PhD '13**, Senior Applied Science Manager, Amazon Alexa
- **Hongzhou Zhao PhD '13**, Apple
- **Jonathan Gordon PhD '14**, tenure-track professor of Computer Science, Vassar College
- **Tivadar Papai PhD '14**, Google
- **Phyo Thiha PhD '19**, Director of the Data Engineering Department, Group M
- **Eduardo Pinheiro MS '00**, Techni Security
- **Girts Folkmanis MS '07**, Gridware
- **Howard Mizes MS '14**, Verizon
- **Jacob Brock MS '15**, Micron
- **Peter Finn MS '16**, GameSim
- **Xingdi Tan MS '18**, Meta

Graduate Alumni Notes

Diane Litman PhD '86 writes, "In December 2021, I returned to Rochester for JamesFest. I greatly enjoyed my first venture into the real world since the pandemic and seeing James as well as so many others from my time in the department. From February to August 2022, I was a Digital Futures Scholar in Residence at KTH Royal Institute of Technology in Stockholm, Sweden. The goal of my visit was to learn how the use of a physical social robot rather than a spoken dialogue system might improve the ways in which people interact both with a computer system and with each other. I was hosted by the Division of Speech, Music and Hearing

at KTH, which spun out the company Furhat Robotics."

Maged Michael PhD '97 has been selected a corecipient of the 2022 SIGACT/SIGOPS Edsger W. Dijkstra Prize in Distributed Computing—the highest honor awarded in the theory of parallel and distributed computing.

Mohammed Zaki PhD '98 writes, "I was honored by being inducted as an ACM Fellow for 2021. I have also recently assumed the role of department head for the computer science department at RPI."

Myroslava Dzikovska PhD '04 writes, "I am still working at Google Health, permanently remote from Edinburgh. I am from Ukraine originally and I was greatly affected by the events there. As I am writing this, I am expecting my 81-year-old mother, sister, and her two kids to join me in Edinburgh in a few weeks. This is an arduous journey of nearly 500 miles by two different trains to Warsaw before they can fly out to Edinburgh. I will be very relieved if everything goes smoothly and they can be safe with me. I am happy that I am able to help them, though I still have many family and friends left behind, both those in the military and the ordinary people living through attacks on civilians, so I will still have many people to worry and pray for."

Adam Sadilek PhD '12 writes, "I left Google to start at AIM, focusing on terraforming this planet with large-scale robotics. Henry Kautz joined AIM to lead the AI team after his directorship at NSF. I have been very fortunate to have Henry as my PhD advisor while at U of R."

M.J. McInerney MS '88 writes, "Diane and I are enjoying being loving grandparents to now three grandchildren under the age of three who are fortunately local to our



home, so we get to do a lot of (unpaid) babysitting. I've just celebrated 18 years at Amazon. I also came out as transgender, with the support of my family and

colleagues: my preferred name is "M.J." and my pronouns are she/her—representation is an important part of diversity and inclusion.

Brian Yamauchi MS '90 writes, "I'm now a principal roboticist at Boston Dynamics, where I'm part of the team developing the autonomous navigation system for Spot, our quadruped dog robot. We've sold over a thousand Spot robots for applications ranging from inspecting the SpaceX Starship prototypes after landing to monitoring nuclear power plants and patrolling automobile factories. Spot has also appeared in everything from Super Bowl commercials to music videos from Katy Perry and BTS and even had a cameo in an episode of The Book of Boba Fett. I'm currently the lead developer for Spot's local navigation system, which covers room-scale path planning and path execution. I've developed techniques to allow Spot to navigate more robustly in dynamic environments with unexpected obstacles and to navigate more precisely in industrial facilities where Spot must remain within narrow pathways."

Ruihan Wang MS '19, writes, "I'm starting a new academic life this July, pursuing an MBA degree after a few years of work. As a software engineer in a small start-up, I'm very excited that our product Meshcal is going live soon! Check our promotional video here: <https://youtu.be/WddUspwrsfg>.

Undergraduate Alumni Notes

WEDDING ANNOUNCEMENTS

Chris Miller '14 and Kate '14 BBC were married in Lake George, New York, September 18, 2021. They met as undergraduates living on the same floor of Tiernan Hall at UR and got engaged on campus at their five-year reunion.

Manuel Navarro '15 and his wife Bethany married April 2, 2022. Manuel is a systems engineer at VTG for the Navy's Hypersonics Program.



Pershing



Newton and Lee



Ferreiras and Stillman



Honore and Everson



Yan



Riffle



Muderick

Wolf Honore '16, and Rebecca Everson '16 got married in October 2020. The pandemic pushed their honeymoon plans by a year, but one does not simply cancel a trip to Antarctica! Rebecca graduated from UR with a BS in CS and a BA in linguistics. After working at a financial software company for five years, she decided to lean more into linguistics and return to UR for a masters in language documentation starting in fall 2022. Wolf is finishing up his PhD at Yale and will begin work at CertiK as a senior research engineer. They are very excited to call Rochester home once again, this time with two cats, Frank and Dweezil (named after the Zappas)!

Gayeon Lee '18 and Edward (Ned) Newton '18 married in September 2020. Ned and Gayeon met while TAing for CSC 171 and have been together ever since. Gayeon is a software developer at Microsoft, and Ned is a production engineer at Meta. They live in Bellevue, Washington.

Gabrielle Stillman '20 and Kelvin Ferreras '20 are engaged and will marry in July 2023. From CSC 171 lab partners to life partners. They reside in San Diego, California, where Gabby is a software engineer at Intuit and Kelvin.

Patrick Phillips '21 married Michaela Chan '18 BBC T5 on June 12, 2022. They reside in Chicago, where Patrick is pursuing a master's degree in computer science at the University of Chicago and working for Riverside Research.

BABY ANNOUNCEMENTS

John Schmid '01 works at the Philadelphia Naval Surface Warfare Center. He writes, "My son, Kyler, will have his first birthday this July and has recently begun walking on his own."

David Walker '06 and Hilarie Lloyd '22 PhD welcomed a baby daughter, Aurora, in February.

Jonathan Chen '07 and his wife welcomed their second child, Olivia Chen, born November 6, 2021.

Michael Riffle '07 writes, "I have a new baby daughter! She's nine months old, and her name is Genevieve. My son, William, just turned four. I'm at a Series B Startup called Luxury Presence as an engineering manager and tech lead. I'm also CTO of a start-up called Bot1 Inc."

Mike Seid '10 welcomed a baby boy, Hayes Gault Seid, on January 29, 2021.

Xing Yan '15 celebrated his daughter's fourth birthday this summer! Xing is a software engineer at Google.

Sarah Venuti '19 writes, "I had my first baby, Adrian, July 1, 2021 (so he's nearly one year old now, somehow!)"

OTHER UPDATES

Shawn Hershey '99 writes, "In December of 2021 I decided that I wanted to move into a field that felt more philanthropic, so after looking internally and externally, I switched to a Google Search Education job, where I'm doing software engineering and machine learning to provide better Google Search answers to students looking for help with schoolwork. We hope to work toward equality by providing better educational support for all. You can Google Search 'how to solve $x^2+x=1$ ' to see an example of our work."

Nate Chambers '02 writes, "I was recently promoted to full professor of computer science at the US Naval Academy. I'm still carrying on the URCS undergraduate tradition by teaching undergraduate CS! My research remains focused on NLP, and I serve as the chief NLP scientist at Birdeye, Inc."



Chambers



Schmid



Curtis



Ab Aziz

David Sankel '02 writes, "Professionally, I made an exciting move to Adobe this year as a principal scientist. I'm still quite active in the C++ world; I'm now the chair of the board of directors of the Boost Foundation and will be delivering a keynote at the Core C++ conference in Israel this year. On a more fun note, I've been jamming with my kids in our Sankel Family Band. You can watch us playing Zombie at <https://youtu.be/WVdVd-vgxSKA>."

Aaron Muderick '03 was appointed in February of this year to be chair of the Toy Association and board member at the Toy Foundation.

Nawrose Nur '03 completed their master's in health informatics in 2020. Nawrose transitioned from being a principal solutions architect to join Fiserv -Digital Lending Organization as a project management advisory to enjoy the work from home, unlimited R&R, and inclusive diversity. Nawrose will be celebrating their 15-year marriage anniversary this July with Itnia, who will be starting as an ER physician at Mohawk Valley Hospital System.

Tom Weingarten '06 has had two papers published in the last year: "From block-Toeplitz matrices to differential equations on graphs: towards a general theory for scalable masked Transformers" in ICML 2022 and "Transfer learning for predicting virus-host protein interactions for novel virus sequences" in ACM Conference on Bioinformatics, Computational Biology, and Health Informatics 2021.

Michael Silverman '08 is president at Silverware Games, Inc.

John Pershing '10 and wife, Kate '11, write, "We've had a very active year. Our second child, Ada Elizabeth Pershing, was born in September. Ada is, of course, named for Ada Lovelace. What If Media Group also had a successful exit close earlier this year, which has given us the ability to scale up our business much more aggressively moving forward."

In early 2020 URCS alumni **Brad Orego '11** contacted the University regarding the growing area of user experience design. While at Rochester, Brad was able to develop his interests in comput-

er science, HCI, and psychology. This combination of major and clusters served as a template for the design of the new UX Certificate Program. Brad's career since he graduated has been focused on UX research and design. You can learn more about the program here: rochester.edu/college/msc/certificates/user-experience.html.

Zubair Ab Aziz '19 is working as a software engineer at Quiltt Inc., an early-stage fintech start-up.

Po-Chun Chiu '19 recently graduated from UCLA as a MSCS student and will move to Santa Clara to join Oracle Cloud Infrastructure as a software engineer.

Lindsey Curtis '19 writes, "After graduating and commissioning through UR NROTC in 2016, I went on to complete Navy Nuclear Power School and Prototype training before reporting to the USS Maine, a nuclear-powered ballistic missile submarine in Bangor, Washington. I led a number of divisions over my three years on board as a junior officer while directing strategic and tactical operations underwater for multiple three-to-four-month deployments. In June of 2021 I received an honorable discharge after completing my five-year contract and transitioned to the civilian sector. As a project manager and now chief of staff at Beowulf Electricity & Data, I oversee design, construction, and operational matters at our large scale zero-carbon Bitcoin mining data centers across the country in addition to other energy infrastructure projects."

Tongtong Qi '20 writes, "I am super happy that through my hard work, I started working as an SDE at LinkedIn this spring! I really appreciate all those helpful professors that helped me through the difficult times of college. I would not have been where I am today without the kindness, patience, and encouragement from so many people!"

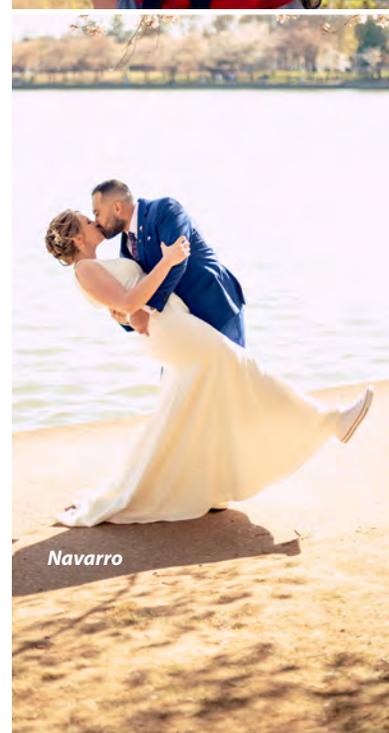
Sifan Ye '20 recently received his master's in computer science from Stanford University.



Qi



Ye



Navarro



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**“People’s Choice” Winner
 at the 2022 Art of Science
 Competition**

Money and Nature
 Frederick Liu '23, computer
 science and political science

Artist’s statement

A charming environment is only one spill away from becoming an unlivable place. I used DJI Mavic Air 2 to take a photo of an island at Hawaii and applied clipart to the image to show the effects of pollution.

Oil destroys the insulating ability of fur-bearing mammals, such as sea otters, and the water repellency of a bird’s feathers. Without the ability to repel water and insulate from the cold water, birds and mammals will die from hypothermia.

When oil is spilled into an aquatic environment, it can harm organisms that live on or around the water surface and those that live under water. Spilled oil can also damage parts of the food chain, including human food resources.



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